INSAR
International Society for Autism Research

2019 ANNUAL MEETING

ABSTRACT BOOK

MAY 1-4
MONTREAL
CANADA

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Keynotes and Awards
- INSAR Awards Ceremony - Lifetime Achievement, Advocate Award, Cultural Diversity Research Award, Slifka Award, Young Investigator, Dissertation
4:00 PM - 5:30 PM - Room: 517A

INSAR Awards Ceremony - Lifetime Achievement, Advocate Award, Cultural Diversity Research Award, Slifka Award, Young Investigator, Dissertation.

Keynotes and Awards
- Welcome from Annual Meeting Organizers and President Address
8:30 AM - 9:00 AM - Room: 517AB

Welcome from Annual Meeting Organizers and President Address.

Oral Session -
Invited, Keynote Speakers, Awards
101 - Keynote Address - Kathryn Roeder, PhD
9:00 AM - 10:00 AM - Room: 517AB

9:00 De Novo Variation in Coding and Noncoding Regions: What We Can Learn from the Data about Etiological Pathways

K. Roeder, *Statistics and Data Science, Carnegie Mellon University, Pittsburgh, PA*

For autism spectrum disorder (ASD), the largest exome sequencing study to date implicates 102 genes in risk. This risk gene set, as well as the *de novo* mutations observed in the sample, serve as a springboard for additional explorations into etiological pathways. Gene expression from human cortical cells highlights enrichment of risk genes in both excitatory and inhibitory neuronal lineages, implying that disruption of these genes alters the development of both neuronal types. Complementing these single cell analyses, a new approach called MIND can estimate subject- and cell-type-specific (CTS) gene expression from tissue. CTS expression of the BrainSpan atlas, which profiles expression patterns of the developing human brain, reveals clear CTS co-expression networks that identify a cluster of co-expressed risk genes, implicate immature neurons in risk, and links the transition from neural progenitors to neurons as one potential origin of atypical neurodevelopment in ASD. Two other analyses lend additional insights: evaluation of *de novo* mutations that disrupt protein interactions and their interaction networks; and whole-genome sequencing results, which suggest that *de novo* mutations in promoter regions, characterized by evolutionary and functional signatures, contribute to ASD. Together, these results broaden our understanding of the neurobiology of ASD.

Panel Session
Cellular Models/Stem Cells
102 - Stem Cell Based Technologies in Autism Research
10:30 AM - 12:30 PM - Room: 524

Panel Chair: Mustafa Sahin, *Boston Children's Hospital/Harvard Medical School, Boston, MA*

A significant limitation on the investigation of neurological and psychiatry diseases including autism is the inability to study disease processes in affected human cells, namely neurons. Ideally, drugs and therapeutics for brain disorders should be tested on relevant human neurons before being used on participants in clinical trials. While the direct use of tissues from human disease populations is scientifically desirable, obtaining them is rarely safe or feasible. Recently, it has become possible to reprogram cells derived from a skin biopsy or blood sample of an individual into induced pluripotent stem cells, or iPSCs. Additionally, significant progress has been made to differentiate iPSC into defined neuron sub-types. Many laboratories are now able to reproducibly reprogram human cells into induced pluripotent stem cell (iPSC) lines, engineer the correction of patient mutations and differentiate resulting cell lines into patient derived models of disease in a dish. As a result, many investigators are starting to develop meaningful phenotypic assays for drug screening in support of syndromic or non-syndromic forms of autism. This panel will discuss the recent advances, opportunities and challenges in this burgeoning field of research.

10:30 **102.001** Strengths and Challenges of Human Cell Models of Neurodevelopmental Disorders

A. Bhattacharyya, *Waisman Center, University of Wisconsin-Madison, Madison, WI*

Human pluripotent stem cells (PSCs), including embryonic stem cells (ESCs) and particularly induced PSCs (iPSCs) from patients, have tremendous potential to unveil cellular and molecular events underlying normal and abnormal neural development as well as to understand neurological disease pathogenesis in a human genetic background. The power of human PSCs to model human brain development lies in the ability to generate specific neural cell types in vitro over a period of time that corresponds to in vivo development, thus recapitulating many of the developmental steps. Yet, there are challenges in using these cells for neurodevelopmental disorder modeling including distinguishing biologically relevant changes leading to complex traits from those resulting from variability between human PSCs, limited maturation of neurons and experimental reproducibility. I will highlight our work using human PSCs to investigate human-specific biology and disease mechanisms in Down syndrome and Fragile X syndrome. Because these two disorders are characterized by mutations unique to humans, human cell models are critical. We rely on the power of isogenic stem cells, co-cultures and rigorous methods to address the challenges of these cells. Understanding

how mistakes in neural development in both these disorders result in cognitive disability may enable us to intelligently design therapies to positively impact individuals and families living with them.

10:55 **102.002** Complete Disruption of Autism-Susceptibility Genes By Gene-Editing Predominantly Reduces Functional Connectivity of Isogenic Human Neurons

E. Deneault[1], *S. H. White*[2], *D. C. Rodrigues*[3], *J. Ross*[4], *M. Faheem*[3], *K. Zaslavsky*[3], *Z. Wang*[3], *R. Alexandrova*[3], *G. Pellecchia*[3], *W. Wei*[3], *A. Piekna*[3], *G. Kaur*[3], *J. Howe*[3], *V. Kwan*[2], *B. Thiruvahindrapuram*[3], *S. Walker*[3], *A. C. Lionel*[3], *P. Pasceri*[3], *D. Merico*[5], *R. K. Yuen*[3], *K. K. Singh*[2], *J. Ellis*[3] *and S. W. Scherer*[3], *(1)McGill University, Montreal, QC, Canada, (2)McMaster University, Hamilton, ON, Canada, (3)The Hospital for Sick Children, Toronto, ON, Canada, (4)University of Prince Edward Island, Charlottetown, PE, Canada, (5)Deep Genomics, Toronto, ON, Canada*

Background: Familial clustering of autism spectrum disorder (ASD) and related subclinical traits has been described, and with sibling recurrence risk estimates ranging from 8.1 to 18.7, a significant amount of familial liability is attributed to genetic factors. Genomic microarray and sequencing studies have identified that ~10% of individuals have an identifiable genetic condition, and there are over 100 genetic disorders that can exhibit features of ASD, e.g., Fragile X and Rett syndromes. Dozens of additional penetrant susceptibility genes have also been implicated in ASD, some being used in clinical testing. Genetically-identified ASD-risk genes are enriched in broader functional groups consisting of synapse function, RNA processing, and transcriptional regulation. Importantly, so far, each risk gene or copy number variation (CNV) implicated in ASD accounts for <1% of cases, suggesting significant genetic heterogeneity. Even within families, siblings can carry different penetrant mutations. Common genetic variants may also contribute to ASD-risk.

Objectives: To determine the role of specific ASD-risk genes in neuronal function, we use gene editing to knockout their expression in induced pluripotent stem cells (iPSCs) that are used as a model in vitro. Patient-specific iPSCs provide a newfound ability to study developmental processes, and functional characteristics, directly. Importantly, differentiation of human iPSCs into forebrain glutamatergic neurons are used to recapitulate early molecular events in the trajectory of ASD development.

Methods: We devised a precise clustered regularly interspaced short palindromic repeats (CRISPR)-based strategy to efficiently generate complete knockout (KO) of any ASD-relevant gene, with all mutations made in the same “isogenic” (identical genetic background) human control iPSC line. We used the CRISPR/Cas9-mediated double-strand break (DSB) mechanism coupled with error-free single-stranded template repair (SSTR) pathways to introduce an all-reading-frame premature termination codon, named “StopTag”, into a specific exon of a target gene, designed to prevent stable RNA/protein product from being made. We then explored excitatory neuron functional differences relevant to ASD for 10 different successfully-edited genes (*AFF2/FMR2, ANOS1, ASTN2, ATRX*, *CACNA1C*, *CHD8, DLGAP2, KCNQ2*, *SCN2A*, *TENM1*). Directed induction into excitatory neurons was achieved with high efficiency using transient ectopic expression of the transcription factor NGN2.

Results: Our results indicate that some ASD-risk genes display reduced synaptic activity between NGN2-derived excitatory neurons implying that ASD genes from different classes can present the same general cellular phenotype in vitro. RNAseq revealed convergence of several neuronal networks. Using both patch-clamp and multi-electrode array approaches, the electrophysiological deficits measured were distinct for different mutations. However, they culminated in a consistent reduction in synaptic activity, including reduced spontaneous excitatory post-synaptic current frequencies in *AFF2*/FMR2-, *ASTN2-*, *ATRX-*, *KCNQ2-* and *SCN2A*-null neurons.

Conclusions: Despite ASD susceptibility genes belonging to different gene ontologies, isogenic stem cell resources can reveal common functional phenotypes, such as reduced functional connectivity.These results also indicate that aberrant functional connectivity is a frequent phenotype in human neurons with ASD candidate gene null mutations. Overall, given the heterogeneity involved in ASD, we believe that this type of CRISPR-isogenic KO system may be essential for step-wise controlled cellular phenotyping experiments.

11:20 **102.003** Understanding Convergent Pathobiology in Idiopathic Autism Using Human iPSCs

D. Dykxhoorn*, John P. Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL*

Background: Autism spectrum disorders (ASDs) are a phenotypically and genetically complex group of neurodevelopmental conditions characterized by deficits in social interaction and communication, as well as the presence of repetitive and stereotyped behavior. To date, hundreds of genetic loci have been implicated in ASD risk. Recent studies have shown that genes harboring ASD risk loci are highly enriched in sets of genes expressed during early neocortical development and genes encoding proteins that function in specific biological pathways involving regulation of transcription, chromatin remodeling, cell adhesion, signaling complexes, and synapse function. However, the impact that these genetic variants have on ASD pathophysiology remains largely unknown. This is due in large part to a lack of genetically-relevant human disease models. The advent of human induced pluripotent stem cell (iPSC) technology and advances in neural differentiation techniques, have made it possible to study the molecular mechanisms that underlie ASD pathology.

Objective: Patient-specific induced pluripotent stem cells (iPSCs) present a unique opportunity to examine the hypothesis that heterogeneous ASD loci converge on specific molecular pathways during early neural development.

Methods: iPSC lines were derived from individuals with idiopathic autism and differentiated into cortical neurons. We examined the transcriptional differences between iPSC-derived cortical neurons from individuals with ASD and cognitively normal control individuals over a 135 day neuronal differentiation approach using RNAseq analysis. Bioinformatic analysis was performed by weighted gene coexpression network analysis (WGCNA) and Ingenuity Pathway Analysis (IPA). This RNA-seq analysis was complemented by functional studies of these developing neurons using electrophysiological, morphological, and biochemical analyses.

Results: Transcriptional analyses of ASD and control neurons at culture days 35 and 135 of their *in vitro* development showed ASD-specific transcriptional signatures, including differences in coding genes, alternative splicing, and non-coding RNAs. These changes in transcription mainly affecting pathways/networks involved in neuronal differentiation, the cytoskeletal matrix structure formation (i.e. axon guidance and cell migration), regionalization, patterning, and DNA and RNA metabolism. Additionally, developing networks of neurons were analyzed using multi-electrode array (MEA) recordings, measurements of calcium transients, and cell migration assays. Neurons from ASD individuals demonstrated significantly decreased network spiking activity and decreased numbers of calcium transients. Additionally, ASD lines showed significant differences in neurite morphology and decreased cell migration at early neuronal differentiation times.

Conclusions: The results of this study suggest that iPSC-derived neurons from individuals with ASD may have early deficits in network activity and

morphology based on a combination of cell based assays, including spontaneous action potentials, calcium transients, and neurite outgrowth complementing the transcriptomic analyses. Taken together, these data suggest that, although there is significant genetic diversity in ASD, there is a convergence of pathophysiological processes that effect neuronal functionality.

11:45 **102.004** Cellular Phenotypes of Angelman and Dup15q Syndrome Neurons

***S. J. Chamberlain**, Dept. of Genetics and Genome Sciences, University of Connecticut Health Center, Farmington, CT*

Angelman and Dup15q syndromes are neurodevelopmental disorders most commonly caused by copy number variation at the chromosome 15q11-q13 locus. Cognitive function, speech/language, seizure susceptibility, and social behavior are profoundly affected in individuals with these disorders. We have developed multiple induced pluripotent stem cell (iPSC) models for each of these disorders, and have differentiated them into forebrain cortical neuron cultures. Here we will discuss the electrophysiological and molecular phenotypes identified in neuronal cultures from patient-specific iPSCs derived from individuals with these disorders, as well as the use of genome editing technologies and antisense oligonucleotide approaches to dissect the involvement of individual genes in the cellular phenotypes of Angelman and Dup15q syndromes.

Panel Session
Education
103 - School-Based Interventions for Children with ASD: Harnessing the Power of Parents and Teachers
10:30 AM - 12:30 PM - Room: 517B

Panel Chair: Jan Blacher, *Graduate School of Education, University of California Riverside, Riverside, CA*

Discussant: Lauren Brookman-Frazee, *Psychiatry, University of California, San Diego, San Diego, CA*

There are many factors affecting the successful inclusion of young children with ASD, and this panel examines those pertaining to relational and academic engagement between teachers and children with ASD, treatment adherence, and intervention access. Blacher and colleagues utilize empirical findings to address the importance of student-teacher relationships and a parental role in these relationships. Preliminary data will also be presented on how teachers' perspectives can shape the content of a new, relationship-focused intervention. Eisenhower and colleagues examine children's receipt of school-based ASD services as they transition from the Early Intervention system into school-based special education services at age 3; they examine factors that promote equity and continuity in receipt of services after this transition. Ruble and colleagues present a promising new observational tool for assessing teachers' effective instruction in response to intervention; the results also shed light on the potential of teacher coaching interventions. Finally, Azad and colleagues report on parents' and teachers' engagement in a parent-teacher consultation intervention; importantly, they report that parents and teachers are more consistent in completing intervention steps when the intervention strategies are aligned with their salient child concerns.

10:30 **103.001** Student-Teacher Relationships and ASD: What We Know and Where We Need to Go

***J. Blacher**[1], Y. Bolourian[2], A. Eisenhower[3] and A. Losh[1], (1)Graduate School of Education, University of California Riverside, Riverside, CA, (2)University of California - Riverside, Riverside, CA, (3)Psychology, University of Massachusetts Boston, Boston, MA*

Background: Good quality teacher-child interactions, not surprisingly, are associated with many child benefits (Pianta et al., 2017), while relationships that are conflictual may engender academic disengagement, low motivation, and poor self-concept (Curby et al., 2013). Children with close, low-conflict relationships with teachers are better positioned to explore their environment and interact with others (Pianta & Rimm-Kaufman, 2006). Children with autism spectrum disorder (ASD) have, on average, more conflictual and less close relationships with their teachers relative to their peers in normative samples (Eisenhower et al., 2015; Caplan et al., 2016), and even relative to children with intellectual disability (Blacher et al., 2009; Blacher et al., 2014). However, little is known about predictors of student-teacher relationship (STR) quality for children with ASD. While teacher characteristics contribute to STRs, behavioral and social characteristics of children may also shape STR quality. Moreover, parenting behavior may indirectly impact these relationships.

Objectives: Working from a conceptual model of predictors and outcomes of STR quality for children with ASD, we present results testing some of the proposed pathways regarding child and parent predictors of STR quality in the context of ASD. These include already-published findings as background to test our model, as well as new findings regarding the role of parents in STR development**.** As part of an overall teacher-directed intervention, preliminary focus group data from general education teachers about their pedagogical practices for children with ASD in their classrooms will be presented.

Methods: Participants include 176 children with ASD (4-7 years), parents and teachers. Children have a mean IQ of 90 on the WPPSI -III; all diagnoses of ASD were confirmed with the ADOS. In addition to parent- and teacher-report measures and child performance-based language and reading measures, children and parents were coded in a free play task using the Parent-Child Interaction Rating System (Belsky et al., 1995; Blacher et al., 2013).

Results: Findings that inform testing of pathways in the conceptual model will be highlighted. Cross-lagged panel analyses indicated that children's' higher early externalizing problems led to increases in STR conflict and decreases in STR closeness across multiple school years and classrooms (Eisenhower et al., 2015). Academically, STR quality predicted change in reading comprehension skills over time. Cross-lagged panel modeling suggested that this link may be causal, with positive early STRs uniquely predicting later gains in reading comprehension relative to peers (Blacher et al., 2015). As evidence of the contribution of parenting to STRs, children whose parents displayed more intrusiveness in a structured reading task had poorer-quality STRs one year later. Parent intrusiveness mediated the predictive relationship between child spoken language skills and STR quality.

Conclusions: Collectively, findings suggest that child characteristics (e.g., fewer behavior problems) lead to early, strong STRs. In addition, findings that parenting predicts STRs one year later have implications for intervention with both teachers and parents. Qualitative results highlight teachers' perspectives on students with ASD in general education classrooms, and the feasibility of a program to improve STRs.

10:55 **103.002** Sources of Equity and Disparity in Access to School-Based ASD Services Among Preschoolers with ASD: Who "Drops Off" from ASD Services after Early Intervention?

A. Eisenhower[1], *A. S. Carter*[2], *R. C. Sheldrick*[3], *N. Portillo*[4] *and N. Hoch*[4], *(1)Psychology, University of Massachusetts Boston, Boston, MA, (2)University of Massachusetts Boston, Boston, MA, (3)Boston University School of Public Health, Boston, MA, (4)University of Massachusetts, Boston, Boston, MA*

Background: Timely diagnosis of ASD is associated with optimal long-term outcomes for children with ASD, enabling earlier access to ASD-related intervention. Unfortunately, research has shown that health disparities emerge in children's access to post-diagnostic services, even in the context of a timely diagnosis. Demographics, especially race and immigration status, may be driving factors in predicting receipt of EI-based ASD services at <36 months (Portillo, Buitrago, Thammathorn, Eisenhower, & Carter, 2018). During the transition from early intervention, which provides services at <36 months via Part C of IDEA, into school-based services at age 3, some children "drop off" and, at least temporarily, cease receiving ASD services.

Objectives: We examined receipt of ASD-related school-based services among children with ASD. To understand which children experience a post-transition drop-off in ASD services at age 3, we assessed demographic predictors of service receipt. We used a latent class analysis--which identified 6 demographic clusters of families within our larger sample of 381 children--to predict ASD service receipt. Qualitative analyses of open-ended parent responses are underway to identify reasons behind children's lack of service receipt.

Methods: Children (ages 16-38 months) were diagnosed with ASD as part of an EI-based, multi-stage screening and assessment protocol designed to reduce diagnostic disparities. Children who received an ASD diagnosis included 87% boys, 40% English learners, 66% first-generation immigrants, 17% White non-Hispanic children; 57% were living below poverty level. ASD service receipt after children transitioned out of EI was determined through 39-, 42-, and 45-month interviews with parents (80% female). Demographics include household poverty, parental US-born status, race, education, employment, and English proficiency.

Results: Quarterly service utilization interviews were conducted with parents of 120 children with ASD. The majority were attending public preschool (77.1%), 73.3% had an Individualized Education Program (IEP), most were receiving school-based ASD special education services after exiting EI (82.5%); however, 17.5% of children were not receiving any ASD services, in or out of school.

We examined demographic factors predicting service receipt; children receiving no services did not differ from those receiving ASD services by poverty, parental US-born status, education, or English proficiency; more Black or African-American children (36% vs. 15%) and marginally fewer Asian-American children were receiving no ASD services (0% vs. 19%). White children were more likely than non-White children to be attending public school (84% vs. 77%); unexpectedly, children whose mothers were not employed were more likely to be receiving ASD services (91% vs. 77%) and be attending school (86% vs. 71% in public school) than children of working parents. Logistic regressions showed that demographic clusters, based on our 6-class LCA, did not predict ASD service receipt.

Conclusions: Even in the presence of equitable access to early detection, disparities emerged in subsequent receipt of post- EI ASD services. Race and employment predicted children's risk of experiencing a gap in ASD services after exiting EI at age 3. These findings may help identify groups in need of particular support around service attainment and inform training for EI staff and health care providers around effective advocacy.

11:20 **103.003** Do Common Elements across Ebps Correlate with Child Engagement and Learning Outcomes?

L. A. Ruble[1], *A. M. Love*[2], *J. H. McGrew*[3] *and V. Hang*[1], *(1)University of Kentucky, Lexington, KY, (2)Educational, School, and Counseling Psychology, University of Kentucky, Lexington, KY, (3)Psychology, Indiana University - Purdue University Indianapolis, Indianapolis, IN*

Background: It is a challenge for special education teachers to be competent in and implement evidence-based practices (EBP). This is particularly difficult given that the National Professional Development Center on ASD has identified 27 different EBPs. We propose a set of common elements, or evidence-based principles, that represent high quality teaching sequences that exemplify features common across most EBPs and within any effective teaching plan.

Objectives: The presentation will propose and test a measure of common elements and examine the association with child outcomes and engagement.

Methods: The Common Elements of Teaching Sequences (CETS) observational scale was assessed using videotapes obtained from an RCT of the Collaborative Model for Promoting Competence and Success (COMPASS), a child-centered, teacher coaching intervention that occurs over five sessions during the school year. For coaching, teachers provide videotapes of their teaching plan implementation. Videotapes from 29 teachers of children with ASD (3-8 yrs) from the first and final coaching session were used.

CETS measures whether: (a) the instruction that engages the child is meaningful and associated with the targeted skill; (b) the teacher/peer /environment is successful in obtaining the child's attention; (c) the teacher/peer/environment prompts the child to demonstrate the skill; (d) sufficient wait time is provided following the initial request and after each prompt; and (e) the teacher/peer/environment reinforces/corrects the child after the sequence. Items are rated dichotomously (1=No; 2=Yes), except item two (attention), which was rated on a 3-point scale (1=Poor; 2=Somewhat; 3=Good). Interrater reliability was good using Holsti's (1969) coefficient of reliability (CR) across all items and coders (93.9%), Cohen's (1960) kappa (*k*) where values ranged from 1 to .82, and Spearman's rho for item two of .81.

Child engagement was assessed with the Autism Engagement Rating Scale (AERS; Ruble & McGrew, 2013). The AERS assesses child: (a) cooperation; (b) functional use of objects; (c) productivity; (d) independence; (e) consistency between child's and teacher's goals; and (f) attention using a 5-point Likert. The summed score of the items was used (alpha = .86, r = 0.88).

Psychometrically Equivalence Tested Goal Attainment Scaling (PET-GAS; Ruble, McGrew, & Toland, 2012) assessed progress toward learning outcomes along a 5-point scale. Scores were based on direct observation of child progress toward IEP goals (ICC=.90-.99) by a blinded rater.

Results: Teachers demonstrated higher scores for maintaining child attention (t=-3.4, p<.01), providing an initial prompt (t=-2.1, p=.05), and allowing wait time initially (t=9.3, p<.01), and subsequently (t=-4.9, p<.01). Implementation of common elements improved (t=8.5, p <.01), and was correlated with child engagement at coaching 1 (r=.69, p<.01) and 4 (r=.61, p<.01), and with goal attainment at coaching 1 (r=.56, p<.01) and 4 (r=.61, p<.01).

Conclusions: A prior study of preschool children with ASD indicated that common elements, rather than specific program components, accounted for learning outcomes (Boyd et al., 2014). The CETS operationalizes one set of common elements that may be helpful for evaluating teaching quality across EBPs. Importantly, children of teachers demonstrating the use of common elements were more engaged and made more progress toward their goals.

11:45 **103.004** Partners in School: A Parent-Teacher Consultation Model to Improve Consistency of Evidenced-Based Interventions across Home and School

G. F. Azad[1], *D. S. Mandell*[2] *and R. Landa*[1], *(1)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (2)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background: Consistency of evidence-based interventions (EBIs) across settings results in better outcomes for children with autism spectrum disorder (ASD). Little is known about whether parent and teacher practices align in a way that would maximize consistency across home and school. Misalignment across settings may be distressing for children's generalization of skills.
Objectives: To examine alignment of intervention practices between parents and teachers participating in *Partners in School.* In this consultation model, parents and teachers work collaboratively with a consultant to (1) identify a mutual concern, (2) define mutually agreed upon (hence, aligned) EBI steps to address the concern, and (3) implement those steps at home and school (reflecting consistency). We 1) examined the number of intervention steps completed by both parents and teachers (consistency); and 2) investigated what EBI characteristics predicted consistency between parents and teachers.

Methods: Participants were 26 teachers and 49 parents of children with ASD from an urban public school district. Most teachers were female (92.3%) with an average age of 36.6 years (SD = 9.7); approximately 80.9% identified as white and all taught in special education classrooms. Parents were mothers (93.9%) who averaged 38.1 years of age (SD = 7.8); approximately 30.6% were white, 36.7% were black, 24.5% were Hispanic/Latino. Participants engaged in a pre-consultation phone interview to prioritize their top three concerns about the child. Parents and teachers, together, also had an in-person consultation meeting to develop EBIs for use at home and school. A daily home-school note was used to monitor the number of intervention steps completed by parents, number of steps completed by teachers, and number of overlapping steps completed by both parents and teachers (i.e., same steps completed in the same way at home and school indicated consistency).

Results: Descriptive statistics and linear regression models were used. On average, parents completed 4.9 intervention steps at home and teachers completed 4.8 steps at school. On average, parents and teachers reported doing 3.4 of the same steps across home and school. When one of their top three concerns were addressed, both parents (B = 2.1, p = .035) and teachers (B = 2.2, p = .050) were more likely to complete the same interventions steps across home and school. For both parents (B = 1.02, p < .001) and teachers (B = .67; p = .009), the number of steps in their intervention plan was associated with home-school consistency. For parents, the number of home-school notes completed (B = .183, p = .034) at home also predicted consistency.

Conclusions: These results suggest that parents and teachers are more likely to do the same intervention steps in the same way when salient concerns are addressed for them. Additionally, it is important to consider the number of intervention steps to ensure comprehensive approaches without overburdening. This information is critical for parent-teacher alignment in intervention practices across home and school, which is important for maximizing consistency for children.

Panel Session
Novel Therapeutic Approaches (gene, protein or RNA targeted therapies)
104 - Cerebellum in Autism: Biomarkers, Mechanisms, and Translational Opportunities
10:30 AM - 12:30 PM - Room: 516ABC

Panel Chair: Peter Tsai, *University of Texas Southwestern Medical Center, Dallas, TX*

Discussant: Evdokia Anagnostou, *Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

The cerebellum has been implicated in the pathogenesis of autism, but the contributions remain poorly understood. Using a combination of sensorimotor tasks, advanced neuroimaging in both preclinical models and humans, and functional circuit neuromodulation in pre-clinical models and humans, speakers within this session have identified key cerebellar regulated circuit mechanisms that offer potential biomarker targets and are demonstrating the potential for circuit neuromodulation of cerebellar regulated circuits as a potential novel therapeutic target for autism behaviors.

10:30 **104.001** Precision Sensorimotor Control and Brain Network Activity in ASD

M. W. Mosconi[1,2], *K. E. Unruh*[1], *L. Martin*[3], *R. J. Lepping*[4], *G. Magnon*[5] *and J. A. Sweeney*[6], *(1)Kansas Center for Autism Research and Training (K-CART), University of Kansas, Lawrence, KS, (2)Clinical Child Psychology Program, Schiefelbusch Institute for Life Span Studies, University of Kansas, Lawrence, KS, (3)Hoglund Brain Imaging Center, University of Kansas Medical Center, Kansas City, KS, (4)Hoglund Brain Imaging Center, University of Kansas, Kansas City, KS, (5)University of Pittsburgh Medical Center, Pittsburgh, PA, (6)Division of Developmental Behavioral and Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH*

Background: Sensorimotor impairments are common in ASD and associated with worse functional outcomes. We previously documented increased force variability during continuous visuomotor behavior in ASD. Patients' visuomotor deficits were more severe when the force required or the precision of visual feedback were increased implicating both motor and sensory feedback processes. Characterizing the neural processes associated with visuomotor deficits in ASD will help determine mechanisms of sensorimotor issues and related clinical issues.
Objectives: We will update behavioral and functional MRI (fMRI) results on neural processes associated with sensorimotor deficits in ASD.

Methods: Individuals with ASD aged 10-35 years and age-matched controls completed three task-based functional MRI (fMRI) studies. For each study, participants completed visuomotor tasks in which they pressed with their thumb and index finger on a force transducer while viewing a white FORCE bar on a screen that moved upwards with increased force toward a fixed green TARGET bar. Participants were instructed to maintain the FORCE bar at the level of the TARGET bar for 26 seconds. For study 1 (force level study), 20 participants with ASD and 15 controls pressed with their right hand at 20 and 60% of their maximum force. For study 2 (visual gain study), a separate 25 individuals with ASD and 22 controls pressed with their right hand at 15% of their maximum force across three different visual feedback gain levels. At higher visual gains, the white FORCE bar moved a greater distance per change in Newtons of force relative to lower gains. For study 3 (laterality study), 10 participants with ASD and 10 controls have completed the fMRI visuomotor tests separately with their right and left hands.

Results: Across studies, individuals with ASD showed greater force variability relative to controls. During the force level fMRI study, individuals

with ASD showed greater activation than controls in ipsilateral premotor/motor cortex (M1) and reduced activation of left angular gyrus during force compared to rest. They also showed reduced activation of cerebellar Crus I compared to controls during the higher force condition. During the visual gain study, individuals with ASD showed reduced M1, SPL and anterior cerebellar activation at low gain compared to controls, but increased activation of SPL and cerebellar lobules I-V at high gain. For the laterality study, data collection and analysis are ongoing.

Conclusions: These studies indicate that increased sensorimotor variability in ASD is associated with dysfunction of sensory processing mechanisms supported by posterior parietal cortex and cerebellum. Parietal-cerebellar circuits are involved in the translation of sensory feedback error information into refined motor commands relayed to motor cortex. Increased ipsilateral M1 activation in ASD during sensorimotor control reflected a failure to de-activate ipsilateral motor cortex during manual actions, suggesting a failure to optimally differentiate hemispheric activity for behavioral demands. Together, these results indicate that dysfunction of neural processes involved in translating sensory feedback into precision behavioral output and atypical lateralization of motor cortical control of precision behavior represent significant components of the neurodevelopmental processes associated with ASD.

10:55 **104.002** Disrupted Cerebellar - Cerebrocortical Circuits in ASD Models and in ASD

J. P. Lerch[1], *J. Ellegood*[1], *C. Hammill*[2], *P. Tsai*[3], *M. J. Taylor*[2] *and E. Anagnostou*[4], *(1)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada, (2)The Hospital for Sick Children, Toronto, ON, Canada, (3)University of Texas Southwestern Medical Center, Dallas, TX, (4)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

Background: There is increasing evidence for cerebellar involvement in autism. It is unclear, however, to what extent different mutations implicated in autism contribute to cerebellar phenotypes, or whether cerebellar involvement is universal to all autism cases.
Objectives: To understand the extent to which cerebellar circuits are implicated in autism and to dissect which mutations might drive those results.

Methods: Anatomical MRIs combined with automated cerebellar segmentation protocols were used in both large human and mouse datasets. In the human sample, T1-weighted images from 582 subjects (328 controls, 254 ASD) collected at a single site in Toronto, Ontario, combining data from the Province of Ontario Neurodevelopmental Disorders Programme and studies from the Taylor lab, were used. All subjects were between 5-21 years of age. For the mouse data, >60 individual mouse models (>1300 individual animals) with high-resolution ex-vivo T2-weighted MRIs were used.

Results: Significant differences in volumes between those with autism and controls were identified in multiple cerebellar regions, strongest in lobules IV, crus I and II, and X. Similar results were identified in the mouse models, where the strongest effects were in the cerebellar nuclei (which were not separately segmented in the human dataset). Not all mouse models showed the same pattern of cerebellar volume change; instead, these effects were driven by a few key, highly affected mutations.

Conclusions: The cerebellum is one of the most affected brain areas in both humans and mice. The mouse data showed that this effect is driven by a few key mutations rather than a broad effect across all models.

11:20 **104.003** Dissection of Cerebellar-Cerebro Cortical Circuits in ASD Reveals Therapeutic Opportunities for Circuit Modulation

E. Kelly[1], *Y. Kazemi*[2], *F. Meng*[1] *and* ***P. Tsai***[3], *(1)UT Southwestern Medical Center, Dallas, TX, (2)UT Southwestern, Dallas, TX, (3)University of Texas Southwestern Medical Center, Dallas, TX*

Background:
Autism Spectrum Disorders (ASDs) are prevalent neurodevelopmental disorders marked by social impairments, repetitive behaviors, and cognitive inflexibility. Despite a prevalence exceeding 1%, underlying mechanisms are poorly understood while targeted therapies and their guiding parameters are needed. Recent evidence has implicated the cerebellum in ASD pathogenesis, and we have demonstrated that cerebellar dysfunction is sufficient to generate autism-relevant behaviors (social dysfunction, repetitive/inflexible behaviors) in a genetic mouse model and via chemogenetic disruption of function in a specific cerebellar domain, CrusI.

Objectives: However, how the cerebellum regulates autism-related behaviors and the neural circuit networks regulated by the cerebellum, and in particular CrusI, are not well understood.

Methods: In this study, using targeted, *in vivo* chemogenetic and optogenetic neural circuit modulation combined with *in vivo* electrophysiology, anatomic mapping (using a host of viral tracing techniques), and behavioral evaluation, we sought to identify cerebellar-regulated circuits that regulate autism-relevant behaviors.

Results: Using these above methods, we have delineated specific cerebro-cortical circuits implicated in ASD that are regulated by cerebellar circuits. We show the anatomic basis for these cerebello-cerebrocortical circuits - from CrusI to cerebellar output nucleus to thalamus to cortical association areas - and demonstrate functional consequences of disruption of each circuit component on ASD-related behaviors while also demonstrating that modulation of these specific circuits can ameliorate ASD behaviors in a genetic ASD mouse model.

Conclusions: These findings delineate the anatomic basis for cerebellar - cerebro-cortical connectivity and demonstrate functional impact of these circuits on ASD-related behaviors. These studies, thus, further our mechanistic understanding of the neural circuit contribution to ASD while also further demonstrating important roles for cerebellar-cerebro cortical circuits in the regulation of ASD behaviors. In addition, these studies raise the possibility that neural circuit modulation may offer potential, novel therapeutic targets for the treatment of autism-related behaviors.

11:45 **104.004** Cerebellar Tdcs Modulates ASD-Relevant Circuits and Behaviors

C. J. Stoodley[1], *A. M. D'Mello*[2], *L. C. Blevins*[2] *and S. E. Martin*[3], *(1)Psychology, American University, Washington, DC, (2)Behavior, Cognition, and Neuroscience Program, American University, Washington, DC, (3)Neuroscience Program, American University, Washington, DC*

Background: Differences in cerebellar structure and function are consistently implicated in autism spectrum disorder (ASD), with converging findings highlighting right lobule VII (RVII, which includes Crus I and Crus II) as a region of interest in ASD. In humans, RVII is part of fronto-parietal and default mode (DMN) networks, and is engaged during social cognition and mentalizing tasks. Our previous work has shown that grey matter

volumes in RVII correlate with core ASD symptoms. In rodent models, specific disruption of RVII is sufficient to produce ASD-like behaviors, including social deficits, repetitive behaviors, and cognitive inflexibility. Crucially, stimulation of RVII rescued social deficits in a *Tsc1* ASD mouse model. This suggests that RVII has a critical modulatory role on social behaviors.
Objectives: We aimed to clarify the role of cerebellar RVII in ASD through combining functional neuroimaging with non-invasive neuromodulation in typically-developing adults and adults with ASD.

Methods: Study 1 examined the impact of neuromodulation with anodal ("excitatory") or sham transcranial direct current stimulation (tDCS) targeting RVII on functional connectivity in 33 typically developing adults (11 males, 22 females, age 23.8±2.8 years; 18 in anodal group, 15 in sham group). In Study 2, 11 typically-developing adults (all males; age 20.9±2.5 years) and 4 adults with ASD (all male; 28.2±14.0 years) underwent simultaneous tDCS-fMRI while performing a social ball-playing task. Each participant completed three sessions, receiving anodal, cathodal ("inhibitory") or sham tDCS in separate sessions. In both studies, participants received 20min of 1.5mA tDCS targeting RVII using the NeuroConn MR tDCS system. Functional MRI data was acquired pre-, during- and post-tDCS.

Results: In Study 1, functional connectivity prior to neuromodulation replicated previous findings showing that RVII is functionally connected to both the fronto-parietal cognitive control network and the DMN. Post-tDCS, functionally connectivity increased between RVII and DMN nodes, including the medial prefrontal cortex and the precuneus. These regions tend to show reduced functional connectivity in children with ASD. During tDCS, functional connectivity was altered between RVII and a region in the inferior parietal lobule that shows atypically increased functional connectivity in ASD populations. In Study 2, cerebellar tDCS modulated performance on the social ball-playing task, with anodal tDCS modulating learning of the patterns of social reciprocity amongst the players. Activation patterns provided further support for the hypothesis that the cerebellum is important in social learning.

Conclusions: Our findings indicate that the cerebellum is part of the distributed neural circuits implicated in ASD, and further suggest that the cerebellum modulates ASD-relevant networks and social learning. These results clarify the role of cerebellar RVII in ASD, and provide further evidence that cerebellar dysfunction could lead to social deficits in autism. The translational potential of RVII as a target for non-invasive neuromodulation in ASD will be discussed.

Panel Session
Postmortem Studies
105 - Functional Genomic Profiling Studies of ASD Brain
10:30 AM - 12:30 PM - Room: 517C

Panel Chair: Daniel Geschwind, *University of California, Los Angeles, Los Angeles, CA*

The last decade has brought substantial progress in understanding the contributions of human genetic variation to neuropsychiatric conditions including ASD. However, such studies alone do not provide a roadmap for understanding disease mechanisms at the level of the functional genome or neurobiological pathways. The focus of this panel is one of the key missing components in elucidating ASD pathophysiology: an understanding of how molecular alterations play out at the level of brain, and whether molecular alterations converge on specific pathways or cell types. Jonathan Mill will present large scale analysis of methylation patterns in controls throughout development and in ASD brain. Mike Gandal will provide an overview of large-scale transcriptomic studies that define core molecular changes in ASD, and their relationship to other major psychiatric disorders. Dalila Pinto will discuss alterations at the level of lncRNA, which are increasingly recognized as potentially important regulators of gene expression and the implications of these data for future study of ASD. Lastly, Dan Geschwind will summarize work integrating multiple molecular phenotypes using a network fusion framework, as well as emerging single cell sequencing data that we expect will significantly refine our understanding of the cell and circuit level alterations in disease.

10:30 **105.001** Epigenetic Pathways to Neurodevelopment Phenotypes
J. Mill, *University of Exeter Medical School, University of Exeter, Exeter, United Kingdom*

There is mounting evidence to support a role for developmentally regulated epigenetic variation in the molecular etiology of autism and other neuropsychiatric disorders. I will describe an analysis of dynamic DNA modifications (5mC and 5hmC) across human brain development and ageing, highlighting how the prenatal period is a time of considerable epigenomic plasticity in the brain, and the importance of neurodevelopmentally-dynamic loci in neurodevelopmental disease phenotypes. I will also describe the impact of genetic variation on gene regulation, showing how molecular quantitative trait loci (mQTLs) can be used to refine associated loci from genetic studies. Novel tools mean that it is now feasible to examine epigenetic variation across the genome in large numbers of samples, and I will give an overview of our recent epigenome-wide association studies (EWAS) of neuropsychiatric phenotypes, integrating findings with those from recent GWAS analyses. Finally, I will outline some of the issues related to epigenetic epidemiological studies of ASD and other psychiatric disorders and explore the feasibility of identifying peripheral biomarkers of phenotypes manifest in inaccessible tissues such as the brain.

10:55 **105.002** Long Non-Coding RNA Dysregulation in Autism Spectrum Disorders (ASD)
D. Pinto, *Icahn School of Medicine at Mount Sinai, New York, NY*

Long non-coding RNAs (lncRNAs) can function as key regulators of gene expression, yet their expression and splicing patterns have not been fully explored in tissues relevant to ASD and other neuropsychiatric disorders. Here we used single-molecule real-time isoform sequencing of total RNA (IsoSeq) and lncRNA-capture enriched samples (Capture-IsoSeq) to construct a comprehensive map of full-length transcript isoforms in 10 human postmortem prefrontal cortex tissues. Transcript isoforms were classified based on their coding potential and conservation, and further characterized by integrating with 5'-end Seq and epigenetic profiles. We discovered >300 novel brain expressed lncRNA loci, as well as ~9,000 and ~8,000 novel high-confidence multiexonic lncRNA and mRNA isoforms, respectively. We further merged our IsoSeq maps with transcript models derived from RNA-Seq assemblies of 2,000 PsychENCODE cortical tissue samples, resulting in the most comprehensive map of both coding and non-coding transcripts in the cortex to date. Altogether, our map significantly increases the number of isoforms of brain-expressed genes, expands most of the lncRNA genes detected in our dataset comprising both 3' and 5' extensions, and reveals multiple cases of interleaved

lncRNA-mRNA transcripts. Our augmented reference map was further used to quantify lncRNA expression by capture RNA-Seq (Capture-Seq) of 140 postmortem samples of prefrontal cortex and cerebellum from 35 ASD and 36 control subjects. Capture-Seq increased the lncRNA fraction of our RNA-Seq datasets from 5% to 57%, substantially improving our ability to assess changes in this transcript population. We identified multiple differentially expressed lncRNAs in ASD compared to controls, including neighbors of *cis*-regulated ASD-risk genes. Finally, coexpression network and "guilt-by-association" analyses further revealed genes under putative regulation of lncRNAs that are in pathways dysregulated in ASD. Taken together, our data constitute a valuable resource for integration with genetic risk variants and genomic data for discovery of candidate risk genes in ASD and other neuropsychiatric disorders.

11:20 **105.003** Patterns of Shared and Distinct Transcriptomic Dysregulation across Psychiatric Disorders

***M. J. Gandal**, Psychiatry, UCLA-Semel Institute, Los Angeles, CA*

Background: Our understanding of the pathophysiology of neuropsychiatric disorders, including autism spectrum disorder (ASD), schizophrenia (SCZ), and bipolar disorder (BD), lags behind other fields of medicine. Defining genetic contributions to disease risk provides a rigorous foothold for biological, mechanistic understanding but is challenged by genetic complexity, polygenicity, and substantial pleiotropy, in which genetic variants are associated with multiple distinct phenotypes.
Objectives: We reasoned that transcriptome profiling can provide a quantitative biological context for interpreting the molecular effects of disease-associated genetic variants and for identifying shared and distinct molecular pathways disrupted across major neuropsychiatric disorders.
Methods: We integrated SNP-genotypes with RNA sequencing in brain samples from 1695 individuals with ASD, SCZ, and BD, as well as controls. We performed comprehensive analysis across multiple levels of transcriptomic organization, including gene and transcript-isoform expression and coexpression networks for both protein-coding and noncoding genes.
Results: More than 25% of the transcriptome exhibits differential splicing or expression, with isoform-level changes capturing the largest disease effects and genetic enrichments. Coexpression networks isolate disease-specific neuronal alterations, as well as microglial, astrocyte, and interferon-response modules defining previously unidentified neural-immune mechanisms. A distinct upregulation of microglial-associated genes clearly differentiates ASD from the other disorders, providing biological insights into disease specificity.
Conclusions: This large-scale integration of genetic and genomic data in human brain enables a comprehensive systems-level view of the neurobiological architecture of major neuropsychiatric illness, demonstrating pathways of molecular convergence and specificity, and provides a resource for mechanistic insight and therapeutic development.

11:45 **105.004** Single Cell Sequencing and Integrative Analysis of Epigenetic and Transcriptomic Profiling in ASD

*G. Ramaswami, B. Wamsley and **D. Geschwind**, University of California, Los Angeles, Los Angeles, CA*

Despite ASD's etiological heterogeneity, previous studies have shown patterns of molecular convergence in post-mortem brain tissue from autistic subjects. Here, I describe our new unpublished work using two approaches: 1) similarity network fusion (SNF) to integrate genome-wide measures of mRNA expression, miRNA expression, DNA methylation, and histone acetylation to identify a convergent molecular subtype of ASD and 2) single cell sequencing in control and ASD brain to identify cell type specific changes and pathways. Using the SNF approach, we identify a core subtype of ASD, and substantially expand the repertoire of differentially expressed genes in ASD and identify a component of upregulated immune processes that are associated with hypomethylation. We utilize eQTL and chromosome conformation datasets to link differentially acetylated regions with their cognate genes and find an enrichment of ASD genetic risk in hyperacetylated noncoding regulatory regions linked to neuronal genes. Similarly, single cell sequencing appears to substantially refine signals obtained from whole tissue. These findings help elucidate how diverse genetic risk factors converge onto specific molecular processes in ASD.

Panel Session
Sensory, Motor, and Repetitive Behaviors and Interests
106 - Promise and Limitations of Multi-Modal Measurement of Sensory Processing in Autism
10:30 AM - 12:30 PM - Room: 518

Panel Chair: Shulamite Green, *Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA*

Discussant: Elysa Marco, *Neurology, University of California San Francisco, San Francisco, CA*

Sensory symptoms are increasingly recognized as an essential target of research and intervention to improve quality of life and decrease functional impairment for those with autism. However, the lack of rigorous, consistent, and specific measures of sensory processing atypicalities is a major barrier to studying and relating behavioral and biological measures of sensory responsivity. Sensory responsiveness in autism is often measured with parent-report questionnaires that are subjective, capture broad categories of sensory responsiveness, and may have poor psychometric properties in autism (Williams et al., 2018). This panel looks critically at recent advances in multi-modal measurement of sensory processing in autism. Our first speaker will discuss a behavioral assessment of auditory and tactile over-responsivity and establishment of cut-off scores. The second will discuss the pros and cons of psychophysical measurements of sensory discrimination within the framework of the sensation-perception-attention-evaluation-reaction stream. Our final two speakers address how multiple imaging measurements can improve interpretation of results: the first combines neural habituation to sensory stimuli and functional connectivity to show how sensory habituation in autism is dependent on sustained regulation; The second combines spectroscopy and transcranial magnetic stimulation to relate different sensory subtypes to different GABAergic abnormalities and associated perceptual dysfunctions.

10:30 **106.001** How Can We Reliably Measure Sensory Reactivity?

***T. Tavassoli**[1], E. J. Marco[2], M. R. Gerdes[2], A. Brandes-Aitken[3], L. J. Miller[4] and S. Schoen[5], (1)Centre for Autism, School of Psychology & Clinical Language Sciences, University of Reading, Reading, United Kingdom, (2)Neurology, University of California San Francisco, San Francisco, CA, (3)New*

York University, New York, NY, (4)Sensory Processing Disorder Foundation, Greenwood Village, CO, (5)STAR Centre, Denver, CO

Background: Sensory processing difficulties are common across neurodevelopmental disorders, and have gained increasing attention in autism since they were added to the diagnostic criteria in the DSM-V. However, the proliferation of sensory-related studies in autism has highlighted the need for reliable behavioral measures of sensory reactivity. This is especially true given that one of the most commonly used measures, the Short Sensory Profile, a parent report questionnaire, has recently been shown to have poor psychometric properties in autism (Williams et al., 2018). This has motivated the development of better clinical and research measures to characterize sensory processing. Specifically, previous research suggests that sensory over-responsivity (SOR), an adverse response to sensory stimuli, is one of the most common and impairing sensory processing difficulties in autism and occurs most frequently in the auditory and tactile domains (Tavassoli et al., 2016).
Objectives: Hence, this study seeks to advance the field of sensory assessments by comparing the auditory and tactile over-responsive items for children with neurodevelopmental disorders using parent report and direct assessment (SP-3D:A), and by providing cut-off scores.

Methods: This study included 304 children from a mixed neurodevelopmental disorders cohort including autism and sensory processing dysfunction (n= 176) as well as neurotypical children (n= 128). The widely used Short Sensory Profile caregiver report was used, in which parents rate how often their child shows a particular sensory behaviour. The SP-3D:A, a direct structured observational tool, which is measuring behavioral response to specific sensory stimuli, was also utilized. The SP-3D:A is ideally suited for this task, as it includes characterizations of SOR in both auditory and tactile domains. To achieve an SOR specific score for the auditory and tactile domains, we chose items on the SSP and SP-3D:A that are reflecting SOR behaviors by clinical consensus. For each measure, we then calculated the TDC mean +1 SD to create cut-scores.

Results: Using direct SP-3D:A assessment, 31% of the children with neurodevelopmental disorders (NDD) had AOR and 27% had TOR. Using the SSP parent report, 62% of the children with NDD were classified as having AOR, whereas 68% had TOR. The Inter-test-agreement between SSP and SP-3D:A for AOR was 65% and TOR was 50%. Moreover, as expected the NDD group was significantly more affected by SOR than the TDC group ($\chi 2 \geq 17.5$, $p \leq .0001$).

Conclusions: This study identified cut-off scores for AOR and TOR using the SSP parent report and SP-3D:A observation. We found that the parent report questionnaire and direct observation have only a moderate overlap. A combination of questionnaire and direct observation measures should be used in clinical and research settings; specifically, the use of sensory questionnaires as a screening tool, followed by standardized direct observations. In line with previous reports, we find that more children meet SOR criteria based on parent report than on direct assessment in both the auditory and tactile

10:55 **106.002** Lessons from Psychophysical Studies of Somatic Sensation in Autism

C. J. Cascio[1], *L. K. Bryant*[2], *T. Woynaroski*[3], *M. T. Wallace*[2], *Z. J. Williams*[4], *S. L. Davis*[5], *M. B. Gerdes*[5] *and C. D. Okitondo*[5], *(1)Vanderbilt University School of Medicine, Nashville, TN, (2)Vanderbilt University, Nashville, TN, (3)Hearing & Speech Sciences, Vanderbilt University Medical Center, Nashville, TN, (4)Child Study Center, Yale School of Medicine, New Haven, CT, (5)Vanderbilt University Medical Center, Nashville, TN*

Background: Atypical responses to sensory input are hypothesized to cascade into higher-order deficits in individuals with autism spectrum disorder (ASD). However, there is a gap between the precise control of the stimulus-perception relationship afforded by psychophysics and questionnaire measures of sensory reactivity in daily life, with the latter generally mapping better onto higher-order deficits such as social-communication difficulties. Adjustments to the design and execution of standard psychophysical approaches may improve the ability to bridge this gap. Examples include designs that consider motor and attention differences, as well as those that incorporate evidence accumulation and consider data points surrounding the point of binary perceptual decisions.
Objectives: To describe two recent studies that offer insights into how psychophysics may be adapted to serve as a more effective measurement tool in this population and thus better evaluate the cascading effects theory.

Methods:

Study 1: In a sample of neurotypical adults (n=43, mean age 30.1 +/- 6.9 years), measures of detection threshold and dynamic range (the width of the decision window surrounding the threshold) were obtained for a 100 msec, 35 Hz vibrotactile stimulus using the method of constant stimuli (20 levels of stimulus amplitude between 0-20 um). The relations for detection threshold and dynamic range with higher-order autism traits were evaluated according to self-reported sensory sensitivity using multiple linear regressions that tested moderated effects.

Study 2: Thermal detection thresholds were collected using the method of limits (continuous temperature increase or decrease from a 32°C baseline at a rate of 1°C/sec) in a large sample of individuals with ASD (n=84; 32 adults [mean age 28.8 years] and 51 children [mean age 11.2 years]) and typical developmental histories (n=60; 24 TD adults [mean age 29.0 years], and 36 TD children (mean age 10.03 years)). Effects of age, sex, group, trial-to-trial variability (CQV), performance IQ, and counterbalance order were included in separate regression models predicting warm and cool thresholds.

Results:

Study 1: Though neither threshold nor dynamic range was independently related to self-reported sensory or higher-order autism traits, self-reported sensory sensitivity significantly moderated the relations between dynamic range and higher-order autism traits.

Study 2: For warmth detection, trial-to-trial variability (CQV) ($p<.0001$) was the strongest predictor of threshold, with smaller but significant effects of performance IQ ($p<.02$) and sex ($p<.03$). For cool detection, performance IQ ($p<.004$) was the strongest predictor, with smaller effects of CQV ($p<.02$), age and sex (p's $<.04$). No significant effects of group or counterbalance order were found in either model.

Conclusions:

Study 1 illustrates a) the need to consider novel psychophysical metrics, including those that incorporate information surrounding the point of a binary perceptual decision (e.g., dynamic range), in future studies of sensory function, and (b) highlight the importance of testing factors that may moderate associations of interest. Study 2 suggests that variability in reaction time may explain findings previously interpreted as between-group differences in sensory thresholds, and that method of limits or other approaches that depend on reaction time may need to be adapted or replaced for assessing sensory differences in ASD.

11:20 **106.003** Neural Habituation to Sensory Stimuli and Sustained Regulation across Time in Youth with Autism, with and without Sensory over-Responsivity

S. A. Green[1], *L. M. Hernandez*[2], *K. E. Lawrence*[2], *J. Liu*[2], *T. Tsang*[2], *J. E. Yeargin*[3], *K. K. Cummings*[2], *M. Dapretto*[1] *and S. Y. Bookheimer*[1], *(1)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA, (2)University of California, Los Angeles, Los Angeles, CA, (3)Brain Mapping Center, UCLA, Los Angeles, CA*

Background: As interest in sensory processing differences in autism has vastly increased, so too has interest in understanding the neurobiological bases of such differences. Our prior work showed that sensory over-responsivity (SOR) in autism is related to greater brain activity in amygdala and sensory cortices in response to mildly aversive sensory stimulation (Green at al., 2013, 2015). Here, we extended our investigation of neural responsivity to sensory stimuli by demonstrating that patterns of brain response to sensory stimuli differ across time, brain region, and SOR severity. Additionally, we examined how changes in prefrontal-amygdala connectivity across a period of sensory exposure differs according to SOR phenotype and contributes to interpretation of BOLD response.

Objectives: To extend the interpretation of brain response to sensory stimuli by examining 1) patterns of response (habituation) across different key brain regions over time in ASD youth with high versus low SOR and TD youth; and 2) how amygdala-prefrontal connectivity changes across sensory exposure in these three groups.

Methods: Participants were 42 children and adolescents with ASD and 27 TD matched controls, aged 8-17 years. ASD participants were grouped into high versus low SOR based on the median split of their parents' ratings of SOR on the Short Sensory Profile (Dunn, 1999) and Sensory Over-Responsivity Inventory (Schoen et al. 2008). During fMRI, participants were presented with mildly aversive auditory (white noise) and tactile (scratchy sponge) stimulation. Stimuli were presented together for 6 blocks of 15-sec trials each. Parameter estimates of brain responses in key regions of interest (ROIs; i.e. amygdala, sensory cortices) were extracted for each block. A psychophysiological interaction analysis was used to examine how changes in amygdala connectivity from the first to second half of the sensory exposure varied as a function of SOR severity.

Results: ASD-high-SOR youth did not show differences in brain responses to the first block of sensory stimuli in any of the ROIs. However, examination of change in brain activity across the 6 blocks of sensory exposure revealed that ASD-high-SOR youth showed reduced habituation in amygdala and relevant sensory cortices, as well as reduced inhibition of irrelevant sensory cortices compared to TD and ASD-low-SOR youth. ASD-high-SOR and ASD-low-SOR youth showed distinct patterns of prefrontal-amygdala regulation.

Conclusions: Findings show that, across a period of sensory stimulation, ASD-high-SOR youth failed to sustain a) reduced habituation in sensory-relevant brain regions, b) reduced inhibition of irrelevant regions, and c) prefrontal downregulation of the amygdala. Taken together, these results indicate that sensory habituation in autism is an active, time-varying process dependent on sustained regulation across time, which may be a particular deficit in ASD-high-SOR youth. Thus, imaging studies that collapse brain responses across time will miss important group differences. Furthermore, ASD-low-SOR youth show increased prefrontal regulation compared to TD and ASD-high-SOR youth, suggesting that behavioral expression of SOR may depend on top-down mechanisms.

11:45 **106.004** Relating Abnormal Tactile Processing and Cortical Dysfunction in Children with Autism Spectrum Disorder

N. A. Puts[1,2], *E. L. Wodka*[3], *G. Oeltzschner*[1,2], *M. Tommerdahl*[4], *R. A. Edden*[1,2] *and S. H. Mostofsky*[5], *(1)Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins University School of Medicine, Baltimore, MD, (2)F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, (3)Kennedy Krieger Institute, Baltimore, MD, (4)Biomedical Enginering, University of North Caroline at Chapel Hill, Chapel Hill, NC, (5)Center for Neurodevelopmental and Imaging Research, Kennedy Krieger Institute, Baltimore, MD*

Background:Sensory, tactile, impairments are considered key features of Autism Spectrum Disorder (ASD). Touch is the first- and only sense with which children can actively explore the world. Studies have suggested that abnormalities in the response to touch may exacerbate social and communicative problems. Most studies investigating tactile processing in ASD to date have used subjective parent- and teacher questionnaires. While clinically relevant, these do not inform the underlying neurophysiology of sensory abnormalities in ASD. Increasing evidence suggests a role of GABA, the main inhibitory neurotransmitter, in the pathophysiology of ASD and cortical processing of touch is known to require GABAergic processes. We developed a method to obtain objective psychophysical measurements of tactile thresholds in children with ASD. In addition, we use Magnetic Resonance Spectroscopy (MRS) to measure brain GABA levels in vivo and recently started using Transcranial Magnetic Stimulation (TMS) to probe GABA-receptor function in ASD.

Objectives: Here, we investigate the relationship between pre-synaptic GABA (MRS), post-synaptic GABA-receptors (TMS), tactile thresholds, and clinical ratings in ASD. We hypothesize that altered GABA function associates with psychophysical and clinical sensory abnormalities.

Methods: 145 children with ASD (10.4 ± 1.3 yrs) and 210 typically developing controls (TDC; 10.2 ± 1.2 yrs) were recruited. Informed consent was given per local IRB procedures. Diagnosis was confirmed using the ADOS-2 and ADI-R. Sensory processing was assessed using the SPM and SEQ3. *Psychophysics* Static and dynamic detection threshold (probing feed-forward inhibition) and amplitude discrimination (probing lateral inhibition) were obtained using a piezoelectric stimulator with vibrations on the left hand (2-alternative forced choice; staircase tracking). *MRS* GABA levels were measured over right sensorimotor cortex (27 ml voxel) using MEGA-PRESS (TE/TR 68/2000 ms; 320 averages). *TMS* Single pulse, short-interval intracortical inhibition (SICI; 2.5 ms ISI, probing GABA-A) and long-interval intracortical inhibition paired-pulse measures (LICI; 100 ms ISI, probing GABA-B) were obtained (20 trials per condition).

Results: Children with ASD show abnormally high static detection and amplitude thresholds (both: $p < 0.0001$; replicating previous work by our lab and others) and no effect of sub-threshold stimulation. GABA levels were reduced in ASD. Abnormal detection thresholds correlated with reduced GABA ($R = 0.54$). Abnormal detection thresholds significantly predicted SPM total score and SEQ hypersensitivity scores ($R > 0.35$, $p < 0.001$), with worse clinical scores for children with higher thresholds and lower GABA levels. Preliminary TMS data suggest that SICI is normal in ASD whereas LICI is abnormal ($p < 0.05$).

Conclusions: Here, we show a relationship between abnormal tactile perception and inhibitory dysfunction in children with ASD. Data suggest that at the receptor level, GABA-B, rather than GABA-A, is affected in ASD. However, close inspection of the data suggests sensory subtypes with different GABA-related abnormalities and different associated perceptual dysfunctions. Our recent explorations using deep learning elucidate this separation and will be discussed. Other studies linking sensory abnormalities to cortical dysfunction will also be discussed. Understanding the link between cortical function and behavioral outcome is key in developing biologically and potential patient-specific treatments in ASD.

Panel Session
Technological Approaches
107 - Innovative Uses of Technology for Autism Screening, Outcome Monitoring, and Treatment
10:30 AM - 12:30 PM - Room: 517A

Panel Chair: Geraldine Dawson, *Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC*

Discussant: Zachary Warren, *Vanderbilt University Medical Center, Nashville, TN*

Innovative technology is increasingly used in autism research. Such applications include active and passive monitoring combined with machine learning to facilitate screening, novel treatment approaches, and expanded outcome assessments. Technological approaches offer quantitative, objective assessments that can be acquired remotely in natural settings. Moreover, because they do not rely solely on expert clinical ratings, they are scalable and permit acquisition of large data sets to produce automated classification algorithms. This panel will describe several contemporary methods and applications of technology in autism research. The first presentation discusses how computer vision analysis can be used to quantify early autism symptoms, discover novel biomarkers, and monitor behavior over time. The next presentation describes research extending the use of computer vision analysis to studies of social interaction and coordination. The subsequent presentation focuses on automated detection and characterization of stereotypical motor movements and their relationship to physiological arousal. The final presentation provides an overview of a multimodal system, which includes both active and passive digital monitoring, for outcome assessment in clinical trials. The discussant will focus on the future challenges and potential impact of technology on autism research, and its application to novel treatment approaches, including the use of robots.

10:30 **107.001** The Use of Computer Vision Analysis for Early Autism Symptom Detection and Monitoring

*G. Sapiro[1], J. Hashemi[1], S. Espinosa[1], Z. Chang[1], K. L. Carpenter[2] and **G. Dawson**[2], (1)Department of Electrical and Computer Engineering, Duke University, Durham, NC, (2)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC*

Background: Early autism symptoms include reduced social attention, failure to orient to name, and atypical emotional expressions, among others. Screening for these symptoms has relied on caregiver-completed surveys which have poor performance for caregivers who have lower levels of education and knowledge about child development; this contributes to disparities in early detection and service access. Expert ratings require training, making such approaches challenging in low resource settings. We demonstrate that computer vision applications can be used in primary care clinics to quantify autism symptoms in an efficient, objective, quantitative, and reliable manner.
Objectives: Provide an overview of a research program based on downloadable, closed-loop software applications for low-cost mobile devices that elicit autism behavioral symptoms in response to neuroscience-informed stimuli which are recorded on the device camera and quantified using computer vision analysis to yield precise measures of visual attention, emotional facial expressions, and motor behavior.

Methods: The sample was 104 toddlers of 16–31 months old; 22 had autism spectrum disorder (ASD) based on the ADOS and 82 had typical development or developmental delay. After extensive pilot testing of both the stimuli (brief movies) and how to effectively deliver them in an exam room, a set of movies that reliably elicited autism risk behaviors were shown on an iPad while the embedded camera recorded the child's attention/gaze, orienting, affective expressions and motor responses, which were quantified via computer vision analysis.

Results: There was strong correspondence between computer and human coding of attention (ICC =.89), orienting (ICC=.84) and affective expression (ICC=.89 - .90). Significant differences between toddlers with and without ASD were found for several known symptom behaviors: Non-ASD children oriented significantly more times (B = 1.89, p = 0.02). Computer coding detected differences in latency to orient that were not readily detectable by the clinician (p = 0.02). Children with ASD looked less at the social stimuli compared to non-ASD children ($p < .05$). A novel finding is group differences in the rate of head movements (postural sway; significant p-values ranged from .012 to <.0001). Toddlers with ASD exhibited higher rates of head movement, suggesting difficulties in maintaining midline position of the head while engaging attentional systems. Preliminary analyses of facial expression data indicate a higher proportion of time spent with "flat affect" for children with ASD compared to non-ASD ($p < .05$).

Conclusions: We demonstrate the feasibility, face validity, and reliability compared to human coding of digital behavioral assessments for detecting and quantifying well-established early autism symptoms, including failure to orient to name, reduced social attention, and flat affect. In addition, we report here that digital assessments can reveal novel biomarkers, such as postural sway, which are not readily detected with the naked eye. We will describe our current NIH Autism Center of Excellence research program which is validating a new version of our technology platform on a large, population-based sample of infants and toddlers being seen in Duke pediatric primary care and assessing its utility for symptom monitoring in clinical trials.

10:55 **107.002** Computer Vision Analyses of Social Coordination and Social Communication Deficits in Autism

*E. Sariyanidi[1], K. Bartley[1], C. J. Zampella[1], A. de Marchena[2], J. Pandey[3], E. S. Kim[3], J. D. Herrington[1], B. Tunc[1], J. Parish-Morris[1] and **R. T. Schultz**[3], (1)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (2)University of the Sciences, Philadelphia, PA, (3)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Reciprocal, coordinated behavior is a fundamental feature of conspecific interactions; birds flock, fish school, bees swarm, and humans deftly coordinate movements with partners during social interactions. This happens so routinely that when there are disruptions to interpersonal coordination, it is palpable. Despite the ease with which we sense difficulties with the fluidity of a social interaction, there are currently no tools that can reliably quantify the degree of coordination during an interaction in a highly granular and easily scalable manner, and no well-established quantitative methods for assessing group and individual differences in dyadic coordination.
Objectives: To develop robust quantitative methods for precisely assessing coordinated facial movements during social interaction; and to test whether such a measurement process can distinguish those with autism spectrum disorder (ASD) from typically developing controls (TD), and whether it can distinguish individual differences in social communication skill within the group with ASD, specific from restricted and repetitive

behaviors (RRB).

Methods: Our primary sample consisted of 44 young adults, 17 with ASD and 27 TD. We tested the generalizability of the results in a replication sample of 30 adolescents, 17 with ASD and 13 TD. Both samples were matched on age, verbal IQ (normative range), and gender. Participants engaged in an unstructured, 3-minute "get to know you" conversation with an unfamiliar study team confederate. Confederates were instructed not to initiate topics and to not speak more than 50% of the time. Dyadic interactions were captured with a specially designed "TreeCam" with two synchronized HD video cameras pointing in opposite directions. Dyadic facial coordination was automatically quantified with a computer vision and machine learning analytic pipeline. Facial movements were captured as a set of 180 independent, regional "bases", where bases represented time series of facial movements (e.g., corner of the mouth) for each person. Quantification of dyadic coordination between conversational partners involved windowed cross correlation between the partners' time series. A machine learning framework (with nested, leave-one-out cross-validation; LOOCV) was designed to predict group membership (ASD vs. TD) and individual differences in ADOS-2 overall CCS, Social Affect (SA), and RRB scores. Only the dyadic features that predicted adult group membership were used in the replication sample.

Results: Classification (ASD vs. TD) accuracy was 88.6% (p<.0001; PPV=.93; NPV=.87) for the primary sample, and 86.7% (p<.0005; PPV=.88; NPV=.85) for the replication sample. Automated computer prediction in the primary sample was more accurate than that of expert (n=9; 87% vs. 82%) and non-expert (n=11; 87% vs 77%) study staff who made diagnostic judgements from the same dyadic videos (p's<.001). Using the feature groups selected for classification, support vector regression with LOOCV predicted the ADOS-2 CSS in the primary sample (r=.57, p=.02) and the replication sample (r=.53, p=.03). As hypothesized, correlations were higher for SA scores than RRB scores (SA: .58 and .20, respectively; RRB: .00 and .06).

Conclusions: Automatic assessment of social coordination from brief videos of natural conversations promises to be an important new tool for autism research, which adds granularity and scalability to diagnostic and social communication assessment.

11:20 **107.003** Automated Detection and Characterization of Stereotypical Motor Movements and Their Relation to Cardiovascular Arousal

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Background: One of the core diagnostic features of autism spectrum disorder (ASD) is engagement in stereotypical motor movements (SMM), although the etiology of this repetitive behavior is unknown. Since the 1960s, it has been hypothesized that SMM serve a homeostatic regulation function, and thereby a coupling mechanism to cardiovascular arousal. However, to date, surprisingly few reports explicitly assess cardio-somatic coupling and SMM in ASD.

Objectives: Examine naturally emitted SMM concomitantly with peripheral nervous system measures for evidence of cardio-somatic coupling.

Methods: SMM recorded via video, three-axis accelerometry, and simultaneous electrocardiographic signals were obtained in a convenience sample (n=10) of children and young adults with moderate to profound ASD to assess cardiovascular responses at or around the onset of naturalistically occurring stereotypy. RR intervals were extracted via Vivometrics software, visually inspected, and hand-corrected using CardioEdit software. Corrected RR intervals were then time-aligned with video annotations, resampled to 5Hz, and subsequently analyzed both as short sections defined by time (designated *window analysis*) or by SMM onsets (designated *point analysis*).

Results: Twenty-four sessions varying in length were analyzed (n=24, mean=25.75 min, SD=8.22, range [8.18-49.81]). Most participants were recorded for approximately 30 to 90 minutes each over multiple sessions. Agreement between annotators in the video codes ranged from k = 0.72–0.92 (M = 0.84), suggesting high inter-rater reliability for observed SMM type, start, and end times. Rocking and flapping were the most commonly observed SMM (n=22 and n=20 sessions, respectively). Without any restrictions on activity or duration, windows containing any SMM were compared to windows without SMM. Averaged across all participants, there was very little change in RR interval (mean Δ=-6.8ms, SD=20.2ms) or RSA (mean Δ=0.03, SD=0.16 $\ln(ms^2/Hz)$). We then extended our analyses to evaluate physiological response differences in type and duration of SMM at the per participant session level. Differences in heart interval and RSA were computed between rocking vs. no SMM, flapping vs. no SMM, and mixed stereotypy vs. no SMM. Additionally, responses were separated by different levels of SMM engagement (any, moderate, heavy). Results indicated a moderate effect on RSA with rocking and a large effect on heart interval with flapping. Finally, instantaneous heart rate changes for one, two, and four second onset latencies produced nearly identical cardiac signatures (5^{th} order polynomial), including the same pattern of comparatively rapid acceleration followed by a slower deceleration observed at all SMM onsets and overall SMM types.

Conclusions: Cardiovascular analyses reveal that both stereotypical body rocking and hand flapping produce a strikingly similar pattern of acceleration and deceleration unrelated to physical demands associated with the movements themselves. However, despite this consistent cardiovascular signature observed across individuals, neither type of SMM provoked directional change in heart rate variability. The data, methods, and results from the current study can be applied and extended in future work to more systematically evaluate the potential role SMM plays in homeostatic regulation, providing potentially important insights for understanding and intervening upon a core symptom of ASD.

11:45 **107.004** A Multimodal Data Capture System for Assessing Outcomes in Autism Clinical Trials

G. J. Pandina, *Janssen Research & Development, Titusville, NJ*

Background: Autism Spectrum Disorder (ASD) is a complex, heterogeneous neurodevelopmental disorder with no approved medications for core symptoms. Objective measures have potential to de-risk drug development by improving patient selection and enhancing sensitivity to drug response. Mobile and web-based approaches could increase signal detection and decrease study burden by allowing fewer in-person visits, using momentary assessment and other novel measurement techniques. Lab- and home-based sensors could create novel, objective endpoints that help with stratification and change measurement in ASD clinical trials.

Objectives: The study objective was to demonstrate the utility of the Janssen Autism Knowledge Engine (JAKE®), a standardized set of mobile/web-based tools and lab- and home-based experimental, proof-of-concept sensor array, to identify potential markers of population enrichment and symptomatic change in ASD. The Autism Behavior Inventory, a caregiver-based rating scale administered through the My JAKE web portal was compared with other common ASD scales. Other experimental mobile assessments assessed caregiver-selected most troubling symptoms, global symptom severity, and important factors (sleep, mood/affect, etc.). Results were compared with lab-based sensor-derived endpoints, using a battery of computer tests specifically designed to detect social communication problems and repetitive behaviors/interests,

and via passive sensing at home.

Methods: A total of N=144 children and adults (aged ≥6 to 53 years) with ASD were assessed in an 8-10 week prospective non-interventional trial (US, 9 sites) with the JAKE system. JAKE includes: 1) a web-and-mobile assessment of clinical symptoms (ABI, ASD-related events, mood report, medical/developmental history) and; 2) an array of experimental home-based wearable sensors for measuring activity and sleep, and lab-based computer tasks designed to provoke ASD-specific physiological signals on a variety of sensors. Participants completed battery of clinical rating scales. ASD results were compared with age and sex-matched typically developing (TD) controls (N=41), who completed rating scales and lab-based test battery once.

Results: Data from rating scales, lab-based tasks, and home- and lab-based web and mobile assessments yielded multiple findings that discriminated between ASD and TD. ASD participants were able to complete the lab-based task battery and produce valid data. ASD and TD participants showed differences in sensor based biologic responses on lab-based tasks. These include reduced facial affect expressivity (both passively and on-demand), a lack of face preference in dynamic social vs. non-social stimuli and a lack of preference for biological motion (both measured by gaze fixation), and differences in resting state electrical activity in the brain and coherence between brain regions during social perceptual tasks. Relationships between symptoms (rating scales) and lab and home-based sensor assessments were modest, suggesting these tools may measure different aspects of ASD.

Conclusions: Assessment of ASD subjects across a range of severity and age using a coordinated system of web-and-mobile clinician and caregiver tools, and lab/home based sensor technologies, is feasible and offers a robust method for assessing a broad range of ASD symptoms. This multimodal approach produces a complex blueprint of ASD behavior of potential utility in clinical trials.

Poster Session
108 - Adult Outcome: Medical, Cognitive, Behavioral, Social, Adaptive, Vocational
11:30 AM - 1:30 PM - Room: 710

1 **108.001** A Comparison of the Experiences of Autistic and Non-Autistic Individuals Participating in a Corporate Internship Scheme.

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Background:
Autistic individuals often face significant challenges to obtaining and maintaining meaningful employment – more so than other disability groups. Aside from the economic impact of this gap, failing to get autistic people into work likely has a negative effect on quality of life in a group of people who commonly have unique and valuable skillsets. In addition, those autistic individuals who *are* in full-time work are often in poorly paid, low-skill jobs that do not reflect their competencies. The UK autistic community has identified that understanding effective employment support is one of their top ten research priorities. Consequently, employers are beginning to offer paid work placement opportunities for individuals on the autism spectrum.

Objectives:

Our previous research examined the experiences of autistic employees and their co-workers on one such British scheme implemented by Deutsche Bank, a large global banking and financial services company. The research highlighted autistic interns' meaningful contributions to the workplace, but a number of challenges to address. The question remains, however, to what extent these challenges are autism-specific or are inherent in starting a new role for all individuals alike. In the current study, we conducted a direct comparison of autistic and non-autistic individuals on the 2017-18 internship programmes at Deutsche Bank UK.

Methods:

Semi-structured interviews were carried out with intellectually able autistic (n=16, 1 female, 15 male) and non-autistic (n=15, 7 female, 8 male) interns (aged 18 to 36 years), and a subset of their hiring managers before the start of the programme and again immediately after its completion. Before commencing the programme, interviews focussed on previous employment experiences (interns) and expectations of the upcoming programme: opportunities, possible challenges and how they might address these challenges (interns and managers). Following the internship, interviews with both interns and managers focussed on their experiences of the internship: aspects that went well, issues that arose, and ways they were overcome.

Results:

Interviews were recorded, transcribed verbatim, and resulting data was analysed using thematic analysis. Analyses are on-going, however preliminary results suggest a number of differences between the experiences of autistic and non-autistic interns. For example, autistic interns more frequently raised the issue of anxiety in the workplace, compared with their non-autistic counterparts. This is supported by higher levels of self-reported mental health difficulties in the autistic interns when they entered the programme. Commonalities were also found, however, with all managers identifying that carefully matching job roles to intern skills is crucial for scheme success. In addition, all managers were enthusiastic about the schemes and willing to partake in future iterations.

Conclusions:

Our results suggest that there are indeed autism-specific challenges, but that these may not surround core aspects of the condition. Instead, aspects such as mental health difficulties should be a key consideration for line-mangers looking to create more enabling environments for autistic employees. Further, while outcomes were overwhelmingly positive for autistic interns involved in this study, it remains to be seen if this would be the case for autistic employees recruited outside of a dedicated scheme.

2 **108.002** A Mixed Methods Evaluation of Social Experiences and Well-Being of College Students with ASD

***K. M. Bailey**, K. M. Frost, K. Casagrande and B. R. Ingersoll, Psychology, Michigan State University, East Lansing, MI*

Background: As more individuals with ASD attend college, there has been a growing interest in the experience of college students with ASD. It is common for students with ASD to experience difficulties while at college, particularly in the domain of social interaction (Adreon & Durocher, 2007). Well-being is associated with social interaction in typically developing populations, but less is known about the role that social interaction plays in well-being for individuals with ASD. For example, social activities typically thought to be stress-reducing for students may actually increase feelings of stress in persons with ASD due to restricted interests as well as the challenges involved with establishing new social networks (Glennon, 2001).

Objectives: This mixed-methods study examined the relationship between well-being and the social experience of college students with ASD. In doing this, we hoped to gain a better understanding of 1) the well-being of college students with ASD, 2) the social experience of college students with ASD, and 3) how social participation and social support relate to well-being.

Methods: This mixed-methods study utilized a convergent design (QUAN+QUAL) using information from an online survey and a semi-structured follow-up interview. The survey included several previously validated measures and questions about participants' backgrounds, types of social participation, forms of informal social support, and well-being. The interview gave us deeper insight into participants' experiences regarding their social relationships and engagement. Correlations were used to examine the relationship between social participation items, perceived social support, and well-being. For qualitative analysis, we used an inductive thematic analysis to allow for themes to naturally emerge from the interviews. Following these separate analyses, joint displays that integrated descriptive statistics, qualitative themes, theme counts, and individual quotations were created to facilitate the interpretation and integration of quantitative and qualitative data. Finally, meta-inferences were included based on an overall review of data to facilitate interpretation.

Results: Students with ASD reported spending the most time doing hobbies by themselves, over spending time with friends, participating in school clubs, and participating in sports. Time spent hanging out with friends was positively associated with subjective well-being (r=0.44). In interviews, participants mentioned common themes around the challenge of new social expectations, struggling to make social connections, and the trade off between socializing and succeeding academically. Participants also mentioned many positive social experiences and talked about their preferred methods of finding friendships at college. Furthermore, immediate family, other relatives, friends, and school personnel were the most frequently-endorsed forms of social support. Perceived social support was positively correlated with well-being (r=0.371). In the interview, participants spoke about the importance of both their family and friends as social support. They also mentioned the potentially positive and negative roles professors can play as social support.

Conclusions: This study adds a new perspective to the current body of literature related to the college experience for students with ASD and highlights the important role that social support and interaction play in their well-being.

3 **108.003** A Mixed-Methods Approach to Understanding the Abilities and Transition Experiences of Young Adults with ASD and Their Parents

N. L. Matthews[1], *S. Tracey*[1], *S. Kiefer*[1], *K. Christenson*[1] *and C. J. Smith*[2], *(1)Southwest Autism Research and Resource Center, Phoenix, AZ, (2)Southwest Autism Research & Resource Center, Phoenix, AZ*

Background: The current understanding of adult outcome in autism spectrum disorder (ASD) stems primarily from quantitative analysis of large datasets or clinically ascertained samples. There is a relative dearth of qualitative data that describe experiences during the transition to adulthood, which could contribute to improved understanding of the needs of this population. This study examined the abilities and transition-related experiences of young adults with ASD without intellectual disability using a mixed-methods approach.

Objectives: (1) To compare intellectual and adaptive functioning among young adults with ASD to determine whether previous findings of an adaptive functioning (AF) disadvantage would replicate in the current sample, and (2) to qualitatively explore transition experiences of young adults and their parents.

Methods: Participants were 18 young adults with an ASD diagnosis (14 males; ages 18-33 years; *M*=24.55, *SD*=4.16) and at least one parent (15 mothers, 3 mother/father dyads). All young adults had a composite IQ ≥ 70 (*M*=95.67, *SD* = 13.88), and all but one met criteria for autism/autism spectrum on the ADOS-2. We oversampled for employed adults (*n* = 8); the remaining 10 participants included 2 full-time college students, 2 part-time college students, 1 high school student (age 21), 2 participants about to begin jobs, and 3 unemployed participants not enrolled in school.

Parents completed the ABAS-3 (Harrison & Oakland, 2015), a questionnaire about their young adult's AF. Participants and their parent(s) completed separate 90-minute semi-structured interviews developed by the authors about independent living skills, employment, and post-secondary education. Interviews were coded line-by-line using grounded theory methodology (Strauss & Corbin, 1990). Qualitative findings include axial codes derived from the interviews of 10 participants and their parents. Coding of remaining interviews is in progress and final analyses will include focused coding of all interviews from the full sample.

Results: Depicted in Figure 1, within-subjects ANOVA followed by Bonferroni post hoc tests indicated that composite IQ was significantly higher than ABAS-3 conceptual, social, and practical AF standard scores (*p*s ≤ .001). Table 1 reports preliminary axial codes from qualitative analysis.

Conclusions: Quantitative analyses replicated previous findings (Matthews et al., 2017) such that participants had significantly lower AF scores relative to intelligence scores. Visual examination of Figure 1 suggests that employed adults had a smaller intellectual-adaptive functioning gap relative to unemployed adults, which may indicate that employment allows young adults to develop increased independence in social and practical AF. Future research using a prospective design should examine this possibility.

Supporting AF impairments documented by quantitative analysis, preliminary qualitative analysis indicated that most participants needed reminders to initiate daily living tasks or to complete tasks adequately, despite knowing how to complete these tasks. Participants with relatively high levels of independence attributed their success to parents setting clear expectations for independence during adolescence. Most employed adults and their parents described methods for overcoming barriers to employment. A minority of participants experienced events that caused substantial interruptions to independence. Qualitative findings provide insight into the well-documented intelligence-AF gap. Findings will inform future interventions aimed at improving the transition to adulthood.

4 **108.004** A Model Program for Increasing Social Opportunities for Adult Women with Autism

M. Huerta[1,2], *J. M. De Brito*[1] *and B. Finkelstein*[1], *(1)Felicity House, New York, NY, (2)Weill Cornell Medicine, New York, NY*

Background: Adults with autism spectrum disorder (ASD) consistently demonstrate high rates of social isolation and report few friendships after exiting structured programming such as high school and college (Roux et al., 2017; Orsmond et al., 2013; Orsmond et al., 2004). From the perspective of adults with diagnoses of ASD, barriers to social participation include the lack of social opportunities (Singer, 2013) and difficulties with social information processing (Chamak et al., 2018). For adult women with ASD, an additional challenge is the limited availability of safe, social spaces (Huerta, 2013).

To provide increased social connections and accessible social opportunities for adult women with ASD, a community program was developed based on concepts from Universal Design (Connell et al., 1997) and the TEACCH philosophy (Schopler, 1994). The program design was further informed by feedback from key stakeholders, including self-advocates, and a pilot social group of adult women with ASD.

Objectives: This formative study has three objectives:

1. To describe a novel program model for increasing social opportunities for adult women with autism.
2. To assess the acceptability of the program design based on participant feedback.
3. To examine self-reported challenges to social participation in a sample of adult women with a diagnosis of ASD.

Methods: As part of the program's yearly review, all participants with active participation plans (N=76) were invited to complete a brief survey and in-person interview led by trained staff. A program-specific questionnaire was used to obtain participant ratings on key elements of the program design. De-identified survey data will be summarized using means and standard deviations. Categorical data will be presented using counts and percentages.

Results: Based on the qualitative data collected to date, participant response to the program has been positive and centered around the increased availability of social activities and greater access to female peers. Participants have also spontaneously described positive, secondary effects of participation including increased adaptive skills and decreased anxiety. Additional data on participant satisfaction and self-reported challenges will be analyzed and presented.

Conclusions: This program represents a unique approach to decreasing social isolation in adults with ASD that does not assume the need for social skills training. Information about self-reported social difficulties will be used to further revise the program model and can inform research efforts on adult autism assessments and measure development.

5 **108.005** A New Grounded Theory of Physical Activity Participation in Autistic Adults: Preliminary Findings.

*A. M. Colombo-Dougovito[1], **J. Blagrave**[2] and S. Healy[3], (1)Kinesiology, Health Promotion, & Recreation, University of North Texas, Denton, TX, (2)Kinesiology, California State University, Chico, Chico, CA, (3)Behavioral Health and Nutrition, University of Deleware, Newark, DE*

Background: Physical activity (PA) is an evidence-based practice for individuals on the autism spectrum (Dillon, Adams, Goudy, Bittner, & McNamara, 2017). Although a growing body of literature has explored PA experiences through first-hand accounts of children on the autism spectrum (Blagrave, 2017; Healy, Msetfi, & Gallagher, 2013), the perspective of autistic adults remains unheard. Thus far, to understand the autistic* adults' experience of PA, research has primarily relied on the perspective of caregivers (Blagrave & Colombo-Dougovito, in review; Colombo-Dougovito, 2017; Nichols, Block, Bishop & McIntire, 2018). Due to the absence of research that exists regarding PA from the perspective of autistic adults, there exists a limited knowledge of the appropriateness and generalizability of current models and theories of PA used in the fields of health and kinesiology for the autistic adult.

Objectives: Therefore, to better inform future intervention or programming practice, a grounded theory study (Glaser & Strauss, 1967; Urquhart, 2013) was conducted to develop a theory of PA participation in autistic adults.

Methods: Autistic adults (n=25) from the United States and the United Kingdom were recruited through various social media platforms and by a process of snowballing. Semi-structured, in-depth interviews were conducted with the participants regarding their retroactive experiences as children participating in PA, as well as their current PA and health perceptions and behaviors. All data were thematically coded (Braun & Clark, 2006), and using constant comparison method (Glaser & Strauss, 1967; Urquhart, 2013) were formed into 4 broad categories. These categories were theoretically analyzed.

Results: A total of 29 codes emerged from the thematic coding process; these codes included bullying, body image, environmental barriers and facilitators, motivation, perceived competence, as well as instance of social positives and success. These codes were formed into 4 broad categories: (1) individual attributes; (2) environmental factors; (3) social relationships; and (4) individual outcomes. A preliminary grounded theory of PA experience for autistic adults was formed and will be presented.

Conclusions: The environment is often cited as the greatest barrier to PA for both those on the autism spectrum. Findings from this study indicate that, though the environment acts as both a barrier and facilitator to PA in autistic adults, social relationships can have an equal or larger impact on the PA experiences of autistic adults across their lifespan. However, both of these factors are mediated by the attributes of the individual and are not necessarily equally impactful for each individual. For example, an individual with a greater perception of their own ability will be less impacted by environmental or social factors than an individual with a low perception. In light of these findings, providing opportunities to build skill and success can help to insulate individuals from external factors that may dissuade them from PA; this new model may better explain PA participation in adults on the autism spectrum. Further research is needed to explore the reproducibility of these findings and further refine this new grounded theory.

(*intentional use of identity first language; Kenny et al., 2016)

6 **108.006** A Pilot Study of DBT Skills Group for Adults with ASD without ID

***L. R. Guy**[1], L. A. Ritschel[2], L. Turner-Brown[3] and C. M. Corsello[4], (1)Psychiatry, UNC TEACCH Autism Program, Greensboro, NC, (2)Psychiatry, The University of North Carolina, Chapel Hill, NC, (3)UNC TEACCH Autism Program, University of North Carolina at Chapel Hill, Chapel Hill, NC, (4)Psychiatry, UNC TEACCH Autism Program, Raleigh, NC*

Background: Comorbid psychiatric conditions, emotional dysregulation, behavior challenges and suicidality are common for adults with autism spectrum disorders (ASD) (Croen et al, 2015; Hirvikoski et al, 2016). While there are evidence-based interventions available to address these challenges, there is a lack of research regarding their feasibility and effectiveness for individuals with ASD. Dialectical Behavioral Therapy (DBT), which targets emotional, cognitive, and behavioral dysregulation, has been used effectively as a transdiagnostic treatment with a number of psychiatric conditions (Ritschel et al, 2015) and may be an effective intervention for individuals with ASD. Standard DBT includes individual therapy and group skills training, although evidence suggests that the skills training component alone may be an effective intervention in some cases. Given the overlap between the comorbid conditions and emotional dysregulation often seen in individuals with ASD and the goals of DBT, it is potentially a beneficial intervention for adults with ASD. The current study was designed to determine the feasibility and appropriateness of DBT as an intervention for adults with ASD without Intellectual Disability (ID).
Objectives: The study aim is twofold: (1) To determine if DBT skills group training is a feasible intervention for adults with ASD without ID; and (2) To determine if modifications to the standard DBT curriculum are warranted to make the treatment more effective or accessible to an ASD population.

Methods: Groups were conducted across four university-affiliated, community-based ASD centers. Training for therapists and ongoing consultation were provided by a DBT expert. Inclusion criteria were chronological age of 18 years or older, diagnosis of ASD, completion of high school regular education, and no co-occurring diagnosis of ID. Groups met weekly for 1.5 hours for 24 weeks using the standard adult DBT handouts and worksheets. DBT modules and durations are illustrated in Figure 1. Feasibility was assessed using a participant satisfaction questionnaire as well as participant attendance and retention rates. Focus groups were conducted with providers to determine appropriateness of materials and curriculum.

Results: Sixteen participants enrolled in the program; 13 (81.25%) completed the full six months of treatment (M_{age} = 36.62, range: 19-68; 76.92% male). Mean session attendance rate was 87.54% (range 80-96%). Responses on the participant satisfaction scale ranged from 1 (lowest) to 5 (highest) and are reported in Table 1. Overall satisfaction ratings were high (M = 4.45, SD=.82), as was the rating of DBT as an intervention that was likely effective for others with ASD (M = 4.86, SD=.69). Focus group with therapists identified recommended modifications to DBT materials.

Conclusions: The current study provides preliminary evidence of the feasibility of providing DBT skills groups for adults with ASD without ID in community-based clinics and its perceived benefit for this under-served population. Recommended ASD-specific modifications to standard DBT include adding visual strategies to make the teaching of abstract concepts more concrete; simplifying handouts and worksheets to include fewer words and more images; and repeated practice of skills in session.

7 **108.007** A Qualitative Examination of the Transportation Experiences and Needs of Young Adults with ASD without Intellectual Disability

K. Christenson[1], *S. Kiefer*[1], *S. Tracey*[1], *N. L. Matthews*[1] *and C. J. Smith*[2], *(1)Southwest Autism Research and Resource Center, Phoenix, AZ, (2)Southwest Autism Research & Resource Center, Phoenix, AZ*

Background: Limited research has examined the transportation needs of adults with autism spectrum disorder (ASD). Existing research focuses primarily on how ASD-related impairments impact transportation skills (Lindsay, 2016). To our knowledge, no published research has explored how transportation independence, or a lack there of, impacts various outcomes in young adulthood.
Objectives: To use a qualitative approach to explore the transportation-related experiences of young adults with ASD without intellectual disability.

Methods: Participants were 18 young adults with ASD (14 males; ages 18 to 33 years; *M* age = 24.55, *SD* = 4.16) and at least one parent of each adult (15 mothers, 3 mother/father dyads). All young adult participants had a composite IQ ≥ 70 (*M* = 95.67, *SD* = 13.88) and a documented clinical diagnosis of ASD; all but one met criteria for autism/autism spectrum on the ADOS-2. We oversampled for employed adults with ASD (*n* = 8); the remaining 10 participants included 2 full-time college students, 2 part-time college students, 1 high school student (age 21), 2 participants about to begin jobs, and 3 unemployed participants not enrolled in school.

Adults and their parent(s) participated in separate 90-minute semi-structured interviews developed by the authors about independent living skills and employment experiences. Interviews were transcribed and coded line-by-line using grounded theory methodology (Strauss & Corbin, 1990). The current analysis focuses on all transportation-related axial codes from interviews with 10 adults and their parents. Coding of the remaining interviews is in progress, and final analysis will include focused coding of all 18 participants' interviews.

Results: Preliminary axial-codes are reported in Table 1.

Conclusions: Findings revealed that many young adults were independent in at least one area of transportation (e.g., driving; public transportation; biking/walking to work). Some participants reported a lack of desire to drive due to ASD-related impairments (e.g., attentional issues); feeling unsafe; or because they perceive driving to be unnecessary. Also, some participants reported dissatisfaction with public transportation (e.g., expensive; unreliable) and difficulties with navigation. In addition to noting these difficulties, both participants and their parents acknowledged that lack of independent transportation is a barrier to employment and improved daily living skills (e.g., health care; grocery shopping).

Parents expressed transportation-related concerns, including fears about traffic accidents or being taken advantage of when using public and alternative modes of transit (e.g., ride sharing apps). Some parents prohibited their young adult from driving, whereas others allowed their young adult to drive despite reservations. Most young adults with driving experience reported no or only minor car accidents, whereas one young adult had multiple significant car accidents.

Adults and their parents suggested that the importance of transportation independence depends on the location of the adult's home. Location also plays an essential role when transitioning to independent living. Jobs and services that were once conveniently located may be unreachable at a new residence due to limited access to transportation. Together, findings complement existing literature on transportation among adults with ASD, and highlight the importance of including transportation considerations when planning for the transition to adulthood.

8 **108.008** A Systematic Review of Strategies That Influence Physical Healthcare Access for Autistic Adults

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Background: Some physical health conditions are reported more frequently by autistic people compared to the general population (e.g. cardiovascular disease). Furthermore, autistic people may be significantly less likely to access preventative screening services (e.g. prostate or cervical screening). Several recent studies reported an elevated risk of premature mortality for autistic people compared to the general population. Autistic people self-report significantly more unmet needs, and lower satisfaction with patient-provider communication. Qualitative work has indicated that inter-personal communication, sensory sensitivities, and self-efficacy may prevent autistic people from effectively engaging with healthcare services.

Objectives: To undertake a systematic review to investigate the barriers to physical healthcare access experienced by autistic people.

Methods: Inclusion criteria: Qualitative, quantitative, and mixed-methods studies published in English; includes a sample, or sub-sample of autistic adults (minimum age of 16 years); includes a qualitative or quantitative description of barriers that prevent effective access to physical healthcare or, factors facilitating healthcare. Databases (including CINAHL; Web of Science; MEDLINE; Embase; and PsychINFO) were searched using a list of terms including: barrier, facilitator, adjustment, access*, delivery of care, autis*. The Qualitative Assessment Tool for Studies with Diverse Designs (QATSDD) was used to evaluate the methodological quality of each study.

Results: A total of 5,177 records were included (including grey literature, n=44). After removing duplicates (n=2,139) a total of 3,308 articles were screened by title and abstract. After screening (n=3,006 removed) 32 articles were assessed for eligibility by full-text read through. Six articles were retained for inclusion in the qualitative synthesis. The QATSDD was completed by two independent raters (Two-way random Intraclass Correlation Coefficient=0.97, $p<0.001$). Included papers varied in methodology: two quantitative papers (a longitudinal study and measure validation study); two qualitative studies about healthcare experiences; and two mixed methodology studies. Both quantitative and qualitative data identified similar barriers to physical healthcare access. These barriers included: difficulties knowing where to find help; anxiety makes accessing healthcare challenging; sensory sensitivities; negative experiences with health professionals; and problems with patient-provider communication. One study testing a toolkit for improving communication between patient and provider did show a significant reduction in barriers to healthcare access, suggesting improving healthcare access for autistic adults is possible.

Conclusions: Six studies highlighted that autistic people face diverse barriers to accessing healthcare. As these barriers are multi-faceted, helping autistic people access healthcare more effectively is likely to require a nuanced, personalised approach that meets an individual's unique needs. Given that barriers to healthcare can be reduced our research team will build on these findings with projects that evaluate ways of improving access to healthcare for older autistic adults and, identifying treatable health conditions through specific health checks for autistic people and developing better informed treatment plans.

9 **108.009** ASD in the Workplace: Understanding Community Employer Perspectives

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Background:

Employment is a key milestone in an individual's life and major component of social integration. Research on individuals with Autism spectrum disorders (ASD) has shown that employment is positively related to several dimensions of quality of life, including economic resources, positive self-perception, access to an active social network, and preferred living arrangements (Blackorby & Wagner, 1996; Butterworth & Gilmore, 2000; Stephens, Collins, & Dodder, 2005). Despite these positive features of employment, individuals with ASD do not achieve the same employment outcomes as the rest of the population. As a group, they encounter issues such as unemployment or underemployment, low wages, and a lack of support in the workplace (DeLeire, 2000; Yamaki & Fujiura, 2002). Recent analyses of individuals with ASD in the workplace found that only 53.4% of young adults have held a job outside the home in the eight years following high school graduation (Roux et al., 2013).

In an effort to understand the employer perspective on hiring and retaining employees with ASD, we applied Psychological Contracting Theory as the basis for generating questions on expectations and allowable accommodations in the workplace. Psychological Contracting Theory is a well establish research paradigm in business and management literature that conceptualizes the employer/employee relationship as an informal contract based on perceived expectations and commitments by both parties. This theory holds that positive employment relationships and long-term employment arrangements rely on an appropriate match in expectations between employers and employees.

Objectives:

The objective of the current study is to conceptualize employer expectations for accommodating individuals with ASD in the workplace.

Methods:

The current study surveyed community employer perspectives across industries in the western United States. Following the Psychological Contracting Theory framework, results of the current study reflect the degree to which community employers are willing to accommodate individuals with ASD. The accommodations included are based on recommendations for individuals with ASD in the workplace from the Job Accommodation Network (JAN) in areas aligned with core features of ASD. The target demographic of the survey was corporate leadership and hiring decision-makers (e.g., human resource managers).. At the completion of the study, 128 individuals participated in the survey.

Results:

Results show high levels of variability between employers regarding acceptable accommodations in the workplace. Survey respondents showed generally high commitment to accommodations related to communicating in the workplace, time management, and strategies to support organization. In contrast, respondents indicated less willingness to accommodate for issues related to atypical body movements, maintaining focus, social skill deficits.

Conclusions:

The current study found high variability between employers with respect to which accommodations should reasonably be expected in the workplace. These findings support the need for individuals with ASD need to self-advocate for accommodations in their workplaces. In addition, individuals with ASD should make informed decisions regarding potential employers, as the variability in the above results demonstrate that there are degrees to which employers are willing offer certain accommodations.

10 **108.010** Academic Achievements Are Differently Associated with Social Anxiety in ASD and Non-ASD University Students

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Background:
Almost half of the ASD population is now considered to have average or above average cognitive ability (i.e 43.9%- IQ > 85, Christensen et al., 2016), though only 14% of those young adults with ASD have a university education (Helles et al., 2016). Most of the studies that examined students with ASD reported on their feelings during their time on campus; anxiety was the most commonly reported experience (Jackson et al., 2017; 2018). There is a scarcity of research on the academic achievements of students with ASD. Objectives: 1. Compare academic achievements in ASD and non-ASD students with and without social phobia. 2. Evaluate the association of academic achievement and anxiety (trait/social anxiety), and autism severity.

Methods: The study included 111university students (13 females) (mean age=24.21, SD=2.69). The study population included three groups: students with an ASD diagnosis (ASD group, n=55), non-ASD students with high levels of social anxiety (SA group, n=31) and non-ASD students with low social anxiety (control group, n=25). All participants underwent assessment for ASD [Autism Spectrum Quotient (AQ-Baron-Cohen et al., 2001)], [Social Communication Questionnaire (SCQ- Berument et al., 1999)], level of social anxiety [Liebowitz Social Anxiety Scale (LSAS -Liebowitz, 1987)], and level of state and trait anxiety [State Trait Anxiety Inventory-(STAI- Spielberger et al., 1983)]. In addition, the students' grade point averages (GPA) for the first semester of their first academic year were obtained.

Results: The comparison between the GPAs of the three groups yielded a significant group effect [F (2, 99)=4.01, p<.05 h^2_p =.08]. The control group had the highest GPA (*M*=83.17 *SD*= 9.79) followed by the SP group (*M*=77.02 *SD*= 14.01), while the ASD group had the lowest scoring (*M*=74.00 *SD*=14.74). However, only the GPA difference between the control and the ASD groups was significant.. A significant group effect on anxiety measures was observed [$F(4,192)=14.31$ $p<0.01$ h^2_p =0.23]. Both the ASD (*M*= 45.43 *SD*=24.60) and the SA (*M*=49.59 *SD*=14.03) groups' LSAS scores were higher than 35 (the cutoff point for social phobia), and significantly higher compared to controls (*M*=17.54 *SD*=9.67). A similar effect was noted for the trait and state anxiety measures. Examination of the correlation between the GPA and other study variables yielded significant and negative correlations with LSAS score for the non-ASD groups (r=-.29, p<.05) and significant and positive correlations for the ASD group (r=.30, p<.05). In addition, autism severity scores (SCQ) correlated significantly and negatively only for the non-ASD groups (r=-.47, p<.01).

Conclusions: ASD is associated with lower academic achievements, even among cognitively-abled students. For non-ASD students, social anxiety is associated with reduced academic achievements, possibly, as previously suggested (Russel & Topham, 2012) as a result of avoidance, leading to a reduction in social capital, which is known to enhance academic gains. For ASD students the opposite association was evident, suggesting that students with ASD and social anxiety may avoid social situations, including studying alone, which reduces social pressures and causes more effective learning and consequently higher achievements. These findings should be considered in planning supports for students with ASD.

11 **108.011** Adolescents with Autism and Their Interest in Future Careers Involving Technology

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Background: In the US, students with autism have some of the poorest post-school outcomes of any disability category, according to the National Longitudinal Transition Study-2. Finding opportunities to match their skills and interests to sustainable employment is a priority. It has been reported that many individuals with autism are attracted to technology, in particular screen-based technology, especially for entertainment. For most young people, their interests often lead to future careers. Since occupations involving technology skills are in high demand, technology-related careers hold promise for improving the adult outcomes for students with autism. However, little is known about this subject.
Objectives: The primary purpose of this study was to explore the interest adolescents with autism have in future careers using technology, and, to identify specific technology areas they are interested to pursue in higher education.

Methods: This study used a paper survey with 275 high school students with autism from 30 high schools spread across 3 states in the US. The majority of participants were male (87%), white (72%), without intellectual disability (93%), and on track to graduate high school with a regular diploma (100%).

Results: Student survey participants were asked about their interest in using technology in their future. The majority (75%) said they would like to have a job using technology. Most are considering going to college (96%) and the majority (65%) would like to study a technology-related subject in college. Video game design was the most popular technology related subject followed by computer science, engineering, and web design.

Conclusions: Cultivating student interest in technology early during middle and high school might help to ensure fulfilling their desire to study technology-related subjects at university and/or work in occupations using technology in their future.

12 **108.012** Adulthood Autism in Brazil: Diagnosis, Intervention, Autonomy and Employment.

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Background: Adult TEA studies were first published in the late 1960s and are typically characterized in terms of adult independence, need for partial support (eg, living with the family, employment support) or need for extensive (residential) support. Early reports of results showed about two-thirds of people with ASD requiring full-time care and less than 10% achieving independence. Recent studies report that nearly 20% of people with ASD have achieved positive results for independence (eg university and employment), while the prevalence of people requiring full-time care has declined to 56%.Many of the improvements in adult outcomes over the last few decades can be attributed to the implementation of

specific social, educational and behavioral practices, in addition to the Brazilian Law. Despite improvements in overall adult outcome, the prognosis is highly variable. Possible explanations for this include failures in adapting effective treatments to adult populations and the paucity of interventions focused on the transition to adulthood. This is particularly evident in the extremely low employment rate for people with ASD. Many adults with autism continue to live with their families and, as their parents grow older, become a major concern for the family. In Brazil we are faced with the limitation of professional qualification and the theoretical approach of the places of care. A recent study shows that in the 27 states of Brazil, 650 institutions were found to assist people with ASD, but the minority specifically targeted young people and adults (1.5%). Objectives: To know the reality of the adult autistic with TEA in Brazil in relation to the autonomy, assistance and labor market.

Methods: In April 2015, a questionnaire was sent via the internet to the 4,000 (four thousand) families registered on the Autism&Reality website, with questions about: gender, education level, current occupation, age of the child when the parents observed the first signs of ASD, age of diagnosis, intervention, treatment line and medication use. We received 1,669 questionnaires answered by parents, guardians or by the adult with TEA and we selected all 558 with data from individuals over the age of 21.

Results: We verified that 63.6% of the questionnaires were answered by the parents and 5% were filled by the adult with ASD. About the profile of adults with ASD: 71.1% were males and 78.7% were unmarried. Only 0.9% lived alone, 0.2% lived in institutions and 79.9% lived with their parents.In relation to academic training, occupational life and employment: 9.9% of adults with ASD had graduation, 9.9% were attended in inclusion system, 14.9% registered in regular employment, 1.3% were registered in the Law of Quotas and 78% did not work. 64% used medication, 77.6% were involved in intervention and 18.1% in ABA intervention.

Conclusions: Although autism awareness and knowledge in Brazil have evolved a lot in the last decade, there is a shortage of institutions and projects for adults with autism, showing the need for public policies, information for families, specialized services, school, occupational and labor for greater autonomy and independence of these people.

13 **108.013** Age-Related Changes in Autistic Traits: A Survey for the Adults with Currently High Autistic Traits with and without Autism Spectrum Disorder.

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Background: Recent studies have showed that adults with autism spectrum disorder (ASD) exhibit symptomatic overlaps with other psychiatric disorders such as schizophrenia spectrum disorder and borderline personality disorder. These results indicate that adults with non-ASD disorders also present ASD traits and, especially in adults, a diagnostic boundary between ASD and non-ASD is blurry. However, little is known about whether or not developmental trajectories in autistic traits show overlaps between adult ASD and non-ASD with currently high autistic traits. Do developmental trajectories in autistic traits between adult ASD and non-ASD show similar/different patterns, especially when they all exhibit high ASD traits and are difficult to differentiate? Thus, we investigate overlaps or differences of age-related changes in autistic traits among adults with and without ASD who present currently high autistic traits.
Objectives: We aim to reveal the overlaps or differences in age-related changes in autistic traits between adult ASDs and non-ASDs, both of whom currently presents high ASD traits.

Methods: We recruited 26 adults (6 female; mean age = 28.31, SD = 8.16) with possible ASD who consulted our specialists for the detailed assessment of ASD through two or three weeks of hospitalization. Our diagnostic process included approximately ten hours of interviews for clients and their parents during their admission. After the clinical interview, the psychiatrist diagnosed the clients based on the consensus of the psychiatrists and psychologists according to the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) criteria. We used Parent-interview ASD rating Scale (PARS) score to examine age-related changes in autistic traits. This scale is a semi-structured interview for clients' parents and evaluates ASD traits in their childhood, adolescent, and adulthood. As a self-rating scale, we also analyzed Autism-Spectrum Quotient (AQ) scores to confirm currently high ASD traits among participants.

Results: Detailed examination through weeks of hospitalization resulted in the clinical diagnosis of ASD (n = 16) and non-ASD (n= 10). A t-test showed that AQ total scores of ASD group was not statistically different from those of non-ASD group (t = 0.44, p = 0.66), which confirmed that both groups similarly presented high autistic traits. We analyzed early childhood peak scores and current adolescent/adult scores of PARS as the index of age-related changes in autistic traits. A two-way ANOVA (Group x Period) showed the significant interaction between Group and Period (F = 7.30, p = 0.01). Post-hoc t-tests indicated that the early childhood peak scores of ASD group were significantly higher than those of non-ASD group (t = 2.82, p = 0.01), while the current adolescent/adult scores of ASD group was not statistically different from those of non-ASD group (t = 0.60, p = 0.55).

Conclusions: Our preliminary results indicate that age-related changes in autistic traits could exhibit different patterns between adult ASD and non-ASD groups even though both groups presently show similarly high ASD features. This finding could be helpful for clinicians to appropriately diagnose adults with high autistic traits and thus giving them efficient service.

14 **108.014** Aging with Elevated Autistic Traits: Theory of Mind Performance in Younger and Older Adults.

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Background: Associations between the presence of autistic traits and theory of mind (ToM) ability have been demonstrated among autistic and non-autistic young adults. Poorer ToM ability has also been observed with typical aging but has seldom been examined across the adult lifespan in relation to elevated autistic traits.
Objectives: This study will explore differences in ToM performance among younger and older adults with/without elevated autistic traits.

Methods: 96 adults (Younger: n=49 aged 18-46; Older: n=47 aged 60-91) completed the Strange Stories Film Task (SSFT) and Frith-Happé Triangle Animations (TA) to measure ToM ability. The SSFT reflects real-world scenarios and produces three scales related to ToM performance (Intention, Interaction, Mental State speech) and one memory scale. The TA task uses dynamic silent animations and produces three scales related to ToM performance (Appropriateness, Interaction and Mental State speech). The Broad Autism Phenotype Questionnaire (BAPQ) measured the level of autistic traits based on self-report. Individuals were divided based on age (Younger vs. Older), and as being below or above the clinical cut-off for

elevated autistic traits on the BAPQ (non-BAP vs. BAP).

Results: A 2x2 ANOVA examined the effects of age and autistic traits. For the SSFT, results showed a main effect of autistic traits on all three ToM scales, with non-BAP demonstrating better performance than BAP. No significant age-effects or interactions were observed. However, SSFT Interaction score showed a non-significant trend towards an interaction, with Older non-BAP adults performing better than Older BAP adults. For the memory scale, both autistic traits and age-effects were observed (non-BAP better than BAP; Younger better than Older) but the interaction did not reach significance. For the TA task, results revealed main effects of autistic traits and age on the Intentionality scale (non-BAP better than BAP; Younger better than Older). An interaction of autistic traits and age was also observed in Intentionality, with Older non-BAP adults performing better than Older BAP adults. No other significant main effects or interaction of autistic traits or age were observed on the TA task.

Conclusions: Results suggest that across adulthood, individuals with elevated autistic traits show poorer performance on ToM tasks. Few age-effects were observed in this study. Despite difficulties in ToM performance being common in later-life, this effect was not observed when using a ToM task designed to reflect real-world scenarios. This suggests that age-decrements in ToM may be exacerbated by non-social task characteristics. However, a significant interaction and a non-significant trend were observed in some aspects of ToM performance, suggesting that age and autistic traits could confer a compounded risk to ToM performance in older adults who endorse elevated autistic traits. Future studies should examine whether tests designed to reflect real-world scenarios are associated with behaviour in the real-world, and further explore whether elevated autistic traits in later-life form a compounded risk to ToM performance.

15 **108.015** Analysis of Essential Factors Contributing to Effective Programming for Adults with Autism to Support Inclusion and Meaningful Community Engagement

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Background: Adults with autism experience social isolation due to limited community involvement and access to social participation with peers, resulting in increased incidence of depression, anxiety, and other mental health challenges. Misconceptions and stigma about autism affect the psychological well-being and quality of life and of individuals with autism (Broady et al., 2017; Jensen et al., 2016). Community inclusion programs to support adults with autism are emerging, although effective programmatic factors and outcome measures have not been identified (Obeid, et al., 2015; Someki, et al., 2018).

Objectives: The purpose of this pilot study was to identify key factors that contribute to effective programming related to improving community participation and positive mental health of adults with autism, while reducing incidences of negative perceptions about autism and stigma from peers.

Methods: Researchers used a phenomenological research design (Moustakas, 1994) to analyze 83 archived reflective essays from university students who participated in a fifteen week service learning course focused on autism. Students partnered with adults with autism from the community during engaging weekly program activities, while studying strength-based, inclusive practices. Researchers used constant comparative methods in qualitative coding and thematic analysis to identify essential factors contributing to meaningful community engagement of the adults with autism.

Results: Researchers identified two primary themes: 1. inclusive social environments positively influenced student peer perceptions of adults with autism, 2. Student peers' knowledge translation of strength-based strategies and positive perceptions of autism influenced mental health and quality of life of adults with autism. Sub-themes identified relationships, recognizing neurodiversity strengths, and autistic self-advocacy as contributing to positive mental health demonstrated by the adults with autism in the program. One student stated, "I believe that I learned more from them than they learned from me" and another commented "we all gained more confidence in ourselves." Students identified the strength-based program as "promoting self-growth and self-determination" for adults with autism through partnerships with peers.

Conclusions: With significant increases in both the number of youth with autism entering adulthood and the rising incidence of mental health challenges, it is important to ensure that programming leads to positive outcomes for both individuals with autism and for society at large. Preliminary results of this pilot study identify key aspects of programming to support better community inclusion outcomes. Specifically, by providing explicit, strength-based knowledge about autism to peers, and inclusive peer-supported experiences in community engagement for adults with autism, community integration programs can become more meaningful and effective. Based on this preliminary study, researchers plan to expand the peer supported programs for adults with autism and further analyze long-term outcomes for these adults and for the student peer partners.

16 **108.016** Assessing the Convergence of Self-Report and Informant Measures for Adults with Autism Spectrum Disorder

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Background: Given the rapidly growing population of intellectually capable autistic adults, self-report measures are increasingly utilized for assessment of current functioning and treatment planning. However, there has been little research examining the utility of self-report measures or the convergence of self- and informant-report in this population. Insight into areas in which adults and caregivers are most likely to agree and disagree can help shape future assessment protocols, and can guide decisions regarding if and when multiple informants should be consulted in making diagnoses and treatment recommendations.

Objectives: Caregiver and adult self-report responses were used to examine the convergence of reporters on measures of symptom severity, daily living skills, and quality of life, as well as the extent to which each reporter's responses were predictive of employment and independent living outcomes.

Methods: Forty pairs of autistic adults with average to above average intellectual functioning (80% male; age range: 23.83 - 47.84; *M*=33.18 years; childhood IQ ≥ 85) and their caregivers independently completed the Social Responsiveness Scale, 2nd Edition: Adult Form (SRS-A), Quality of Life Questionnaire (QoL-Q), and Waisman Activities of Daily Living Scale (W-ADL). Responses on these measures were analyzed for inter-rater correlation, discrepancy size, and predictive power of objective living and employment outcomes.

Results:

Adult and caregiver responses were significantly positively correlated on all measures (*r*'s on the SRS-A, W-ADL, and QoL-Q=.50, .75, and .78, respectively). There was no significant difference between the mean caregiver- (*M*=61.97) and self-report (*M*=60.26) t-scores on the SRS-A (*t*[37]=-.95, *p*=.25, *d*=.15). On the W-ADL, caregivers reported that adults demonstrated significantly fewer (*M*=28.87) daily living skills than adults reported (*M*=30.00; *t*[37]=2.36, *p*=.023, *d*=.38). There was also a significant difference between caregiver- and self-report scores on the Satisfaction subdomain of the QoL-Q, with caregivers reporting significantly lower satisfaction ratings for the adults with ASD (*M*=20.55) than adults reported for themselves (*M*=22.43; t[39]=2.96, *p*=.002, *d*=.55).

Finally, hierarchical logistic regression analyses indicated that the combination of self-report and caregiver-report on all measures better predicted current independent living (χ^2=8.50, *p*=.04) and employment status (χ^2=8.99, *p*=.03) than did any individual reporter.

Conclusions: Taken together, the present study demonstrates that, overall, intellectually capable autistic adults can serve as reliable and accurate reporters of their own symptoms. These findings contrast with previous research suggesting that poor social insight may limit the validity of self-report for this particular population (e.g., Bishop & Seltzer, 2012). Recognizing the utility of self-report in this capacity can help to shape treatment planning, as well as provide a means of measuring intervention effectiveness in research contexts. However, adults tended to report fewer difficulties with daily living skills than caregivers reported, and predictive power of independent living and employment outcomes was highest when including both caregiver and self-report perspectives. This indicates that a multi-informant approach is likely to provide the most comprehensive information about service needs.

17 **108.017** Association between Physical Activity, Sedentary Time, and Technology Use in Adults with Autism Spectrum Disorder

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Background: Limited research indicates that adults with autism spectrum disorder (ASD) do not meet physical activity (PA) guidelines and are highly sedentary. Inadequate PA is a leading preventable cause of death worldwide, but little is known about PA, sedentary time (ST), and factors influencing these variables in adults with ASD. Technology is used as an educational and social intervention for people with ASD, yet is also associated with low PA and high ST in the neurotypical population. It is important to determine if technology use is also associated with low PA and high ST in adults with ASD to better understand these health variables in this unique population.
Objectives: (1) Assess PA and ST levels, and technology use in a large sample of adults with ASD and (2) examine factors that influence PA and ST, particularly technology, in adults with ASD.

Methods: A self-report, online survey addressing autism symptoms (Autism Spectrum Quotient-10; AQ10), PA and ST (International Physical Activity Questionnaire), and technology use was developed, assessed for content validity, and pretested with 6 adults with ASD. Participants were recruited via ASD support groups in social media and direct contact with ASD advocacy organizations in the U.S. and other English-speaking countries. A 15-minute minimum survey completion time and AQ10 score ⩾6 were used to verify valid responses and meeting the inclusion criteria. Stepwise forward multiple regressions were generated to explain the variation in PA and ST, with demographic variables, time spent in technology use, and AQ10 score as predictor variables. No multicollinearity was observed in the models. Analyses were performed using SPSS and significance level was set at $p < 0.05$.

Results: Of the 802 survey responses received, 229 were included in the analyses. Adults with ASD engaged in moderate to vigorous PA (MVPA) $\bar{x}$=128.3±114.8 min/week. Median sedentary time was similar for weekdays (470 min/day, IQR = 300) and weekends (420 min/day, IQR= 240). Participants spent $\bar{x}$=590.2±331.7 min/day using technology devices for Internet surfing ($\bar{x}$=145.8±126.2 min/day), entertainment ($\bar{x}$ = 106.8±93.4 min/day), and social media ($\bar{x}$=80±69.1 min/day). Moderate positive correlations were found between technology use and weekdays (r = 0.416, p < 0.001) and weekends (r = 0.417, p < 0.001) ST. AQ10 score was the strongest negative predictor of total PA time in 3 regression models (β = -0.360, p < 0.001; β = -0.323, p < 0.001; β = -0.258, p = 0.001). Technology use time strongly predicted ST in both weekdays (β = 0.399, p < 0.001) and weekends (β = 0.422, p < 0.001).

Conclusions: Adults with ASD do not acquire the recommended 150 min/week of MVPA, spend excessive time using technology and are highly sedentary. Additionally, more autistic symptoms and more time spent using technology lead to more ST. These data indicate that PA and ST interventions are needed to meet the unique health needs of adults with ASD, particularly those with more symptoms. It is recommended that technology use to be leveraged as an intervention tool to address these health variables in adults with ASD.

18 **108.018** Autism Spectrum and Substance Use Disorder: Protective and Risk Factors

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Background: The social and behavioural characteristics of individuals with Autism Spectrum Disorder (ASD) were initially presumed to protect these individuals from substance abuse. However, recent findings suggest that rates of substance use disorder (SUD) in individuals with ASD may be as high as 36%. The risk and protective factors for SUD that are unique to people with ASD, and how these factors interact to influence social adaptation and quality of life of people with ASD are not well understood.
Objectives: To review the evidence base on co-occurring ASD and SUD in order to inform clinical practice and future research.

Methods: A systematic review was conducted of identified studies pertaining to ASD and substance use using the preferred reporting items for systematic review and meta-analysis protocol (PRISMA).The focus was on study and participant characteristics (e.g., diagnostic measures, gender, age, intellectual functioning), prevalence, risk and protective factors to SUD, and consequences of SUD (i.e., impact of interaction of risk and protective factors on functional outcomes). In addition, studies were evaluated for methodological quality and risk of bias based on the Mixed

Methods Appraisal Tool (MMAT).

Results: Twenty-five studies were included in the analysis. Overall study quality was high (*M*= 76.8%). There was wide variability in sample characteristics, and means of assessing ASD and SUD. In addition, no assessment measures designed specifically to screen for SUD in individuals with ASD were identified. Prevalence of ASD and co-occurring SUD ranged from 1.3-36%. Alcohol appears to be the most frequently used substance for individuals with ASD. The trajectories of ASD to SUD appear to differ depending on the presence of concomitant conditions, cognitive and personality factors and environmental conditions. A number of known risk and protective factors were identified, such as familial history of SUD, co-occurring internalizing (i.e., anxiety) and externalizing disorders (i.e., ADD, ODD). In addition, factors that are unique to or exacerbated in individuals with autism (e.g., limited social support, disengaging coping behaviours, low sensation seeking, late ASD diagnosis) that may serve to increase or decrease their risk of SUD were also identified. Having a diagnosis of ASD was both a risk and a protective factor for SUD but may be explained by co-occurring intellectual disability (an identified protective factor) in some samples. Substance use was associated with diminished quality of life, increased psychological distress and higher functional disability for individuals with ASD. Treatment success for individuals with ASD includes highly structured CBT focused therapy, and controlled substance use, but these have yet to be examined in an RCT study.

Conclusions:Due to variability in sample characteristics an accurate prevalence rate of SUD in individuals with ASD cannot be established at present. More research, using comparable samples and standardized measures of both SUD and ASD is needed to clarify conflicting results regarding the risk and protective aspects of having an ASD diagnosis and to establish a prevalence rate of SUD in this population. There is also a need for research on interventions that take account the special needs of this group.

19 **108.019** Barriers to Seeking Help for Interpersonal Violence in People with Developmental Disabilities

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Background: Interpersonal violence (IPV) against people with disabilities is highly prevalent and associated with negative outcomes. Little is known about barriers to seeking help for IPV experienced by adults with developmental disabilities.
Objectives: To 1) describe barriers to help-seeking by IPV survivors with developmental disabilities; 2) explore relationships between socio-demographic, abuse and disability factors, and barriers to help-seeking; and 3) examine relationships between barriers to help-seeking and health outcomes.

Methods: We used a community based participatory research approach to conduct a survey about health, disability, and IPV in people with developmental disabilities in Oregon and Montana, USA. This analysis was limited to the 66% (223/338) of participants who reported abuse experiences as an adult in the larger study. We assessed demographics, functional limitations, use of personal assistance and assistive devices, abuse experience in adulthood and childhood, barriers to help-seeking, and health outcomes. We measured depression, health symptoms and PTSD symptoms using versions of The Center for Epidemiologic Studies Short Depression Scale (CESD-10), Personal Health Questionnaire (PHQ-15) and Post Traumatic Stress Disorder Checklist – Civilian (PLC-C) adapted for people with developmental disabilities.

We analysed differences between participants with and without barriers to help-seeking using two-sample t-tests, Person's chi-square and Fisher's exact tests. We used linear regression to determine the relationship between barriers to help-seeking and health outcomes.

Results: The mean age of participants was 39.7 years (SD 13.3). About half were women (52%). The majority were white (73.4%), not Hispanic (89.7%) and lived in a city or suburb (70.4%). Fourteen percent reported being on the autism spectrum and 64.6% reported a cognitive disability.

Over half (56%) reported at least one barrier to help-seeking: 29% felt too ashamed to tell someone; 24% thought that they could lose their independence or support; 23% reported that they would not be believed if they told someone; 18% did not think there would be services to help them; and 9% reported that they would not have a way to tell someone of their abuse.

Participants with barriers to help-seeking had higher rates of employment (44.4% vs. 28.1%, p = 0.0135), use of personal assistance (70.2% vs. 54.2%, p = 0.0147), and history of child abuse (82.3% vs. 64.6%, p = 0.0028), in comparison to participants without barriers. The mean CESD-10 score was higher for survivors with barriers to help-seeking (12.59 vs 10.63, p=0.0199). There was no significant difference in PHQ-15 and PLC-C scores between the two groups. Survivors with barriers had a mean CESD-10 score 1.67 points higher than those without barriers when adjusting for demographic characteristics and child abuse history (p=0.045). This association was weakened after adjustment for functional limitations and abuse severity.

Conclusions: Barriers to help-seeking, which are widespread among IPV survivors with developmental disabilities, may be more prevalent in those who are employed, require personal assistance, and/or are survivors of child abuse. Research and practice must address the conditions that disincentivize help-seeking for abuse in this population.

20 **108.020** Capturing Lived Experience in Pictures Using Co-Production: Quality of Life of Autistic Adults

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Background:
Research has consistently documented that autistic adults experience poorer quality of life (QoL) compared to their neurotypical peers. Despite this, a paucity of research has aimed to understand the meaning of QoL from the perspective autistic people themselves. In order to address this gap, the current study recruited a steering group of autistic adults in order to co-produce this research, being involved in development and refinement of the research design, materials and assisting with data interpretation.

Photovoice methodology has been used with minority populations and those with intellectual disability, and more recently with autistic people.

This method allows participants to capture meaning, and articulate their needs and perspectives in a way that limits misinterpretations by researchers. Photovoice could potentially evoke creativity, and critical reflection that may be unavailable via words alone.

Interviews challenging for autistic adults, due to language, communication and social challenges that they can experience. Capturing information through photovoice supports the visual strengths and preferences of autistic people could be a more effective approach. One autistic co-author is a photographer, and has assisted in developing the photovoice resources to ensure participants are taught some simple photography techniques, and to ensure this is communicated clearly to the autistic participants.

Objectives:

To capture life experiences relevant to the QoL of autistic adults.

Methods:

15 autistic participants are being sampled to participate in this photovoice study following participation in an interview study exploring subjective QoL. Photovoice participants receive a link to a video introduction and photography tutorial prior to partake in taking photos capturing and reflecting their perspectives of their QoL. Following this, participants attend a focus group, presenting a choice of 3 photos, and discussing what each photo means to them. The group also label each photo and develop themes to describe their collective experiences, hence, analysing the data from their perspective. These analysis focus groups are co-facilitated by the autistic photographer working on the project. Following the focus group, the participants will be invited to an interview allowing for a detailed analysis of their remaining photos.

Results:

Preliminary themes important to QoL of autistic adults include; Interests, Independence, Having a valued role in society, Engaging in the community and Sensory preferences. Some examples include engagement in outdoor activities, partly due to an interest in nature, partly due to the sensory aspects associated with the activity, for example the warmth of the sun and sounds of the leaves rustling in the wind. Current preliminary themes suggest that more specific examples are obtainable using photovoice when compared to interviews. Data is still being collected from the participants and analysis is continuing. Further comparisons between photovoice data and interview data are emerging as data collection and analysis continues.

Conclusions:

This study has captured a wide variety of experiences that are important to QoL of autistic adults, including independence, interests and having a valued role in society. Photovoice has served as an effective method through which to obtain this information, being particularly beneficial for those that are more visually oriented.

21 **108.021** Caregiver Training for Behavioral Problems in Adults with Autism Spectrum Disorder: A Case Series

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Background: Challenging behaviors in adults with autism spectrum disorder (ASD) are prevalent and have been shown to increase caregiver stress while impeding adaptive skills development and habilitation efforts designed to increase independence. While the literature available on behavioral interventions for this population shows promising effects, practice is limited by access to qualified clinicians. Additionally, programs tend to focus on direct care delivery (therapist to adult). Interventions specifically supporting caregivers of adults with ASD are limited. The Research Unit on Behavioral Interventions (RUBI) Autism Network developed a manualized parent training program for families of children with ASD and co-occurring disruptive behaviors. RUBI utilizes techniques grounded in applied behavior analysis to teach parents how to manage child behavioral problems over 11 outpatient visits. With over a dozen published research studies, RUBI has been found to be acceptable to parents, reliably delivered by trained therapists, and effective in reducing disruptive behavior in children ages 3-14. RUBI is emerging as an important component of short-term, effective treatment for youth with ASD. In response to the shortage of efficacious interventions for adults with ASD, RUBI may be a promising approach to support caregivers grappling with the management of disruptive behaviors in adults with ASD under their care.

Objectives: Three case studies were conducted to evaluate the initial feasibility and efficacy of RUBI when delivered to caregivers of adults with ASD and co-morbid disruptive behavior problems.

Methods: RUBI was delivered to parents of three transition-age males (ages 19, 20, and 24) with a community diagnosis of ASD and caregiver-reported disruptive behaviors. Demographics (e.g., age, sex, race, school/vocational placement) were collected through medical record and intake documentation. Outcomes of interest include treatment feasibility (attendance, attrition), which denotes evidence that the treatment is acceptable to families and efficacy (reduction in disruptive behavior problems), measured through change on the parent-reported Aberrant Behavior Checklist-Irritability (ABC-I) subscale and Home Situations Questionnaire-Autism Spectrum Disorder (HSQ-ASD) at the first and last session.

Results: While originally designed to be administered over 11 sessions in a proscribed order, the therapist adapted RUBI to meet each family's needs, with the number of sessions varying from 8 to 16. All three families completed treatment. Caregivers for the 19 year-old reported a significant decrease in explosive behavior (1 major and several partial episodes per month at intake, 1 major episode over 2 months at post-treatment), an increase in independence within the daily routine, and effective use of self-soothing strategies. Reductions on the ABC-I or HSQ-ASD were noted for two individuals [24 y.o. ABC-I decreased from 28 to 14 (50%), HSQ-ASD decreased from 3.88 to 1.67 (57%); 20 y.o. HSQ-ASD decreased from 1.25 to 0.75 (40%)].

Conclusions: Results of the three case studies indicate that RUBI could be a promising intervention for behavioral problems when delivered to caregivers of adults with ASD. Outcomes indicate high engagement in treatment and notable reductions in caregiver-reported disruptive behaviors. The variability in number and type of sessions delivered suggest that a modular approach in administration may be required.

22 **108.022** Children with Autism Spectrum Disorder Display Increased Functional Connectivity in the Periaqueductal Gray Network

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by impairments in social interactions, communication, and restricted and repetitive behaviors. Nevertheless, the underlying mechanism of ASD remains unclear due to its complex presentation.
Objectives: We investigated resting-state functional connectivity (rsFC) differences of the periaqueductal gray (PAG) between boys with autism spectrum disorder (ASD) and typically developed (TD) controls, and the association between PAG rsFC and clinical outcomes (Autism Diagnostic Interview-Revised (ADI-R) and executive function scores.

Methods: ASD (n=103) and TD (n=127) were selected from the Autism Brain Imaging Data Exchange II project.

Results: The demographic and clinical characteristics of ASD and TD are shown in Table 1. There were no significant differences in age ($t_{(228)}$ = 0.64, p = 0.53) or intelligence (F-IQ) ($t_{(228)}$=-0.96, p = 0.35) between the ASD and TD groups. Compared with the TD group, boys with ASD showed significantly increased PAG rsFC with left thalamus / hippocampus / parahippocampus, and middle temporal gyrus (Table 2,Figure 1). There were no significant decreased rsFC between PAG with other regions in boys with ASD than TD. The rsFC of PAG- thalamus / hippocampus / parahippocampus showed significant negative correlation with ADI-R verbal scores; the rsFC of PAG-left middle temporal gyrus showed significant positive correlation with subscale scores of executive function including inhibit, shift and behavioral regulation. The rsFC of the control seed located at the fourth ventricle showed no significant difference between ASD and TD groups.

Table 1 Demographic and Clinical Characteristics

Variable	ASD (Mean(SD))	TD (Mean(SD))	Statistic
Number	103	127	
Age (years)	10.80(1.99)	10.64(1.63)	0.53
IQ	111.43(13.50)	112.91(10.04)	0.35
ADI-R			
Social	18.80(5.42)	----------	
Verbal	14.85(4.45)	----------	
RRB	5.66(2.37)	----------	
BRIEF			
Inhibit	61.14(10.96)	44.24(7.21)	< 0.001
Shift	68.47(12.79)	43.72(7.23)	< 0.001
Emotional control	59.91(11.85)	43.70(7.10)	< 0.001
BRI	64.49(10.39)	42.82(6.91)	< 0.001
Initiate	64.30(9.91)	45.19(7.20)	< 0.001
Working memory	64.57(9.91)	44.16(7.82)	< 0.001
Plan/organize	64.18(10.38)	44.16(8.76)	< 0.001
Organization	59.40(10.14)	47.11(9.65)	< 0.001
Monitor	63.84(9.88)	43.19(9.70)	< 0.001
MI	65.74(9.25)	43.67(8.71)	< 0.001
GEC	66.52(9.16)	42.77(7.89)	< 0.001

ADI-R, Autism Diagnostic Interview-Revised; RRB, restricted and repetitive Behaviors.

GEC: general executive composite; BRI: behavioral regulation index; MI, metacognition index.

Table 2 rsFC change in ASD compared with TD and regression of ASD with ADI-R

Conditions			MNI coordinates Peak z value			
	Region	Cluster size	X	Y	Z	
ASD > TD	Left thalamus/hippocampus /parahippocampus	168	-10	-32	0	3.78
	Left middle temporal gyrus	191	-52	-52	2	3.48
ASD < TD	None					

Conclusions: Our findings demonstrate increased PAG rsFC with brain regions associated with sensations, cognition, emotion and facial expressions in ASD patients, and specific association patterns with different clinical outcomes, which may provide insights into the underlying mechanism of ASD.

23 **108.023** Cognitive-Behavioral Intervention on Emotion Regulation in Adults with High-Functioning Autism Spectrum Disorders

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Background: Recent studies have found that adults with high-functioning autism spectrum disorder (ASD) are unable to understand their own emotions which can lead to difficulties in emotion regulation. The effectiveness of cognitive-behavioral therapy (CBT) in improving emotion regulation has been reported in children with ASD, but few studies have examined the efficacy of CBT in adults with ASD.
Objectives: We developed the program of group-based CBT on emotion regulation in adults with high-functioning ASDand investigated its efficacy.

Methods: We conducted a randomized, waitlist-controlled, single-blinded clinical trial with adults with ASD; 31 participants were allocated to the CBT intervention group and 29 allocated to the waitlist control group. The CBT group underwent an 8-week program of weekly 100-min group CBT sessions. At pre-intervention and post-intervention, all participants completed the Coping Inventory for Stressful Situations (CISS) scale, the ASD questionnaire, which assesses knowledge and attitudes about ASD, the 20-item Toronto Alexithymia Scale (TAS20), and the Motion Picture Mind-Reading task. These scores were the primary outcomes.

Results: Compared to the waitlist group, the CBT group exhibited significantly greater pre-to-post-intervention score improvements on the ASD questionnaire and the TAS20.

Conclusions: These findings indicate that group-based CBT is effective for adults with ASD, as it increases their positive thinking about ASD and improves their emotional expression.

Conclusions: Our study provides novel evidence for the efficacy of group-based CBT for adults with high-functioning ASD. Participants who received CBT exhibited an increased positive attitude about ASD and reduced difficulties in expressing feelings. The CBT program described in this study may be the first effective behavioral intervention on emotion regulation for adults with high-functioning ASD.

24 **108.024** College to Career Transition: Employment Priorities for Young Adults with ASD

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Background: Research suggests that young adults with autism spectrum disorder (ASD) often experience poor postsecondary employment outcomes, especially within the first two-years after high school (Shattuck et al. 2018). Unemployment rates in this population range from 50-75% (Hendricks 2010; Liptak et al. 2011; Volkmar et al. 2009) compared to 6.8% in typically developing young adults (US Department of Labor 2018). Existing employment support programs for college-aged youth with ASD primarily focus on vocational training, with little emphasis on the soft skills needed to manage interpersonal relationships in the workplace (Smith et al. 2015). While previous social skills interventions have been successful in helping young adults with ASD improve friendships skills (Gantman et al. 2012; Laugeson et al. 2015), there is a paucity of evidence-based treatments focusing on the soft skills needed in a professional environment. Furthermore, little is known about the treatment priorities of young adults and their caregivers in relation to the college to career transition.

Objectives: The purpose of this study is to (1) determine employment priorities and (2) identify challenges faced in the process of gaining and maintaining employment, among young adults with ASD and their parents.

Methods: Fifty-three participants (22 young adults and 31 parents) attended separate but concurrent 90-minute focus groups in order to identify treatment priorities and soft skills most pertinent to young adults with ASD seeking employment. Young adult participants (5 females) ranged in age from 19 to 33 (M=23.59; SD=4.16). Young adult and parent participants were given a list of 16-items and asked to rank-order each item based on their perceived level of support needed (from 1–16). Using the nonparametic Kendall's W test, the omnibus rank differences between items was examined. Wilcoxon Signed Ranks Tests were used to compare mean rank values for each item.

Results: Parents and young adults both ranked "*finding employment*" and "*applying for employment*" significantly higher than all other items ($c^2(15)=172.04$, $p<.001$). Given the high variability in ranking among the 16-items, in order to assess general trends in treatment priorities, skills were categorized into three subscales including: *Job Attainment (finding employment, applying for employment, choosing a career, creating a resume); Employment Logistics (navigating the workplace, disclosing diagnosis, discussing accommodations, stress management, executive functioning, electronic communication)*; and *Workplace Relations (starting and entering conversations, exiting conversations, interviewing skills, direct and indirect bullying, conflict resolution, humor in the workplace).* Parents prioritized *Workplace Relations* higher than young adults, while young adults ranked the *Job Attainment* subscale higher than parents. Notably, young adults ranked "*creating a resume*" significantly higher than parents ($F(1,51)=8.78$; $p<.01$), demonstrating their greater interest in job attainment skills. Alternatively, parents ranked "*starting and entering conversations*" significantly higher than young adults ($F(1,51)=7.98$; $p<.01$), demonstrating a heightened concern for workplace relational skills.

Conclusions: Young adults with ASD and their parents appear to similarly value the process of finding employment. However, while young adults were more focused on the specific skills needed to apply for and obtain employment, parents were more interested in the relational skills needed for gaining and maintaining employment.

25 **108.025** Contributors to Family Stress in Transition-Aged Youth with Autism Spectrum Disorder

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Background: Adolescents with autism spectrum disorder (ASD) and their families experience significant stress as they approach the transition to adulthood following graduation from high school (Lounds et al., 2007). Recent efforts to improve transition services (e.g., transition planning for individualized education programs [IEPs], family psychoeducation programming) have improved family understanding and support during this time. However, few studies have investigated whether the increases in services relate to reduced child and family stress, and what needs remain for families. Understanding associations between family stress and transition will be critical to ensure successful transition to adulthood for youth with ASD.

Objectives: The aim of this study was to determine contributors to family stress in youth preparing to transition to adulthood.

Methods: Participants included 19 families of verbally-fluent adolescents with ASD who did not have Intellectual Disability (ID) who enrolled in Transitioning Together, a multi-family group psychoeducation intervention for families of individuals with ASD preparing for the transition to adulthood (DaWalt et al., 2018). This program is specifically designed to assist families in navigating the transition process, gaining transition-specific knowledge and resources, and reducing parent stress. Prior to beginning the program, parents completed the Adolescent Transition Survey (ATS, Duncan & Bishop, 2011), which assesses knowledge of the transition process, general and social concerns related to the transition to adulthood, as well as perceived need for supports and available resources. The General Concerns Scale included 26 concerns related to the transition to adulthood (e.g., skills pertaining to independent living, decision making, social success). The Social Concerns Scale was comprised of 23 items related to social skills pertaining to independent living (e.g., interacting well with others, joining activities, responding to challenging

situations). Both scales were rated on a scale of 1 (very concerned) to 4 (not concerned), with lower scores indicating higher concerns. Parents also indicated the number of supports their adolescents receive on the ATS. Parents also completed the Stress Index for Parents of Adolescents (SIPA), which assesses parent and adolescent stressors, as well as indexes of the parent-adolescent relationship. The Total Stress scale was used for the present study, with higher scores indicating greater family stress.

Results: Descriptive values for primary variables and correlations with family stress are presented in Table 1. Overall, parental general and social concerns, as well as level of family stress, were high in the present sample. Greater parental social concerns for their adolescents was associated with higher total stress at a trend level, p=.09 (Figure 1). Surprisingly, total transition-related concerns were not associated with greater stress, p=.23.

Conclusions: Parents reported significant concerns related to the transition to adulthood, which emphasizes the importance of interventions designed for transition-aged youth. Social concerns specifically were associated with greater perceived stress in parents. Currently, many transition-related services focus on improving academic and functional achievement through vocational training. However, it will be important for transition-related psychoeducation programs and school-based interventions (e.g., transition plans, pre-employment training) to target concerns across multiple domains, including social functioning, to support youth as they transition to adulthood.

26 **108.026** Development and Validation of a Paratransit Skills Assessment for Adults on the Autism Spectrum

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Background: There is a wide body of literature that focuses on transportation for persons with developmental and cognitive disabilities, though there is limited published literature regarding transportation needs and barriers of autistic adults. The studies conducted on adults with autism are frequently mode specific and focused on driving, public transit, pedestrian, and travel training. The research focused on individuals with autism, or all developmental disabilities, using paratransit services is limited.
Objectives: The Paratransit Skills Assessment (PaSA) was developed in 2011 to assist individuals on the autism spectrum in accessing public paratransit services. The PaSA is a criterion-referenced assessment which was designed with three hierarchical sections for the three different paratransit service types as well as a trip planning and scheduling section (see Figure 1). It is composed of discrete 37 tasks that are used to make a determination if an individual can use paratransit independently. This report is on the validation of the PaSA.

Methods: The validation process was conducted with 98 study subjects who participated in the PaSA of which 86 were retested with 60 retests with non-paratransit users through in-vehicle trips and 26 current users through interviews about their revealed experiences in using paratransit services.

Results: The results of the data analysis find a high level of confidence in the PaSA results. The Kappa Statistic was generated after each vehicle trip to ensure that the blind-observers were in agreement on their observations. The majority of the observations were in almost perfect agreement while the lowest scores were in the moderate agreement range. The accuracy rate was 96.4%. The correlation coefficient was 0.995 illustrating high positive correlation with a strong linear and homoscedastic relationship. For a better understanding of the accuracy rate and correlation the Response Outcomes were analyzed, which found four tasks error rates exceeded the error rate of 0.05. These four tasks are: providing identification, time window, emergency: interacting with strangers, and emergency: lost off the vehicle. The accuracy rate for each discrete task was analyzed using the Wilcoxon signed-rank test indicating the results are significant. The Kuder-Richardson analysis found the 98 PaSA study participants result in a ρ = 0.894 indicating high reliability while not being homogeneous. The retests on the 60 in-vehicle participants and the 26 current users result in a ρ = 0.519 signifying the participants have moderate reliability while not being homogeneous. The cluster and dendrogram analyses illustrate the strong relationships within each group type as well as the overlap between the those with the highest skill set and the current paratransit riders. It should be noted that the accuracy rate for those who tested with only the six basic skills required tested significantly lower than those that tested in the other study groups.

Conclusions: The research findings including the high accuracy rate provide validation that the PaSA is a reliable method for predicting one's ability to use paratransit services independently. These results can be useful for transit providers, transportation experts, and professionals working on issues with transportation disadvantaged population.

27 **108.027** Early Employment-Related Experiences of Young Adults on the Autism Spectrum

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Background: Employment outcomes for young adults with an autism spectrum disorder (ASD) are poor, with many unemployed, underemployed, or otherwise unable to achieve their potential regardless of cognitive ability.
Objectives: To explore early employment-related experiences of young adults with ASD, identifying key challenges to and facilitators of success while considering the roles played by schools, families, service-providing agencies, and employers.

Methods: Qualitative interviews addressing post high school experiences were conducted with 35 parents of young adults with ASD from across the autism spectrum. In twelve cases, the young adult was also interviewed. Material relating to pre-employment and employment experiences was segregated, then coded using the constant comparative method.

Results: Three major themes emerged from family and young adult narratives. ***Life Aspirations:*** Families and young adults alike expressed a clear sense of the advantages of work, from potential independence to daily engagement in the larger world. Many mentioned strengths associated with ASD that could prove valuable in the workplace such as attention to detail, an ingrained sense of responsibility, loyalty, and honesty. A father asserted: *"The fact of the matter is that someone like my son is the last person who is going to be a security risk because he literally cannot lie... If you tell him that these are the rules, he is going to follow those rules. And there is nothing you can do to make him break the rules."* Such strengths accompanied belief in young adults' potential, but coexisted with fear that this could be squandered if proper support were not provided. ***Support and Opportunity:*** Families often worked hard to create pre-employment experiences (e.g., opportunities to acquire skills, volunteering), but encountered barriers to assisting with actual employment. Influencing what went on within service agencies or employment settings could be beyond their access or simply inappropriate. The mother of a college graduate with ASD explained: *"If you have a young adult with a more obvious disability, everybody knows they need a lot of help, and it makes more sense if the parent is alongside of them giving help. But when they look sort of neurotypical, it makes them weirder if mom is involved."* When high schools, colleges, agencies, and employers

provided the right support at the right time, families were grateful. More often, however, they reported a dearth of appropriate support. ***Work Dilemmas:*** Un- and underemployment were frequently mentioned. Families described how ASD-related challenges (e.g., social blindness, rigidity, anxiety), little experience coming out of high school, inflexible systems, and inadequate support could lead to a young adult's failure to get or keep a position, with negative consequences. The mother of a son who failed to get a job after multiple attempts said: *"I think that's the trigger for his major depression... He says 'I'm hopeless. Nobody wants me.'"*

Conclusions: Young adults with ASD face significant challenges gaining pre-employment experiences and employment opportunities. A better understanding of how both ASD-associated difficulties and organizational practices interfere with success may help high schools, parents, agencies, and employers more effectively support them.

28 **108.028** Work Motivation of Adults with ASD: A Qualitative Exploratory Study

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Background: Employment carries a pivotal role in adult life. For individuals with ASD, successful integration into the labor-market poses a central challenge upon entering adulthood. The need to overcome work-related obstacles highlights the importance of motivation, which fuels the process of initiating and maintaining employment over time. While the importance and complexity of work motivation of adults with ASD has been suggested (Cheak-Zamora, Teti & First, 2015; Scott et al., 2017), an empirical examination of the concept has not yet been carried out. Employment literature emphasizes intrinsic work motivation, defined as engagement in an activity primarily for its own sake, as a basis for higher work performance and satisfaction. For disadvantaged populations, such as adults with ASD, opportunities to actualize intrinsic motivation in an inherently interesting job might be limited (Blustein, 2013). Self Determination Theory (SDT) asserts that even in the absence of intrinsic motivation, fulfillment of basic psychological needs for competence, relatedness, and autonomy can lead to internalization of motivation, thus leading to better employment outcomes (Deci & Ryan, 2000).
Objectives: The current study aims to examine work motivation in adults with ASD through a person-centered approach, focusing on work motivation, specifically in relation to SDT.

Methods: Eleven participants (8 males 3 females, aged 28-47y) took part in the study. They had a formal diagnosis of ASD, and work experience of at least six consecutive months, within the two years prior to participation. Educational level ranged from a high-school diploma to a master's degree. Semi-structured interviews were conducted, containing general questions regarding work experience and motivation, along with specific questions guided by SDT. A thematic approach was employed for identifying and categorizing different aspects of work motivation (Shkedy, 2011).

Results: Work motivation expressed by the participants was almost exclusively extrinsic. The most common motives mentioned were: earning money, being independent, having a daily schedule, playing a part in society and meeting other people. Most of the participants reported that their work tasks were not inherently interesting or enjoyable. Themes relating to SDT assured the importance of basic psychological need satisfaction: feelings of *social relatedness* were shared, through experiences such as having a positive social atmosphere, helping colleagues in need and sharing 'inside-jokes'. These often differentiated a desired job from an undesired one; *Competence* was an important factor influencing job choice and satisfaction. It was mostly based on positive feedback from supervisors or colleagues; The extent of the need for *autonomy* varied between participants. Most of them stressed the need for guidance in situations that involve choosing among alternatives.

Conclusions: The current study provides preliminary data in support of the relevance of SDT to adults with ASD. SDT holds the promising possibility of facilitating more autonomous motivation by providing an environment that responds to basic needs, even in the absence of intrinsic motivation, demonstrated in this study. Motivation can be facilitated by providing an environment that offers social relatedness, giving feedback that promotes competence, and offering guidance and support in situations that require choice.

29 **108.029** Patient-Reported Outcomes: Promis® Sexual Functioning for Autistic Adults

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Background:
Little is known about the sexual functioning of autistic adults. However, research showing high rates of sexual victimization and low sexual knowledge suggests that access to high-quality sexual and reproductive healthcare is critical – yet there is evidence of lack of preventative care for teens and adults with autism. Barriers may include privacy concerns (e.g., if caregivers are present), communication issues (e.g., need for efficient verbal communication during brief appointments), or providers failing to ask about sexual health. Patient-reported outcomes (PRO) measures can strengthen outcomes measurement, treatment planning, progress monitoring, and quality improvement. The NIH developed the brief PROMIS® Sexual Functioning (SF) Screener with gender-specific items addressing sexual interest, sexual activity, and functioning (i.e., orgasm ability and pleasure, erection and lubrication, pain) to improve healthcare for people with chronic conditions.

Objectives:

(1) Examine whether the SF Screener was feasible/acceptable for autistic adults. **(2)** Compare scores to normative sample using PROMIS guidelines (e.g., mild-severe). **(3)** Investigate associations between SF Screener scores and age, relationship interest, and relationship satisfaction, and **(4)** gender and sexual orientation.

Methods:

203 verbal adults (18-65 years) with self-reported medical diagnosis of autism and ability to complete a 30-minute survey were recruited via the Interactive Autism Network. Participants completed a longer PROMIS survey and could choose not to answer SF Screener items. SF Screener items cover the previous month, are rated on 5-point Likert-type scales (1=never, 5=always), and provide T-scores (M=50, SD=10), with .5 SD from population norm mean indicating mild symptoms, 1 SD moderate, and 2 SD severe. Chi-square, Pearson correlations, and ANOVAs were used to address objectives (a priori α=.01).

Results:

Participants reported diverse gender (female=48%, gender diverse-GD=6%) and sexual orientation(LGBQ=20%, asexual=14%). Half were single (males=61%, females=42%, GD=33%; *p*=.007), 39% in a relationship, and 10% divorced/widowed.

(1) 99.5% completed the SF Screener. 93% finished in 1-2 minutes (*M*=1.9, *SD*=5.2). **(2)** Most reported solo or partnered sexual activity in the past month, with no gender difference (*p*=.028; M=58.5%, F=51.5%, GD=91.7%). Average scores for autistic adults were in the mild range for sexual interest (*M*=44.0,*SD*=10.7) and sexual satisfaction (*M*=44.5, *SD*=8.2) compared to normative sample. Orgasm ability, pleasure, genital functioning, and pain were within normal limits. **(3)** Greater desire for finding/maintaining a relationship was associated with higher sexual interest (Table 1). For sexually active participants, sexual satisfaction was correlated with orgasm ability, orgasm pleasure, and (for those in relationships) relationship satisfaction. **(4)** On average, cisgender women and asexual participants had lower sexual interest compared to others (*p*=<.001; Table 2). There were no other significant gender or orientation differences.

Conclusions:

The SF Screener appeared feasible, acceptable, and provides a private, non-verbal method for patient-provider communication about sexual activity and functioning. Fewer gender, sexual orientation, and age differences were found compared to research with non-autistic populations. More research is needed to understand the clinical significance of SF scores indicating elevated symptoms, particularly for people who identify as women or asexual. Measure inclusivity of transgender/non-binary populations will be discussed.

30 **108.030** Partnership for Employment Support for Adults with ASD or Intellectual Disability: Co-Creation of Research Evidence and Knowledge Mobilization Tools

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Background: Low levels of employment hold significant negative repercussions for individuals, their families, and for society as a whole in lost potential and the financial burden of long-term adult care (e.g., Ganz, 2007). The specialized support offered by job coaches is designed to address the barriers, and to put in place the facilitators expressed by adults with ASD (Hedley et al., 2017), who have very low levels of employment in the US (14%) (Roux et al., 2017) and across countries (Statistics Canada, 2006).
We describe the work of a community-academic partnership for employment support for adults with autism or intellectual disability. We are partnering with non-profit organization in Montreal, Action main d'oeuvre (henceforth AMO), that offers job search and retention support to individuals with ASD and their employers. Many similar organizations currently lack evidence on the efficacy of their services, which is necessary to negotiate for and retain public funding. Aside from service providers themselves, multiple stakeholder groups (e.g., potential employers, decision makers, educators) that are key to an ecosystem approach to employment (Nicholas et al., 2018) would benefit from having accessible information on the value added by and best practices in employment support.

Objectives: To further the inclusion of people with ASD in the workplace, we are pursuing in parallel

1. a) Knowledge mobilization: provide information on the value added by job coach support, and best practices in employment support in user-friendly and targeted formats for a range of stakeholder groups who are critical to creating more employment opportunities
2. b) Co-created research study with AMO clients: examining *how* job coach support facilitates job retention, and what the most helpful components are from employee, employer, and job coach perspectives.

Methods: a) We synthesized evidence from an extensive literature review on employment facilitators and obstacles for people with ASD, and are transforming this information into accessible visual representations or infographics (in both French and English) to facilitate knowledge uptake (Arcia et al., 2016). The infographics will be workshopped with our collaborators to ensure effectiveness for broad dissemination to community, social service, and government networks concerned with the employment of people with disabilities. b) We are examining how job coach support facilitates job retention, and what the most helpful components are in this regard, by assessing employee and their employer's satisfaction with their job or employee (respectively), both before and after receiving AMO's services, as well as collecting a detailed evaluation of AMOs services.

Results: a) Figure 1 shows our infographic targeted for potential employers, Figure 2 shows one targeted for decision makers. b) Our prospective multiple case study with AMO clients, their employers, and job coaches is underway. Both pre-data and 3-month post data will be collected by INSAR 2019.

Conclusions: Our partnership's infographics will be made available for public use. They are resources to help mobilize research evidence to multiple stakeholder groups concerned by the employment of adults with ASD. Results from the case study will be used to improve AMO services and inform best practices in employment support more broadly.

Poster Session
109 - Biomarkers (molecular, phenotypic, neurophysiological, etc)
11:30 AM - 1:30 PM - Room: 710

31 **109.031** Kinase and Phosphatase Signaling As Biomarkers for ASD Detection

ABSTRACT WITHDRAWN

Background: A high priority in autism spectrum disorder (ASD) research is the identification of robust and reliable biomarkers. Biomarkers can enable early detection and intervention, and etiologic stratification leading to the development of precision therapeutics and, ultimately for both approaches, to better outcomes. Recent progress in the genetics of both syndromic and idiopathic ASD suggests that aberrant signaling within two key kinase pathways, RAS-MAPK and PI3K-PTEN-AKT, may be important for ASD pathogenesis (Figure 1). Reports in the literature identify both over and under activation in these pathways (as in Rasopathies and in PTEN associated macrocephaly/autism syndrome) and in genetically

mediated disorders that intersect with these pathways, such as Fragile X syndrome and disorders with mutations in ASD genes MECP2 and CHD8. In support of this hypothesis, we previously demonstrated that, in the ASD-related BTBR mouse strain, the degree of kinase activation in the frontal cerebral cortex correlated with the degree of social impairment. We also showed that the degree of activation of kinases in the blood matched those in the brain suggesting that a peripheral blood biomarker may be feasible.
Objectives: We first aim to assess the time-dependent stability of these biomarkers, by assessing kinase/phosphatase measures monthly in a cohort of participants over a three month period (multiple time points; MTP). We principally propose to test whether there is an alteration in kinase signaling in peripheral blood mononuclear cells (PBMC) from ASD patients compared to aged and gender matched neurotypical controls and whether these changes correlate with clinical severity.

Methods: We obtained blood samples and then isolated PBMC from a cohort of 107 children (58 with ADOS confirmed idiopathic ASD and 49 neuro-typical matched controls). We also obtained blood samples from 12 (6 male and 6 female) neurotypical MTP controls. Cognitive and adaptive behavioral assessments were obtained across the cohort. A cytosolic fraction from these PBMC was purified, an equal abundance of protein samples were separated by poly-acrylamide electrophoresis and the abundance of kinases and phosphatases, and their degree of activation were measured by Western blot analysis using monoclonal antibodies targeted to three groups of proteins, p44/42 MAPK (ERK1/2), PTEN and AKT(1-3) and their key activation-based phosphoepitopes.

Results: We found that these kinase/phosphatase measures are highly stable, with a coefficient of variation ranging from 4% to 8% across nine measures assessed thrice. We also found that these key signaling pathways are significantly altered (increased or decreased, by taking the absolute value of the Z-score of each kinase/phosphatase measure) in ASD children versus controls (pERK/ERK, *P*=0.005; pPTEN/PTEN, *P*=0.001). Young children separately tested were equally affected; for p-ERK/ERK (*P*=0.017); for pPTEN/PTEN (*P*=0.003) and, in this subgroup also for pAKT/AKT (*P*=0.02). From amongst these three ratios, we found the strongest positive correlation between the degree of the pERK/ERK ratio and the SRS-2 (*P*=0.0034**)**. A full model analysis of these biomarkers showed an upper bound AUC of 0.86 and a lower bound of 0.73 (figure 2).

Conclusions: These findings demonstrate that blood-based kinase and phosphatase measures enable biomarker development in idiopathic ASD.

32 **109.032** Atypical Circuit Level Brain Activity in 3 Month Old Infants at Risk for Autism Spectrum Disorder

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Background: Heterogeneous genetic and environmental etiologies of autism spectrum disorder (ASD) converge upon circuit level brain disruption well before behavioral symptoms emerge (DeLaTorre, 2017). Prompt detection of early changes in brain development could facilitate earlier identification or enhanced stratification of risk, which in turn can improve the timing of early intervention. Traditional algorithms to examine neural signal are limited in infants, due to inherent data collection challenges.
Objectives: Here we take a data driven approach, developing a robust pipeline to maximize EEG data quality to study cortex-wide electrophysiological differences in infants at risk for ASD, as measured by alpha oscillations (6-12 Hz), specifically phase coherence (APC; Dickinson *et al.,* 2017). 'High risk' is defined based on an older ASD sibling (Charman *et al.,* 2017). The objectives of the present study were, 1) Develop a robust signal processing pipeline appropriate for infant EEG data, 2) Quantify differences in APC in infants who develop early signs of ASD symptoms (at 18 months), and 3) Examine whether APC at 3 months predict later behavioral outcomes (at 18 months).

Methods: Spontaneous EEG data were collected during the first year of life from high and low risk infants, with focus here on the earliest timepoint (3 months). Infants were grouped into 'high risk' (ADOS-t CSS ≥ 4, N=14) and 'typically developing' (CSS<4, N=49) groups based on the presence of social communication impairments at 18 months, and the Mullen scales of early learning were used to assess overall development. We designed processing methods which allowed us to maximize data quality, while retaining enough data to calculate stable estimates of signal characteristics. This involved 1) extensively cleaning data using artifact subspace reconstruction (ASR) and independent component analysis (ICA), 2) transforming EEG data into current source density (CSD) using a Laplacian transform, and 3) calculating APC between every possible electrode pair, obviating the need for *a priori* assumptions regarding spatial patterns of atypical APC.

Results: 1) The pipeline presented here was successful in minimizing sources of noise in the data, and also mitigated the effects of volume conduction (particularly relevant to connectivity analyses), allowing us to retain 100% of the EEG recordings collected at 3 months of age. 2) FDR-corrected permutation testing reveal that APC is increased at 3 months in the group of infants who demonstrate ASD behaviors at 18 months. These group differences were most statistically evident in one long-range interhemispheric electrode pair (ASD: M=0.33; typical: M=0.23; P<.000003). 3) Across all participants, long range APC at 3 months was inversely related to verbal cognition at 18 months (R=-.56, P=.02).

Conclusions: The present data suggest that the dynamics of circuit level brain activity are altered early in infants who later show symptoms of ASD. The hyperconnectivity demonstrated here is consistent with structural findings of increased white matter during infancy in ASD (Wolff et al., 2012). We will discuss the potential utility of circuit level biomarkers to 1) objectively identify neurodevelopmental disruptions early in life, 2) support individualized prognoses, and 3) inform neurobiological targets of early intervention.

33 **109.033** EEG Integrated Platform (EEG-IP): Repository of Pre-Processed EEG Data Optimized for Signal Retention and Harmonization across Projects.

J. Desjardins[1], *S. van Noordt*[2], *S. Huberty*[3], *L. A-Abbas*[4], *&. The BUCANL Team*[5], *A. C. Evans*[2], *M. H. Johnson*[6], *C. A. Nelson*[7], *S. J. Webb*[8], *E. J. Jones*[9], *H. Tager-Flusberg*[10], *S. Jeste*[11], *A. R. Levin*[12], *S. J. Segalowitz*[13], *&. The BASIS Team*[14], *M. Elsabbagh*[15] *and T. Charman*[16], *(1)SHARCNET, St Catharines, ON, Canada, (2)Montreal Neurological Institute, McGill University, Montreal, QC, Canada, (3)Mcgill University, Montreal, QC, Canada, (4)Research Institute - McGill University Health Centre, Montreal, QC, Canada, (5)Brock University, St Catherine, QC, Canada, (6)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (7)Boston Children's Hospital, Boston, MA, (8)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (9)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (10)Psychological and Brain Sciences, Boston University, Boston, MA, (11)University of California, Los Angeles, Los Angeles, CA, (12)Neurology, Boston Children's Hospital, Boston, MA, (13)Psychology, Brock University, St Catharines, ON, Canada, (14)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (15)McGill University, Montreal, PQ, Canada, (16)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: EEG is a non-intrusive method for capturing brain behavior dynamics at a high temporal resolution. Because of the high availability of EEG it is particularly well suited for accumulating large samples of data from diverse participant populations including infants at varying risk of ASD. The substantial recent advancements in analytic methods for studying brain dynamics in EEG recordings have increased the impact of this modality in integrated neuroscience. Although this technology holds great potential for large samples, the acquisition is prone to artifacts. Further, there are few standards for data acquisition that would facilitate harmonizing data across projects. Finally, substantial pre-processing of EEG data is required to isolate the cortical signals from the various artifact sources. There are no accepted standards for the pre-processing and many of the current strategies are highly reductionistic resulting in substantial loss of potentially important data. Identifying neural correlates to autism in infant EEG could have a large impact on treatment outcomes, however, the lack of standards and methods for harmonizing data across projects for large scale analyses is still a limitation in the field.
Objectives: Implement tools required to produce a transferable "lossless" state for harmonized pre-processed EEG data which places minimal restrictions on post processing procedures. Apply this pre-processing strategy at large scales on HPC resources to contributed data sets of infant EEG from independent research institutions to produce an integrated repository for the study of ASD risk factors.

Methods: Contributing Research groups from Birbeck University of London, University of Washington and the Boston Children's Hospital shared over 1450 EEG sessions consisting of 446 unique participants spanning 3 age retest trajectories (London: 7, 14 months; Washington: 6, 12, 18 months; Boston: 3, 6, 9, 12, 18, 24, 36 months). The contributed EEG recording were pre-processed using the lossless pipeline that employs robust measures to isolate spatially non-stationary channels and periods of time in the recording (bad channels, movement artifacts, etc), then performs multiple Adaptive Mixture Independent Component Analysis (AMICA) to isolate stationary noise factors from cortical signal (eye movements, blinks, ECG, EMG, etc), as well as isolate the activation of specific cortical generators.

Results: Descriptive statistics of the pre-processed data indicate that the lossless pipeline performed well in isolating cortical signal from noise in all three sites. Although the three contributing sites had varying acquisition properties the resulting cleaned data has similar properties across the sites.

Conclusions: With increasing computational resources at researchers disposal large scale analysis have the potential for significant impact on our understanding of ASD risk factors. While EEG data is well suited for contributing to large scale neuroimaging efforts because of its non-invasive nature and high accessibility, its vulnerability to artifacts and lack of acquisition/processing standards make it difficult to harmonize data across projects for combined analysis or replication. The lossless pipeline provides a method for maximizing the retention of cortical signal from EEG recordings and establishes a state of data that is harmonized across acquisition parameters.

34 **109.034** The Early Trajectory of Relative Power in Autism Spectrum Disorders

S. Huberty[1], *S. van Noordt*[2], *J. Desjardins*[3], *M. H. Johnson*[4], *E. J. Jones*[5], *C. A. Nelson*[6], *H. Tager-Flusberg*[7], *A. R. Levin*[8], *J. Frohlich*[9], *&. the BASIS Team*[10] *and M. Elsabbagh*[11], *(1)Mcgill University, Montreal, QC, Canada, (2)Montreal Neurological Institute, McGill University, Montreal, QC, Canada, (3)SHARCNET, St Catharines, ON, Canada, (4)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (5)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (6)Boston Children's Hospital, Boston, MA, (7)Psychological and Brain Sciences, Boston University, Boston, MA, (8)Neurology, Boston Children's Hospital, Boston, MA, (9)University of California Los Angeles, Los Angeles, CA, (10)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (11)McGill University, Montreal, PQ, Canada*

Background: During the last decade, there has been increased interest in studying infants who have an older sibling with ASD (infant-siblings). Given that that ~20% of these infants will be diagnosed with ASD, studying infant-siblings from early infancy may help identify early behavioral or Neural precursors of ASD. Previous studies have found that oscillatory power in early infancy is predictive of later language ability (Levin, 2017), and that infants at risk for ASD have significantly lower frontal absolute EEG power across multiple frequency bands at 6 months of age, compared to infants not at high risk for ASD (Tierney, 2012). However, these studies are often limited by relatively small samples sizes and little is known about the early trajectory of EEG power in infants who eventually receive a diagnosis of ASD.
Objectives: As part of the international infant EEG data integration platform (EEG-IP), combining over 400 participants from three infant-sibling EEG studies, we aim to study spectral relative EEG power within the first year of life as it relates to autism risk.

Methods: We used resting state EEG data from two infant-sibling studies (Boston, USA and London, UK) at 3,6,9,12,18,24, and 36 months of age. The Boston data set included data from 250 infants between 3-36 months, and London included data from 104 infants between 6 and 12 months. Data were processed using a lossless pipeline that employs robust measures to isolate systematic sources of artifact (e.g., unreliable channel signal, non-stationarity, movement, non-cortical biological sources), and Adaptive Mixture Independent Component Analysis (AMICA) to isolate spatially fixed field projections. The EEG was interpolated to 10-20 sites. Following Tierney et al., 2012, Relative power was extracted in delta (2-4 Hz), theta, (4-6 Hz) low alpha (6-9 Hz), high alpha (9-13 Hz), beta (13-30 Hz), and gamma (30-50 Hz) bands from and 9 regions corresponding to 10-20 channels F3,Fz,F4,C3,Cz,C4,P3,Pz,P4. Relative power values between high familial risk for ASD (HR) and low risk infants (LR) were compared at each visit.

Results: At 3 and 6 months, gamma was significantly higher in all regions in the HR group (p <.01). At 6 months, theta was significantly lower in the HR group (p <.01), as well as low alpha in Regions Cz,C4,P4 (p <.05). At 12 months differences in theta and gamma converge, while alpha remained lower in the HR group for regions Fz-F4-Pz. (p <.05). Despite no differences at 24 months, the HR group had lower gamma power and higher theta power at 18 months (p <.01) and higher gamma power at 36 months (p <.05).

Conclusions: Results suggest that differences between HR and LR infants are more pronounced at the edges of the frequency distribution in early infancy. In the coming months as more data are added to the repository, our analyses will focus on differentiating the subset of infants who developed ASD, and measure trajectories of change in oscillatory power across development for all groups.

35 **109.035** Frontal Theta Coherence to Gaze Fixation Is Associated with Infant Autism Risk

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Background: Neural phase coherence is a fundamental mechanism underlying information processing. Abnormalities in neural coherence may reflect atypical information processing, manifesting as widespread cognitive and behavioural difficulties in a range of neuropsychiatric disorders. A growing body of evidence suggest that reduced neural phase coherence represents an endophenotype of ASD. Theta oscillations are a promising neural signature of atypical information processing given their links to attention control. Several studies suggest that ASD is characterized by reduced frontal theta coherence at rest and is correlated with attention flexibility in children. Not only have reductions in frontal theta been found in infants at risk for ASD, at risk infants also show a distinct trajectory as theta dynamics unfold across early development. A hallmark of the autism phenotype is poor attention control and atypical patterns of eye contact, particularly for mutual gaze fixation, which are thought to contribute to the broad deficits in social interaction that are common in ASD. Although much evidence points to a severe impairment in eye contact and gaze fixation in ASD, studies have not yet assessed whether inter-trial phase coherence (ITPC) of theta to gaze fixation is reduced in infants at risk for ASD.
Objectives: The goal of this study is to test whether frontal theta ITPC to gaze represents an early biomarker for ASD. To achieve this goal we will compare single trial measures of phase coherence in 6-month old infants who have an older sibling with ASD diagnosis (sib-ASD) and typically developing (TD) infants with no family history of ASD.

Methods: The target sample comes from the British Autism Study of Infant Siblings (BASIS). Infants were assessed using a dynamic gaze task. Frontal scalp regions were assessed for theta oscillatory phase coherence to gaze stimuli. Analyses were done using an open-source MATLAB toolbox, STATSLAB, which implements robust statistics for analyzing single trial EEG data in single subjects.

Results: Compared to TD controls, sib-ASD infants show reduced P400 ERP amplitude to direct gaze stimuli and lower frontal theta ITPC.

Conclusions: Reduced frontal theta ITPC to gaze fixation in at-risk infants has both theoretical and clinical implications, possibility contributing to an impairment in outcome expectation/prediction in ASD, particularly with respect to processing social cues such as eye gaze. Identifying sensitive and stable biomarkers capable of differentiating ASD risk in infancy has important clinical implications for diagnostic status, dissociation between transdiagnostic categories, and tracking treatment response.

36 **109.036** Using Machine Learning to Predict Risk and Diagnostic Outcomes of Autism Spectrum Disorder

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Background: Identifying early risk and/or diagnostic biomarkers for autism spectrum disorder is one of the challenges in autism research today. Recent studies have investigated the use of Event Related Potential ERP to identify neural markers of ASD in infancy, through identifying brain function difference between infants at risk for ASD and control. Previous findings indicated the existence of significant differences in statistical features and in power spectral density of the different frequency bands across all brain regions (frontal, central, parietal, occipital and temporal). Objectives: In this study, we combined averaged ERP extracted measures, including power metrics as well as statistical features across different brain regions to explore the performance accuracy of classification algorithms in distinguishing on the one hand between infants At-risk with ASD and control group and secondly between infants diagnosed with ASD and others with no-ASD.

Methods: EEG data was collected at 6 months of age on 54 infants at risk for autism (HR) by virtue of having an older diagnosed sibling and 46 low risk (LR). From the group of HR infants, 17 were later diagnosed with ASD (n= 17 HR-ASD, 34 HR-noASD and 54 LR-noASD). ERP recordings were collected while infants watched a passive “eye-gaze” task. A total of 134 features, including power spectral density at different frequency bands (delta, theta, alpha, beta and gamma), P1, N1, P2, N270, P3, and LPC, were derived from the averaged ERP data during the averted eye gaze stimuli across all brain regions. Three classifiers including linear and nonlinear techniques: Discriminant analysis (DA), K-Nearest Neighbor (KNN) and Support Vector machines (SVM), are compared for distinguishing offline data to choose the suitable classification algorithm for each experiment. To avoid overfitting, 10-fold cross validation was used to test the efficiency of machine learning algorithms.

Results: the results indicate that while all methods succeeded in achieving suitable performance levels, DA 10-cross validation provides the best average accuracy rate for correctly associating an ERP infant to risk or control classes and SVM 10-cross validation shows the highest accuracy in distinguishing infants diagnosed with ASD from LR-noASD and HR-no ASD.

Conclusions: Due to the number of ERP components and conditions being integrated in this study, our analysis was limited due to the sample size. Optimizing these machine learning techniques to be applied at a large scale will allow for robust prediction of risk status and diagnostic outcomes based on a combination of ERP features.

37 **109.037** A Multi-Site Study of Noldus Ethovision XT Video Tracking of Children with and without Autism: Results from the ABC-CT

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Background: Parent-child interactions are a naturalistic method of measuring child behaviors and response to treatment. Manual coding is conducted to quantify child behaviors, but this method is time-intensive and subjective. Video tracking offers an automated alternative to coding, yielding quantitative, objective measures of behaviors. Noldus EthoVisionXT (EVXT) was developed to quantify animals’ movements, and was recently applied to children with autism spectrum disorder (ASD) and a non-ASD group during a parent-child free play task (PCFP) (Cohen et al., 2014). As the only study of its kind, further research is needed to assess the validity and reliability of this method.
Objectives: 1) Examine correlations of EVXT outcomes with child characteristics and clinical measures; 2) Determine relations among EVXT

outcomes across timepoints; 3) Assess effects of group and timepoint on EVXT outcomes for school-aged children with ASD and TD during a lab-based PCFP.

Methods: As part of the Autism Biomarkers Consortium on Clinical Trials (ABC-CT), a multi-site longitudinal study, school-aged children (baseline mean Age = 8.73 years, range = 6.02-11.53 years; baseline mean FSIQ = 101; range = 60-150) with ASD (N= 161) and TD (N=64) and their caregivers participated in three 6-minute PCFPs (baseline, week 6, week 24). EVXT software generated durations, latencies, and frequencies in core regions of interest (ROIs; Periphery, Caregiver, and Activity), and Total Distance Moved and Mean Distance to Caregiver. Group differences, longitudinal change, and associations of EVXT outcomes with child characteristics (age, gender, IQ) and clinical measures of hyperactivity (CASI-5), autism severity (ADOS-2, SRS), and social-communication skills (Vineland Adaptive Behavior Scales, PDD Behavior Inventory) were explored.

Results: At Baseline, the ASD group spent more time in the Center Activity ROI (F=4.74, p=.03) between the Parent and Table ROIs, whereas the TD group spent more time at the Table Activity ROI (F=3.57, p=.06), across from the Parent ROI. Baseline analyses show associations of EVXT outcomes with parent report outcomes. Lower expressive/receptive social communication ability (PDDBI) correlated with more time in the Periphery ROI for the ASD group (r = -0.18614, p=.023). Higher hyperactivity ratings (CASI-5) correlated with greater Total Distance Moved for the TD group (r= 0.29435; p=.024), and more time in core ROIs for the ASD group (r=0.17464; p= .033). EVXT outcomes across timepoints were positively correlated (Baseline/Week 6: r's = .216 - .469, p's = .009 – <.0001; Baseline/Week 24: r's = .175 – .562, p's = .035 - <.0001). Analyses of longitudinal change and the effects of site, gender, age and IQ on EVXT outcomes are underway.

Conclusions: This study is the first to use EVXT in a multi-site, longitudinal study of children with ASD and TD. Preliminary analyses of baseline EVXT outcomes indicated different movement patterns for ASD and TD children. Movement patterns detected via EVXT were correlated with individual differences in parent-reported behavior, including social communication ability and hyperactivity. These results suggest that EthoVision is a promising method for automatically tracking individual differences in children's movements that correlate with clinical features. Methodological considerations for applying EVXT in longitudinal clinical trials are discussed.

38 **109.038** An Examination of Changes in Urinary Metabolites and Behaviors with Use of Folinic Acid in Children with Autism Spectrum Disorder (ASD)

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Background: Children with autism spectrum disorder (ASD) have been found to have a high prevalence of folate receptor auto-antibodies (FRAA) that either block or bind to the folate receptor alpha, which is believed to impair the normal transport of folate from blood into the cerebrospinal fluid (CSF). This creates the condition known as "cerebral folate deficiency," where serum folate concentrations are normal but CSF folate concentrations are low. Folinic acid (FA) is believed to be able to bypass the impaired folate transport system through a secondary mechanism. A recent randomized controlled trial of FA supplementation in children with ASD found improvements in behavior and language development. We sought to test this treatment option through an ongoing research partnership at a local school for children with ASD to determine if FA would improve behavior and social skills. We further examined changes in urinary metabolites among treated children to attempt to identify a mechanism of action.

Objectives: The purpose of this study is to see if the behavior of children and young adults with autism improves in response to FA and to measure the urinary metabolites as a treatment biomarker.

Methods: Children attending a K-12 school for ASD were recruited and enrolled in an open-label, 12-week treatment study of high dose FA (2mg/kg/day, max dose 50mg/day). The primary outcome measures were the mean changes in the Aberrant Behavior Checklist (ABC) and the Social Responsiveness Scale (SRS). We also examined changes in Pediatric Quality of Life (PedsQL). We further measured urinary metabolites at baseline and week 12 to examine their fold of change. Surveys at baseline and week 12 were analyzed using Paired Sample T-Tests.

Results: Twelve children aged 13 to 19 (2 girls, 10 boys) were enrolled in the study. Parents and teachers for these children completed all measures. The parent-reported mean of the differences in SRS showed a non-significant decrease of 7.8 points (95% CI -1.6 to 17.3, p = 0.095, Figure 1). The parent-reported ABC showed a non-significant decrease of 2.4 points (95% CI -6.4 to 11.3, p=0.56), and the teacher-reported ABC showed non-significant increase of -1.2 points (95% CI -7.6 to 5.2, p=0.68). The parent-reported PedsQL decreased insignificantly by 0.8 points (95% CI -3.5 to 5.2, p=0.69).

The top 5 urinary metabolites with the greatest fold of change were 5-methyltetrahydrofolate (24.9), 1-stearoyl-2-arachidonoyl-GPC (10.1), 1-stearoyl-2-oleoyl-GPC (9.3), alpha-tocopherol (9.2), and 1-stearoyl-2-linoleoyl-GPC (7.8).

Conclusions: In an open label study in an unselected, small sample of school-aged children with ASD, FA treatment did not lead to measurable improvements, but the small sample size limited the power to detect changes. The parent-reported SRS showed a non-significant improvement of 7.8 points, which is clinically important and worthy of future study with larger samples. The potential benefits of FA may be limited to children with a specific physiological abnormality (e.g., FRAA status) and may require a study with a targeted treatment approach to determine efficacy. Urinary metabolites may be a useful tool to identify children who are likely to respond to treatment.

39 **109.039** Application of Supervised Learning Methods in Stratification of Autism Based on Mixed Measures of Eye Tracking and Electroencephalogram: Results from the ABC-CT Interim Analysis

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Background: Biomarker discovery in autism research includes a focus on identifying reliable, quantitative measures associated with meaningful subtypes. Standard approaches investigate how specific values extracted from individual experimental paradigms, drawn from methodologies such as eye-tracking(ET) and electroencephalography(EEG), relate to clinical outcomes. While powerful, these approaches do not necessarily take advantage of the full spectrum of data measured from different devices on a range of paradigms that, if considered in their fullest, might provide more comprehensive picture of the disorder and its multifaceted aspects.
Objectives: To investigate the feasibility of combining individual measures for ASD biomarker discovery, this study utilizes computational and machine-learning methods to examine how measures extracted from EEG and ET paradigms can be combined to achieve robust predictions of behavioral phenotype.

Methods: This study leverages derived variables from all ET paradigms (Biomotion Preference, Activity Monitoring(AM), Social Interactive(SI) Play, Static Social(SS) Scenes, and Pupillary Light Reflex(PLR)) and EEG paradigms (Visual Evoked Potential(VEP) and Faces vs Houses(ERP)) presented in the interim data set (Summer 2018) of Autism Biomarkers Consortium for Clinical Trials(ABC-CT), formed to investigate promising biomarkers for ASD. The dataset contained data from baseline measurements from 225 children with ASD(n=161) and typical-development(n=64). K-nearest-neighbors was used for imputation of missing predictors. Using a variety of machine-learning techniques, with 10-fold 100x-repeated-cross-validation, this study examines the Pearson's correlation of predictions derived from 47 potential predictors to ADOS calibrated severity scale(CSS) and IQ. The complete set of predictors, LASSO, principal component analysis(PCA), elastic net(EN) and ridge decision tree(RDT) are used for feature selection; first and second order linear regression models(LM), random forest(RF), support vector machines(SVM) are used for prediction(total of 16 different machine-learning approaches). For comparison, the best single predictor is identified from the set of all predictors.

Results: 1.As a baseline, correlations between individual variables and outcome variables was examined.

- CSS: the highest correlations were observed in ET %head averaged across AM,SI,SS paradigms,%heads(AM), and %looking(SI), r=0.548,0.469,0.447. The average correlation across all variables was r=0.282.
- IQ: ET looking%(SI), EEG erp (faces_good) and ET looking%(SS) showed top correlations of r=0.47,0.45,0.43. Similar to CSS, the mean variable correlation was r=0.280.

2.Using 2nd and 1st-order LM,SVM and RF with all derived measures (EEG&ET) achieved:

- CSS: r=-0.000576,0.545,0.609,0.584.
- IQ: r=0.00307,0.549,0.533,0.484.

3.Combining PCA,LASSO,RDT, and EN with 1st-order LM and SVM achieved:

- CSS: LM:r=0.54, 0.59,0.59, 0.60 and SVM:r=0.601,0.602,0.612, 0.594.
- IQ: LM:r=-0.54,0.568,0.551, 0.564 and SVM:r=0.574,0.553,0.504, 0.541.

Conclusions: These results suggest that a machine-learning approach improves associations above the average single biomarker outcomes and results in minor gains as compared to best single biomarker outcomes. However, only limited improvements were observed, relative to straightforward first-order linear regression, by using either variable selection or more advanced machine-learning techniques (SVM,RF). This suggests that leveraging complex interactions between biomarkers may not provide substantial gains in matching biomarkers to clinical phenotypes -- a finding that may be expected given that ABC-CT paradigms were all primarily designed to index social-communicative function. Additional nuances of this work, including variables identified by machine-learning approaches best describing phenotypic relationships, the robustness of machine-learning in high-dimension spaces, and machine-learning limitations, will be discussed in subsequent reports.

40 **109.040** Developmental Differences in N170 Morphology in Children with Autism Spectrum Disorder: Results from the ABC-CT Interim Analysis

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Background: Individuals with autism spectrum disorder (ASD) exhibit impairments in face recognition that are associated with reduced neural efficiency reflected in increased peak latency of the N170, a face-sensitive event-related potential (ERP). However, the shape and morphology of these ERPs are highly variable, and N170 to social stimuli are bifid, i.e., showing two peaks, in 65% of typically developing (TD) children aged 4 to 12 years (Taylor, Batty, & Itier, 2014). Though researchers have acknowledged the variability in N170 waveform morphology, few have quantified it across development. Given the centrality of the N170 as a putative biomarker in ASD, investigating atypical waveform morphology is critical for understanding the neural mechanisms associated with social perception in ASD.
Objectives: To quantify relationships among N170 morphology, age, diagnosis, and clinical characteristics in children with ASD and TD controls.

Methods: ERPs to upright faces were collected from 172 participants (124 male, 115 ASD) 6 to 11 years of age (*M* = 8.72, *SD* = 1.64). Visual inspection was used to determine presence of bifid N170 morphology in the left hemisphere. A bifid was defined as two negative peaks between 100 and 350ms after stimulus presentation. Clinical measures are presented in Table 1.

Results: 29.13% (*n* = 67) of children with ASD exhibited bifid morphology; 33.33% (*n* = 37) of TD children. A chi-square test revealed that diagnosis did not predict presence of bifid morphology [$\chi^2(2, N = 171) = 2.11$, $p = .348$]. Independent-samples *t*-tests compared means of age and clinical measures between individuals with bifid morphology versus those without (Table 1). Older children were more likely to exhibit bifid morphology (*M* = 9.11, *SD* = 1.68) (*M* = 8.50, *SD* = 1.59) [$t(168) = -2.33$, $p = .021$]. Among children with ASD, children with bifid morphology had lower FSIQ (*M* = 92.33, *SD* = 16.66) than those without (*M* = 101.42, *SD* = 18.25) [$t(113) = 2.60$, $p = .011$] and higher ADOS severity scores (*M* = 8.21, SD = 1.77) (*M* = 7.36, *SD* =

1.90) [$t(113) = -2.33$, $p = .022$]. Bivariate correlations were performed to assess the relationship among variables with the time between bifid peaks (Table 2). Time between peaks was reduced in older children [$r(127) = -.25$, $p = .004$] and in children with higher NEPSY scores [$r(127) = -.19$, $p = .029$]. Furthermore, time between peaks was greater in children with later N170 latencies [$r(127) = .26$, $p = .003$] and reduced in children with more negative N170 amplitudes [$r(127) = -.31$, $p < .001$].

Conclusions: Results show that bifid morphology of N170 waveform associates with demographic and clinical characteristics. Reduced time between bifid peaks correlating with age and face processing supports the idea that the maturational time course of the N170 may reflect increasing efficiency of a specific face-processing system. These data hold significant promise for understanding the neural mechanisms guiding the development of social performance and face processing, and increasing the utility of the N170 as an effective biomarker for diagnosis and stratification of ASD.

41 **109.041** Differences in Cortical Activation Patterns between Children with and without Autism Spectrum Disorder (ASD) during Interpersonal Synchrony Tasks.

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Background:
Children with Autism Spectrum Disorder (ASD) have difficulties with social interaction as well as socially-embedded motor skills such as imitation and interpersonal synchrony (IPS). These behaviors share common neural mechanisms which may better explain the core symptoms of this population. Using functional Magnetic Resonance Imaging (fMRI), previous studies have reported atypical patterns of activation in the Mirror Neuron Systems (MNS) of children with ASD compared to typically developing children (TD). However, the tasks were restricted to simple finger movements and did not involve upright and naturalistic face-to-face interactions. We address these limitations through the use of functional near-infrared spectroscopy (fNIRS) to investigate cortical activation during a naturalistic reach to cleanup task.

Objectives:

We compared MNS activation between children with and without ASD during a reach to cleanup, interpersonal synchrony task.

Methods:

Sixteen children with ASD and 17 age- and gender-matched, typically developing children without ASD between 6 and 17 years of age participated. Each child wore a cap embedded with two 3x3 fNIRS probe sets that covered the bilateral MNS regions, including inferior frontal gyrus (IFG), superior temporal sulcus (STS), and inferior parietal lobe (IPL). The children were seated at a table face to face with an adult social partner. Multiple blocks were arranged in a circular fashion. The task involved cleaning up the blocks into a container across 3 conditions: a) *Watch*: the child observed the adult cleaning up the blocks, b) *Do*: the child cleaned up the blocks on their own, and c) *IPS*: the child cleaned up the blocks along with the adult by matching the block location and color/shape. Eighteen trials (6 per condition) were collected in a random order. The oxy-hemoglobin response of the fNIRS signal was analyzed per channel.

Results:

Children with ASD had decreased spatial and temporal accuracy during the IPS condition compared to their TD peers. Compared to other cortical regions, both groups showed higher STS activation during Watch and higher IFG activation during Do and IPS. Both groups showed greater cortical activation during Do and IPS conditions compared to Watch. The IPS > Do pattern of activation was found in the right IFG region in the TD group and the left IFG and right STS regions in the ASD group. In terms of hemispheric differences, during movement conditions of Do, both groups showed significant left lateralization (TD group for the STS region and ASD for the IFG region). In contrast, children with ASD showed right lateralization over the STS region during IPS. Most importantly, children with ASD showed lower STS and IFG and greater IPL activation compared to the TD children.

Conclusions:

Children with ASD had more IPS errors, decreased bilateral STS and IFG activation, and greater compensatory IPL activation than the control group. Children with ASD have markedly different patterns of cortical activation than TD children. In the future, we will examine therapeutic contexts that could normalize the patterns of cortical activation in children with ASD, for example, effects of music/no music or visual/auditory cueing, etc.

42 **109.042** Disruption of Mtor and MAPK Pathways Correlates with Severity in Idiopathic Autism

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Background:
The molecular signature underlying idiopathic Autism Spectrum Disorder (ASD) remains largely unknown. Some insights have been gained through the study of syndromic forms of autism and intellectual disabilities, such as Fragile X Syndrome (FXS) and Tuberous Sclerosis (TSC), two monogenic diseases associated with mutations in genes that regulate protein synthesis and affect transmission and plasticity of synapses. Thus, it has been hypothesized that excessive synaptic protein synthesis might contribute to the pathogenesis of ASD and other intellectual disabilities (IDs) with ASD-like clinical features. Specifically, the mTOR and MAPK signalling pathways are two key regulators of synaptogenesis and local protein synthesis in the brain. Interestingly, compelling evidence implicated those two pathways and, ultimately, protein synthesis, in syndromic autism and little is known about non-syndromic autism. Therefore, the identification of a molecular signature of ASD and disease's severity will support the clinicians for an early diagnosis.

Objectives:

This study aims to characterize the mTOR and MAPK pathways in peripheral blood of children with idiopathic autism in order to identify a molecular signature in subjects affected by mild and severe idiopathic autism.

Methods:

A total of 55 subjects were enrolled: 33 ASD patients (aged between 3-11 years; 27 males, 6 females) and 22 healthy children as controls (aged between 3-17 years; 10 males, 12 females). A standardized clinical assessment of developmental level (psychoeducational profile third edition-PEP-3) and autistic symptoms (Autism Diagnostic Observation Schedule-ADOS) was performed for each patient. Components of the mTOR and the MAPK signalling pathways were analysed from peripheral blood at the protein level. Patients were next grouped according to their clinical phenotypes and the molecular profiling was analyzed according to the severity degree of ASD.

Results:

Increased activity of the mTOR and the MAPK pathways, emerged in patients with idiopathic ASD. Intriguingly, we observed differential expression of the MAPK and mTOR pathways according to the clinical profile of patients. Specifically, p-eIF4E, rpS6 and p-MNK1 proteins exhibited significantly increased levels in the severe group compared to controls (p-eIF4E: $p = 0.0003$; rpS6: $p = 0.03$; p-MNK1: $p = 0.01$;). Furthermore, we observed an increase of TSC1 levels in the mild ASD subgroup but not in the severe subgroup ($p = 0.048$).

Conclusions:

Our data show that an increase in both the MAPK and mTOR pathways possibly leads to aberrant protein synthesis in subjects with ASD, indicating that alteration of mTOR and the MAPK pathways may contribute to intellectual disabilities and to both syndromic and non-syndromic ASD. Moreover, our findings suggest that mild and severe autism may be discriminated according to different protein expression profiles. Although further studies in different cohorts are required, we suggest that components of protein synthesis signalling pathways might be considered as a molecular signature of clinical severity in Autism Spectrum Disorder.

43 **109.043** Divergent Autonomic Response Profiles in Early Childhood Autism

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Background: The heterogeneous presentation of Autism Spectrum Disorder (ASD) presents challenges for clinical care and research, including complicating the development of methods to assess clinically relevant indicators of prognosis (long-term functional outcomes) and treatment response. There is a need for measures that can mark clinically meaningful individual differences in underlying features or characteristics related to short-term responses to treatment and long-term functional outcomes. Physiologic measures of autonomic regulation may be promising biomarkers for prognosis and outcome.

Objectives: To utilize autonomic responses to index individual differences in social and regulatory responses of children with autism during standardized behavioral assays of social engagement and emotion regulation.

Methods: Participants were 104 children, 66 with ASD and 38 typically developing controls (age range 2–7; *M*= 4.3 years, 79% male). IQ was assessed using the Stanford Binet-5 and scores for the ASD group varied widely (range: 40-122; *M*=70.6; SD=23.4). ECG was acquired at 1kHz during standardized behavioral assays designed to reflect levels of social engagement (responses to opportunities for social interaction) and emotion regulation (responses to frustrating tasks such as a sabotaged toy). Heart rate (HR) and RSA were derived from the ECG. RSA was defined as HR variability in the frequency range of respiration (spectral method; frequency band: .24 – 1.04 Hz). Latent cluster analyses were performed using the HR/RSA responses during social engagement tasks and frustration tasks for the ASD group using a Gaussian Mixture Model method. Models were evaluated using Bayesian Information Criteria (BIC). Missing data was addressed using multiple imputation (predictive mean matching). Resulting ASD clusters were compared to typical controls.

Results: A 2-cluster solution was found for HR/RSA responses to Frustration Episodes. A single "cluster" was found for the HR/RSA responses to the Social Engagement tasks. BIC indicated that the 2-cluster solution for the Frustration responses was a very good fit for the data and visual inspection of cluster plots indicated very good separation between the two resulting ASD classes. As expected based on latent classifications, the ASD Class 1 children had lower RSA and higher HR than ASD Class 2 children (p's < 0.001). While the overall ASD group did not differ from the typical group, the ASD Class 1 and 2 children differed from typicals in opposite directions. ASD Class 1 children had higher HR than typicals ($p <$ 0.001), whereas ASD Class 2 children had lower HR during frustration events. ASD Class 2 children had higher RSA than typicals (p < 0.001).

Conclusions: Our results identified two subsets of children with ASD who have qualitatively different autonomic response profiles during mildly frustrating events. Physiologic response profiles during standardized behavioral assays can be used to dissect ASD heterogeneity into clinically meaningful subgroups. If validated, these biomarkers may help to predict behavioral outcomes and/or treatment response. Ongoing analyses will test the relationship between frustration and social engagement responses, and will investigate whether the ASD classes differ on measures of behavioral functioning.

44 **109.044** Evaluation of Fragile X Mental Retardation Protein Levels in NICU Infants

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Background: Fragile X syndrome (FXS) is a most common form of inherited intellectual disability with a single gene effect. At least 30% of individuals with FXS are also diagnosed with autism spectrum disorder (ASD). FXS is caused by CGG repeat expansions in X-linked gene FMR1, resulting in reduction or absence of the gene product, fragile X mental retardation protein (FMRP). Typically, FMRP is expressed early during fetal development and a substantial amount of the protein is detectable at birth. Although reduction of FMRP is associated with FXS, scientific efforts to rescue Fmrp expression in Fmr1 KO mice reported to result in increased hyperactivity/anxiety-like behaviors when the protein is greatly overexpressed. Profiling the developmental expression of FMRP may help to establish physiologic and diagnostic guidelines. Neonatal intensive care unit (NICU) graduates are at risk for neurodevelopmental delay and are more frequently diagnosed with ASD later in life than the general population.

Objectives: The current study surveyed the levels of FMRP in NICU infants as an at-risk population for ASD.

Methods: Newborn dried blood spots (DBS) were collected at the Richmond University Medical Center, Staten Island NY. Research DBS card collection for consented participants was timed to the collection of the state-mandated newborn card. The levels of FMRP and the *FMR1* gene CGG repeat number were assessed. This study examined the levels of FMRP expression in the peripheral blood of infants from a well nursery (WN)

(N=324) and the NICU (N= 75) with normal *FMR1* genotypes. We used the immuno-based qFMRP assay to evaluate the protein levels in extracts from 3mm DBS punches using anti-FMRP 6B8 mAb (BioLegend) - R477 polyclonal antibody duo and abbreviated recombinant FMRP standard for protein quantification. Detected FMRP was further normalized to the number of white blood cells (WBC).

Results: Analysis of FMRP data for the two cohorts shows elevated FMRP levels in NICU newborns ($mean_{NICU}$ 4.23 pg/10^3 WBC) compared to the well nursery infants ($mean_{WN}$ 3.90 pg/10^3 WBC). In the NICU cohort the FMRP data distribution failed a normality test due to the greater proportion of the infants presenting with either reduced or elevated levels of FMRP expression, resulting in an asymmetric and more heavily tailed data distribution (skewness 1.336 and kurtosis 2.774).

Conclusions: The FMRP levels among age matched NICU and a well nursery newborns showed small but significant differences ($p < 0.05$) in mean values. Further recruitment and analysis is necessary for more definitive conclusions. Patterning the data for the presence of diagnostic commonalities that would correlate with the increased frequency of the contrasting levels of FMRP in NICU newborns is expected to refine this study's conclusions.

45 **109.045** Examining Patterns of Physiological Arousal in Children with and without Autism Spectrum Disorder

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Background: Autism Spectrum Disorder (ASD) is characterized by impairments in social communication and restricted and repetitive behaviors (American Psychiatric Association [APA], 2013). Cardiovascular activity has been studied as a biomarker for social-emotional functioning (Beauchaine, 2015; Patriquin et al., 2014) with increased autonomic dysregulation being associated with more social and emotional problems (Shahrestani et al., 2014). One common metric of autonomic activity is heart rate variability (HRV), or the fluctuation in the time interval between heartbeats. Respiratory sinus arrhythmia (RSA) is a measure of HRV that is associated with parasympathetic activity or the restoration of physiological functioning when the body is at rest (Porges, 1995). In typically developing populations, higher levels of RSA are related to better social functioning (Patriquin et al., 2014). However, these relationships are not well characterized in younger children with ASD.
Objectives: The present study aims to examine the relationships of physiological measures of arousal and ASD symptomology in preschool-aged children with and without a diagnosis of ASD during conditions with varying social demands.

Methods: Preliminary data were collected from 20 children between the ages of 2-5 years that participated in an ongoing study examining physiological arousal and symptoms of ASD and anxiety in preschoolers with and without ASD. Participants were categorized into two groups: children with a clinical diagnoses of ASD (N=11) and typically developing children (N=9). Physiological data included average heart rate (HR) and RSA collected during the following conditions: (1) baseline, (2) play-based assessment (Autism Diagnostic Observation Schedule; ADOS-2), and (3) recovery. The participants viewed a video for 5 minutes during the baseline and recovery conditions. The ADOS-2 severity score was used as a measure of ASD symptoms.

Results: Preliminary results indicate that children with ASD demonstrated lower levels of baseline RSA (M = 6.22) and recovery RSA (M = 6.02) than typically developing children (M = 6.61 and M= 6.79 respectively). Additionally, typically developing children displayed higher levels of RSA during the play-based condition (M = 6.93) than children with ASD (M = 6.09). Levels of RSA increased during the play-based condition in typically developing children, whereas levels of RSA decreased in the play-based condition in children with ASD. Children with ASD had higher measures of HR across baseline (M = 115.70), play-based (M= 117.40), and recovery (M= 111.54) conditions compared to the typically developing group across respective conditions (M=113.18, M= 114.16, and M =108.55). Autism symptom severity was negatively related to RSA in the baseline (r = -.561), play-based (r =-.227), and recovery (r =.608) conditions in the ASD group.

Conclusions: It is critical to identify potential subgroups in young children that may confer increased risk given specific biological and behavioral profiles. These preliminary findings suggest differences in patterns arousal across conditions with varying social demands in children with and without ASD. Results suggest that ASD symptom severity is related to parasympathetic influence and regulation. The detection of physiological processes that are associated with symptom presentation will allow for future studies to examine potential mechanistic factors that can be targeted for intervention.

46 **109.046** Examining Relations between Cardiac Autonomic Activity and Autism Traits in Adults

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Background: The autonomic nervous system (ANS) regulates basic bodily responses, and individuals with ASD show atypical cardiac ANS activity, including higher heart rate (HR) and lower variation in timing between heart beats during respiration, known as respiratory sinus arrhythmia (RSA; Bal et al., 2010). In neurotypical adults, cardiac ANS activity is related to emotion processing, with greater HR deceleration when viewing negative images as compared to positive and neutral (Bradley et al., 2008), and RSA positively correlating with emotion recognition (Quintina et al., 2012). Relatedly, RSA has been found to positively correlate with social functioning in ASD (Van Hecke et al., 2009). Recent work found that pupillary ANS activity was related to ASD traits in a broad population of children (DiCriscio & Troiani, 2017), but more work is needed to understand how variability in *cardiac* ANS responses might also relate to ASD traits.
Objectives: This study investigated cardiac ANS activity during emotional images and ASD traits in adults.

Methods: Participants included 42 college students who viewed 60 emotionally-valenced images for six seconds per image (20 neutral, 20 negative, and 20 positive, from the International Affective Picture System; Lang et al., 2005). HR was recorded using a Biopac MP150WSW system. Participants then completed the Social Responsiveness Scale, Second Edition (SRS-2; Constantino & Gruber, 2012), a measure that has been used to assess ASD traits in the broader population (e.g., DiCriscio & Troiani, 2017). Total SRS-2 scores ranged from 19 to 107 (M = 50.76, SD = 18.16). ΔHR was calculated as HR during the image minus HR during a 2-second pre-image baseline, and average ΔHR was computed for each valence. A negative bias score was calculated as ΔHR to negative images minus average ΔHR to neutral and positive. RSA was averaged across the first five 60-second segments of the valence task using a respiration frequency of 0.12-0.40 Hz.

Results: An ANOVA examined effects of valence on ΔHR and found a significant effect, $F(2,82) = 3.865$, $p = .025$ (see Figure 1), with greater HR deceleration to negative images as compared to positive and neutral ($ps < .05$). Associations between cardiac ANS activity (RSA, ΔHR to negative,

and HR negative bias) and SRS-2 Total score were examined, and no significant correlations were found (*p*s > .20). Results remained unchanged with and without the 12 participants with SRS-2 scores in a range typically associated with ASD (*T*-score > 59).

Conclusions: Consistent with prior work by Bradley et al. (2008), we found greatest HR deceleration to negative images. However, unlike work with individuals with ASD (e.g., Van Hecke et al., 2009), there were no correlations found between cardiac ANS activity and autism-related traits. This might suggest that differences in cardiac ANS vary with ASD characteristics only in individuals meeting clinical criteria for ASD, in contrast to pupillary ANS responses. More work is needed to understand why different aspects of ANS functioning might vary with ASD traits in individuals with ASD specifically, as opposed to varying with these traits in the broader population.

47 **109.047** Examining Underlying Mechanisms of Emotional Regulation in Toddlers with Fragile X Syndrome

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Background: Frustration, an emotional response to the interruption of a task or the blocking of a goal, begins to develop during infancy. An individual's ability to react to and recover from frustrating situations is mediated by behavioral and physiological responses to emotional arousal via the autonomic nervous system. An inability to effectively regulate responses to frustration during infancy has been associated with later behavioral problems, anxiety, and attentional difficulties. Children with fragile X syndrome (FXS), a neurodevelopmental disorder associated with autism, often exhibit atypical autonomic regulation as well as anxiety, ADHD, and challenging behaviors.
Objectives: This longitudinal study aimed to investigate frustration regulation in toddlers with FXS and typically-developing (TD) toddlers between the ages of 12 and 36 months. Furthermore, the study investigated the relationship between frustration regulation and autism symptom severity at 36 months.

Methods: Participants included 136 toddlers assessed at 12, 24, and 36 months (FXS: *n* = 84, *M*age = 27.81; TD: *n* = 52, *M*age = 24.95), for a total of 240 observations. Physiological responses to a frustration-inducing task were evaluated by measuring respiratory sinus arrhythmia (RSA) during the Arm Restraint or End of the Line paradigm of the Laboratory Temperament Assessment Battery. Both paradigms consisted of three conditions: baseline (toy play), frustration reactivity (toy retraction), and frustration recovery (toy return). Parent-reported frustration reactivity and frustration recovery were assessed using age-appropriate Rothbart temperament questionnaires. Furthermore, autism symptom severity was calculated using the Autism Diagnostic Observation Schedule – Second Edition calibrated severity score (ADOS-2 CSS).

Results: Linear mixed models employed to investigate how physiological regulation changes across age revealed a significant main effect of age, $F(2, 59) = 7.50$, $p = .001$, and a marginally significant effect of condition, $F(2, 129) = 2.53$, $p = .083$. The main effect of group and the interaction effects were non-significant, *F*s < 1.45, *p*s > .238. For parent-reported frustration reactivity, the main effect of age was significant, $F(1, 82) = 18.47$, $p < 0.001$. No main effect of group or group-by-age interaction was observed, *F*s(1, 82) < 2.83, *p*s > 0.10. For parent-reported frustration recovery, the main effect of group, $F(1, 125) = 14.33$, $p < .001$, and age, $F(1, 86) = 6.92$, $p = .010$, were significant, whereas the group-by-age interaction was marginally significant, $F(1, 86) = 3.48$, $p = .065$. Pearson correlations were conducted to assess the relation of reactivity and recovery to ADOS-2 CSS at 36 months. Parent-reported frustration recovery correlated with ADOS-2 CSS, $r = -0.61$, $p < 0.001$, and RSA suppression, $r = -0.58$, $p = 0.003$. No other significant correlations were found.

Conclusions: Findings indicate that toddlers with FXS and TD toddlers show similar changes in physiological regulation in response to frustration between 12 and 36 months. However, parents of toddlers with FXS reported poorer frustration recovery than parents of TD toddlers. Furthermore, at 36 months, poorer parent-reported frustration recovery was associated with higher autism symptom severity and attenuated physiological reactivity, suggesting a link between ASD features and difficulties with frustration regulation in FXS.

48 **109.048** Folic Acid Improves Abnormal Behavior Via Mitigation of Oxidative Stress, Inflammation, and Ferroptosis in the BTBR T+Tf/J Mouse Model of Autism

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Background: Autism spectrum disorder (ASD) is a group of pervasive heterogeneous neurodevelopmental disorders that is characterized by lasting impairments in restricted interests; stereotyped, repetitive behaviors; and social interaction and communication deficits. The etiology of this disorder is not well understood. Recent research has also reported that folic acid (FA) notably impacts cognitive function and autistic-like behaviors. However, the underlying mechanisms of FA are rarely studied, and the signal transduction pathways affected by FA remain elusive.
Objectives: The aim of his study were to examine the effects of FA on the autistic phenotypes in BTBR T+ Itpr3tf/J (BTBR) mice, and to investigate the possible underlying mechanisms.

Methods: Mice received 0.2 mg/kg FA orally daily from postnatal days 14 to 35. Mice were tested for stereotyped and repetitive behaviors, social interaction, and spatial learning and memory at the end of FA supplementation. Oxidative stress, neuroinflammatory responses, and ferroptosis-related proteins in the brain were evaluated.

Results: FA supplementation in BTBR mice (1) reduced repetitive and stereotyped behavior, improved social communication, and enhanced memory and spatial learning. (2) FA supplementation reduced neuronal loss in hippocampal CA1 regions of the brain, and (3) decreased the levels of the pro-inflammatory cytokines interleukin-1β (IL- 1β), Iba- 1, IL- 18, TNF- a, and IL- 6 and glial fibrillary acidic protein (GFAP) in the hippocampus. (4) FA supplementation changed the malondialdehyde (MDA) and glutathione (GSH) levels and superoxide dismutase (SOD) and glutathione peroxidase (GSH- Px) activities in the hippocampus. (6) FA supplementation inhibited the elevation of the SOD1 and TFR protein levels and enhanced the relative expression levels of GPx4 and Fpn1 in the hippocampus and (7) increased the relative levels of phospho-Ca^2+/calmodulin-dependent protein kinase II (p- CaMKII) and phospho- cAMP-response element binding protein (p- CREB) in the hippocampus.

Conclusions: FA oral supplementation to BTBR mice rescued stereotyped and repetitive behaviors, social deficit, and spatial learning and memory impairments, likely by improving the oxidative-stress and inflammatory responses and altering the ferroptosis signaling pathways.

49 **109.049** Stronger Pupil Light Response Is Associated with Fewer Autism Traits in College Students

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Background: The pupil light reflex (PLR) is a well-studied index of autonomic nervous system (ANS) functioning, and children with ASD show a slower and weaker PLR as compared to controls (e.g., Daluwatte et al., 2013; Fan et al., 2009). Recent work by DiCriscio and Troiani (2017) extended this to find that pupil adaptation responses to light were related to autism traits in a broad population of children.
Objectives: The present study examined associations between PLR measures and autism-related traits in adults.

Methods: Participants included 51 college students. An SMI RED 120Hz eye-tracker captured pupil data during a PLR paradigm adapted from Nyström et al. (2015). Participants saw nine PLR trials, each starting with a small animated shape in the center of a black screen appearing for 1.6 to 2.4 seconds, followed by a 120-ms white flash. Later in the session, participants completed the Social Responsiveness Scale, Second Edition (SRS-2, Constantino & Gruber, 2012), a measure that has been used to assess autism traits in the broader population (e.g., DiCriscio & Troiani, 2017). Custom Python scripts were used to process each trial's dilation time series to find latency to PLR onset (peak negative acceleration) and relative constriction. Pupil diameter was processed using a degree-2 Savitzky-Golay filter with a window of 11 samples to yield smoothed diameter and acceleration series, which were then further smoothed using a Gaussian convolution with a standard deviation of 5 samples. Relative pupil constriction was calculated from D_0 (baseline diameter) and D_m (minimum diameter) as $(D_0 - D_m)^2/D_0^2$. All participants had six or more usable trials (i.e., trials with clean data from both eyes), and analyses focused on the PLR variables used in Nyström et al. (2015): mean constriction and median latency.

Results: Correlations were run between PLR measures and SRS-2 Total score. A significant negative correlation was found between mean constriction and SRS-2 Total score, $r(49) = -.279$, $p = .048$, with stronger constriction associated with fewer autism traits. The SRS-2 Social Communication and Interaction (SCI) and Restricted Interests and Repetitive Behaviors (RRB) subscales were also examined alongside PLR measures, and results showed that RRB was negatively correlated with mean constriction ($r(49) = -.380$, $p = .006$, see Figure 1), and positively correlated with median latency ($r(49) = .322$, $p = .021$, see Figure 2), while SCI showed no relations with PLR ($ps > .1$). This suggests that a stronger and faster PLR is associated with fewer RRB traits.

Conclusions: Past work has found a less robust PLR in individuals with ASD, and Nyström et al. (2018) found that the PLR was highly predictive of later ASD in a group of high-risk infants. The current study is in line with work by DiCriscio and Troiani (2017) in finding that pupil light responses relate to ASD traits in a broad population of adults. The strongest associations in the current study were found with RRB, supporting previous studies that suggest that ANS difficulties could play an important role in RRB (e.g., Condy et al., 2017).

50 **109.050** High Resolution Mass Spectrometry for Biomarker and Risk Factor Discovery

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Background:
Hypothesis-based epidemiologic study of candidate prenatal risk factors for autism spectrum disorder (ASD) commonly utilize exposure or exposure-response biomarkers obtained from biospecimens collected in the pre- or peri-natal window. When these targeted analyses utilize liquid chromatography-high-resolution mass spectrometry (LC-HRMS) on modern instruments, the picture of the molecular contents of the sample can often be expanded by semi-quantitative description of the wider chemical space (metabolomics/exposomics), which may facilitate the development of hypothesis-agnostic, discovery type analyses. Correlation of this wider metabolome/exposome with neurodevelopmental outcomes may help understand the role of environment and gene/environment interactions in risk of ASD, especially across cohorts.

Objectives:

We previously conducted targeted analyses for four exposure or exposure-response biomarkers using LC-HRMS in two different cohorts across 4 sample types and with 5 classes of targeted analytes using hybrid targeted/untargeted metabolomics. Our objective here is to mine the semi-quantitative data from these experiments to determine if we characterized the prenatal metabolome/exposome with overlap between different methods, sample types, and cohorts. Such overlap would increase the power of single or limited risk factor studies, since each targeted study could then serve as a replication of other studies that quantified the same molecules.

Methods:

In the EARLI cohort, we quantified the sex steroid and phthalate metabolite content by two separate methods in meconium samples (n=193) as well as metabolites of prostaglandin E2 from maternal urine (n= 547 across multiple gestational visits). In addition, in maternal serum (n=1002 across multiple gestational visits) and newborn blood spots (n=400) we quantified polyunsaturated fatty acids (PUFAs) from a case-control study built from the state of California registry and biobank. All experiments were conducted on a Q Exactive Plus high resolution mass spectrometer coupled to an Ultimate 3000 HPLC in the same laboratory by blinded analysts. After targeted analysis was conducted, data was re-interrogated with untargeted metabolomics pipelines.

Results:

Targeted assays with known performance characteristics provided quantitative abundance on select analytes. Simultaneously, semi-quantitative relative abundance was collected on around 10,000-14,000 features per experiment, with number of features depending on the biosample and method of analysis. Putative identification was conducted by database searching. Confirmatory identification for select analytes was conducted by LC-MS/HRMS, and elution time matching with an authentic standard. Some targeted analytes, including PUFAs, we detected by other analytical methods in other sample types. Other molecules, including unconjugated testosterone, were only detected in targeted analysis. This allowed us to compare findings across some, but not all, studies.

Conclusions:

Mixed targeted/untargeted analytical methods can provide data for both hypothesis testing and hypothesis generating from limited biospecimens from epidemiological studies of risk factors for ASD. Untargeted data can potentially, but not necessarily, be compared across experiments.

51 **109.051** Lower Circulating Endocannabinoid Levels in Children with Autism Spectrum Disorder

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Background: The endocannabinoid system (ECS) is a major regulator of synaptic plasticity and neuromodulation. Alterations of the ECS have been demonstrated in several animal models of autism spectrum disorder (ASD). In some of these models, activating the ECS, rescued the social deficits. Evidence for dysregulations of the ECS in human ASD are emerging, but comprehensive assessments and correlations with disease characteristics have not been reported yet.
Objectives: To assess circulating levels of various endocannabinoids in children with ASD and delineate the correlations with disease characteristics.

Methods: Serum levels of the main endocannabinoids, *N*-arachidonoylethanolamine (AEA or anandamide) and 2-arachidonoylglycerol (2-AG), and their related endogenous compounds: arachidonic acid (AA), *N*-palmitoylethanolamine (PEA), and *N*-oleoylethanolamine (OEA), were analyzed by liquid chromatography/tandem mass spectrometry in 93 children with ASD (age = 13.1± 4.1, range 6-21; 79% boys) and 93 age- and gender-matched neurotypical children (age = 11.8± 4.3 , range 5.5-21; 79% boys). Results were associated with gender and use of medications, and were correlated with age, BMI and adaptive functioning of ASD participants as reflected by scores of: Autism Diagnostic Observation Schedule (ADOS-2), Vineland Adaptive Behavior Scale-II (VABS-II) and Social Responsiveness Scale -II (SRS-2).

Results: Children with ASD had lower levels (pmol/mL, mean±SEM) of AEA (0.722 ± 0.045 vs. 1.252 ± 0.072, *P* <0.0001), OEA (17.3 ± 0.80 vs. 27.8 ± 1.44, *P* <0.0001) and PEA (4.93 ± 0.32 vs. 7.15 ± 0.37, *P* <0.0001), but not AA and 2-AG. Serum levels of AEA were correlated with BMI and age in children with ASD, but not in the control group. There were no other correlations or associations of AEA, OEA and PEA with age, gender, BMI, medications and adaptive functioning of ASD participants.

Conclusions: In concordance with previous findings in animal models, we found a lower endocannabinoid 'tone' in human ASD. Serum levels of AEA, PEA and OEA are promising novel biomarkers for ASD. These biomarkers can be longitudinally measured, in the exact same way, in human participants and animals, and hence can support the development of novel treatments. Our results also suggest a role for the ECS in ASD pathophysiology, and further support the need for clinical trials to assess the efficacy and safety of phytocannabinoids in ASD.

52 **109.052** Serum Serotonin Levels As a Biomarker of Autism Severity

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Background: Despite remarkable inter-individual differences at the clinical level, individuals with autism spectrum disorders (ASD) essentially share two major clinical characteristics: 1) deficits in social interaction and communication and; 2) behavioral abnormalities, such as stereotypic behaviors, insistence on sameness and/or restricted interests. This clinical heterogeneity and its molecular complexities have driven increasing interest into biomarkers. Biological markers can be defined as a biological variable associated with the disease of interest and is measured directly in a patient´s biomaterial using sensitive and reliable quantitative procedures. Those measurable parameters could facilitate earlier and more reliable diagnosis, as well as the identification of subgroups of patients sharing common pathophysiological aspects.
Objectives: This study aimed to evaluate the serum serotonin level and its relationship with the severity of the symptoms in the child with autism.

Methods: A comparative cross-sectional study was performed with 140 children diagnosed with ASD (70 classified into mild/moderate and 70 classified into severe autism), and 65 healthy controls. Their ages ranged from 2 to 11 years old. The diagnosis of ASD was confirmed by the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-V) and the severity was assessed by the Childhood Autism Rating Scale (CARS). Serum serotonin levels were determined through high performance liquid chromatography (HPLC).

Results: Serum serotonin levels were significantly increased in autistic children when compared to gender matched controls. Serotonin levels were in 170,62+/-67,17 ng/dL in mild/moderate and 304,98+/-90,05 ng/dL in severe autistic patients. While serotonin levels were 136,25+/-46,30 ng/dL in controls. Applying univariate regression analysis, serum serotonin levels above 200 ng/dL represented a 13 fold increased risk of revealing a case of severe autism.

Conclusions: Previous studies have hypothesized that a disruption in the synaptogenesis plays an important role in the pathophysiology of autism. In this regard, many evidences suggest that the different systems of neurotransmission may be involved in autism. Serotonin (5-hidroxytryptamine; 5-HT) is a neurotransmitter which is involved in modulating cortical plasticity with a significant role in early cortex development as a regulator of neuronal proliferation, migration and differentiation. Association studies, aiming to demonstrate that serum serotonin levels may represent a good biomarker of the susceptibility of autism, however, had controversial results. The results of this study were in accordance with previously obtained data that demonstrates a significant elevation in the levels of serum serotonin in autistic children when compared to healthy control subjects. An even more interesting result, was a significant positive correlation between elevated serum serotonin levels and autism severity.

Poster Session
110 - Cognitive Neuroscience
11:30 AM - 1:30 PM - Room: 710

53 **110.053** Cognitive Profiles of Adolescents with Parent-Reported Extraordinary Skills and Relative Strengths

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Background: Parent-report studies suggest 26-63% of individuals with ASD have "savant" skills - extraordinary skills (ES) that stand out relative to the general population (e.g., Meilleur et al., 2015; Howlin et al., 2009). Studies suggest that only a small subset of individuals with a parent-

reported ES also show evidence of an exceptional cognitive skill on an IQ test (Howlin et al., 2009; Bolte & Poustka, 2004); however, research in this area is limited. Moreover, few studies have explored relative strengths (RS; i.e., strengths exceeding the individual's own general ability level, but not general population norms). Understanding the correspondence between parent-reported and directly assessed skills is important to inform future studies of strengths in ASD.

Objectives: To investigate whether autistic adolescents with and without parent-reported ES or RS show differences in cognitive profiles. We expect that adolescents with ES will exhibit significantly higher scores on the cognitive domain most relevant to that skill (see Table 2) than peers without ES. In addition, we expect that adolescents with RS, will not differ from adolescents without parent-reported strengths, but will show within-subject strengths in the most relevant cognitive domain).

Methods: Participants were 322 adolescents (ages 13-17; 84% male) from the Simons Simplex Collection who completed the Differential Ability Scale-II, School Age form and the Autism Diagnostic Interview-Revised (ADI-R). ADI-R items 88-93 were used to group adolescents: 0=no strength (NS), 1=RS, 2=ES in six areas: visuospatial, memory, drawing, musical, reading, and computational ability. Analyses were conducted separately for adolescents with NVIQ above and below 70 (>70=77%). ANOVA compared the three groups for each area on Verbal, Nonverbal, and Spatial Domain standard scores. Paired-sample t-tests made within-subject score comparisons in adolescents with RS.

Results: Forty-seven percent of adolescents had at least one ES and 22% a RS; proportions varied by specific skill/strength across NVIQ groups (Table 1). Within NVIQ<70, neither the ES or RS groups showed the expected group differences or within-subject strengths. The following results focus on NVIQ>70. Adolescents with visuospatial or drawing ES had significantly higher Spatial scores than adolescents without strengths in these areas, but did not differ on other domains (Table 2). Adolescents with reading ES had higher Verbal and Nonverbal scores and those with computation ES had higher Nonverbal and Spatial scores, relative to the NS group for those areas. Memory and musical ES groups did not differ from NS groups. The drawing RS group had lower Nonverbal scores and the computational RS had higher Nonverbal scores, relative to the NS group in each area; other RS groups did not differ on any cognitive domain (Table 2). There was some evidence for expected within-subject domain differences: visuospatial RS=Spatial>Verbal ($t(21)=-4.00$, $p=.001$), drawing RS=Spatial>Nonverbal ($t(10)=-2.33$, $p<.042$), computational RS=Nonverbal>Spatial ($t(20)=.44$, $p<.662$).

Conclusions: Findings lend support for the validity of parent-reported ES. Nearly one-quarter of adolescents exhibited RS, suggesting a need for additional research to understand strengths at all levels, not just the extraordinary. Understanding the neural basis of these strengths may advance understanding of cognitive processing in individuals with ASD.

54 **110.054** Hyperactivation of the Posterior Medial Network Supports Preserved Episodic Memory in Adolescents with Autism Spectrum Disorder

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Background:

There is ongoing debate about whether memory is spared or impaired in autism spectrum disorder (ASD). Most research suggest that the deficits found in ASD are primarily related to episodic memory, and include impairments in relational encoding and recollection. Previously, our group published a behavioral study using the well-validated Relational and Item-Specific Encoding (RiSE) paradigm (Solomon, McCauley, Iosif, Carter, & Ragland, 2016). See Figure 1 (A). This task is premised on the notion that item-specific encoding and familiarity are sub-served by an anterior-temporal (AT) network anchored in the perirhinal cortex of the medial temporal lobe (MTL), whereas relational encoding and the process of recollection rely on a posterior-medial (PM) network anchored by the hippocampus and parahippocampal cortex. Contrary to our predictions, during a recollection test, ASD versus TYP showed lower discriminability for items encoded in the item-specific versus the relational condition; used familiarity less than recollection for items encoded relationally; and showed greater improvements in performance with age. To develop a mechanistic explanation for these findings, we conducted a well-powered functional magnetic resonance imaging (fMRI) study of the RiSE task in adolescents and young adults with ASD.

Objectives:

Study goals were to investigate whether: 1) relational encoding is impaired in ASD, 2) whether impairment is associated with aberrant recruitment of the PM versus the AT network, and whether 3) patterns of neural recruitment change from adolescence to young adulthood.

Methods:

One-hundred and seven individuals with ASD (*N*=47) or typical development (TYP, *N*=60) from the completed first wave of an NIMH-funded 5 year cohort-sequential study on development of cognitive control in adolescents and young adults ages 12-22 years performed the RiSE task while undergoing fMRI. Accuracy (*d'*) during item recognition (IR-*d'*) and associative recognition (AR-*d'*) indexed performance, and robust inferential analyses were deployed. Threshold-free cluster enhancement (TFCE) was used to isolate brain activation within the PM and AT networks, and functional connectivity with false-discovery rate (FDR) correction was used to elucidate interactions between regions.

Results:

IR-*d'* and AR-*d'* did not differ between ASD and TYP ($p\geq0.607$; $BF_{01}\geq3.80$). See Figure 1 (B, C). Despite similar performance, the ASD group demonstrated PM hyperactivation compared to TYP ($p_{TFCE}<0.025$), which was associated with IR-*d'* in ASD (*rho*=0.36, *p*=0.006). In contrast, PM activity during relational encoding was associated with AR-*d'* in TYP (*rho*=0.64, *p*<0.001). Lastly, PM network connectivity was greater in TYP relative to ASD ($p_{FDR}<0.05$), and increased regional activation of PM clusters was *negatively* associated with PM network connectivity in ASD (*rho*=-0.33, *p*=0.014). See Figure 2. The aforementioned findings were not associated with age in either group.

Conclusions:

The present results suggest that, through adolescence and early adulthood, increased local activation within PM regions may be a compensatory mechanism for decreased PM network connectivity during relational encoding in ASD, ultimately supporting broadly similar episodic memory performance in both groups. Accordingly, interventions designed to facilitate PM network connectivity may represent a viable personalized medicine approach for cognitive treatment in adolescents and young adults with ASD who exhibit relational encoding impairments.

55 **110.055** Absence of Adolescent-Specific Sensitivity to Motivating Cues in Autism

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Background: Extensive research has shown that typically developing adolescents show increased attention towards motivating cues relative to children and adults, that is accompanied by adolescent-specific changes in reward sensitive frontostriatal circuitry. However, it is unknown whether motivating cues elicit a similar bias during adolescence in autism.

Objectives: The aim of this study was to investigate adolescent-specific changes in sensitivity to motivating cues (social and non-social stimuli) in individuals with and without autism. We expected typically developing participants would show a bias towards positive social cues during adolescence and that individuals with autism would not show such sensitivity.

Methods: 105 typically developing participants and 71 participants with autism, aged 10-30 years, performed a novel go-nogo task on an iPad. For the social conditions, participants were presented with happy and calm faces. For the interest conditions, participants chose their favorite (interest) and least favorite hobby/activity (non-interest) from 23 options. There were 4 different runs of go-nogo pairs (happy vs. calm, calm vs. happy, interests vs. non-interests, non-interests vs. interests). Participants were instructed to press to the target cue (go) when it appeared on screen and not press to the distractor cue (nogo). False alarms for happy minus calm faces and interests minus non-interests were calculated for each participant. Linear and quadratic age models were fitted to test for developmental differences in the difference scores between diagnostic groups across age.

Results: We compared false alarms for happy faces minus calm faces and, as shown in Figure 1, there were no adolescent-specific changes in autism (linear & quadratic models not significant). In contrast, typically developing teens and young adults had greater false alarms for happy minus calm faces with an interaction between quadratic age and diagnostic group ($p = 0.02$). We found no differences across age in autism or typically developing individuals for false alarms to interests minus non-interests.

Conclusions: The findings suggest that adolescents with autism did not show increased sensitivity to either social or non-social cues, compared to typically developing teens who demonstrated increased sensitivity to positive social cues, in line with previous work. Greater sensitivity towards motivating cues in typical development is thought to underlie the observed increases in risk taking behavior and growth of independence skills associated with adolescence and young adulthood. Therefore, the absence of increased motivation during adolescence in autism may explain some of the challenges with independent living skills associated with early adulthood. Future work will explore the neural mechanisms towards motivating cues to better understand adolescent-specific difficulties in autism.

56 **110.056** Brain Network Involved in Response Inhibition Shows Delayed Recruitment in Adults with ASD

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Background: There are varying reports of inhibitory control skills in adults with autism spectrum disorder (ASD), with some showing that their ability to exercise inhibition is on par with controls, while others find a significant deficit. Neuroimaging studies have demonstrated that despite performing similarly to controls, adults with ASD have atypical activation of and connectivity between brain regions subserving inhibition, such as the bilateral inferior frontal gyri (IFG) and anterior cingulate cortex (ACC). A thorough characterization of these brain differences is still lacking, however, as little is known regarding the timing of recruitment of these brain areas and networks and in which frequency bands of neuronal firing they occur in ASD.

Objectives: We determined the temporal, spatial, and frequency-specific dynamics of brain connectivity in adults with and without ASD during an inhibitory control task using magnetoencephalography (MEG).

Methods: We recruited 47 adults with ASD (32 M; 27.0±5.9 years old) and 43 age- and sex-matched control adults (30 M; 27.3±5.7 years old). In the MEG scanner, participants performed a go/no-go task comprising two blocks of differing proportions of 'no-go' trials, inhibition (25%) and vigilance (75%), allowing us to compare 'no-go' trials with high vs. low inhibition demands, rather than compare 'no-go' to 'go' trials, the latter being contaminated by motor responses. For the MEG analyses, we estimated time series of activity across the brain using a beamformer. We calculated connectivity between regions within each canonical frequency band using the weighted phase lag index. We compared connectivity values in the 'no-go' trials of the inhibition vs. vigilance blocks between 100-500ms, post-stimulus onset. Significant results are reported at a FWE-corrected $p < 0.05$. Participants also completed the self-report version of the Behavior Rating Inventory of Executive Function, Adult Version (BRIEF-A). Inhibition subscale scores were compared between groups and correlated with brain connectivity values.

Results: Results indicate that adults with ASD reported more difficulties with inhibition on the BRIEF-A, but this difference was only a trend ($t(46)=1.93$, $p=0.06$). Despite equivalent performance on the go/no-go task ($F(1,83)=0.10$, $p=0.76$), adults with ASD showed decreased connectivity ($p=0.047$) in a network containing the right IFG and right insula between 200-300 ms in the high gamma frequency band. Subsequently, between 300-400 ms in the same frequency band, adults with ASD exhibited increased connectivity ($p=0.042$) in a similar network, which included the right IFG, right insula, ACC, and left supplementary motor area (SMA). Connectivity between the right IFG and the bilateral SMA was negatively correlated with Inhibition scores on the BRIEF-A in controls ($\beta=-9.80$, $p=0.02$), but not in adults with ASD ($\beta=4.10$, $p = 0.21$).

Conclusions: Adults with ASD appear to show delayed recruitment of an inhibitory control brain network compared to controls, as well as atypical connectivity between inhibitory and motor areas, both of which may contribute to the inhibition difficulties reported in their everyday life, but less apparent in laboratory tasks.

57 **110.057** Clinical Correlates of Corollary Discharge Signaling in Children with Autism Spectrum Disorder

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Background: Sensory and motor impairments are key features of autism spectrum disorder (ASD). An abnormality in the link between action and sensation may underpin these symptoms. Corollary discharge (CD) signals enable such a link between sensory and motor systems. CD signals are

"copies" of motor signals sent to sensory brain regions at the same time the corresponding motor commands are sent to motor regions. They allow organisms to suppress sensory consequences of self-generated actions in order to enhance attention to and processing of external sensory input. We hypothesized that altered CD signaling in ASD contributes to heightened bodily awareness and hypo-responsiveness to external sensory input, resulting in sensory-seeking behaviors such as repetitive motor mannerisms.
Objectives: To test (1) whether CD signaling is disturbed in children with ASD, compared to typically developing (TD) children; and (2) whether CD signaling is related to sensory and motor symptoms in children with ASD.

Methods: Eighteen children with ASD and 15 TD children (matched on age, sex, and IQ) performed a task that measures the influence of CD on visual perception following a saccadic eye movement. Subjects are instructed to look first at a visual target. Upon saccade initiation, the target disappears and reappears at a horizontally displaced position. Subjects then indicate the direction of displacement. If CD is intact, subjects are able to make accurate perceptual judgements, despite variability in saccade landing site. If CD is disrupted, subjects instead use saccade landing site to inform perceptual judgements. Two measures of CD integrity are derived: (1) the slope, which measures individuals' reliance on saccade landing sites when making perceptual judgments and (2) just noticeable difference (JND), which indicates individuals' sensitivity to target displacement. Larger JND and smaller slope indicate reduced influence of CD. Sensory and motor symptoms were measured by the Restricted and Repetitive Behaviors subscale of the Autism Diagnostic Observation Schedule (ADOS-2), the Body Perception Questionnaire (BPQ), and the Beery VMI Developmental Test of Visual-Motor Integration.

Results: There were no significant group differences between ASD and TD children on either JND ($t(31) = -.01$, $p = .99$) or the slope ($t(31) = -.06$, $p = .96$). However, in the ASD group, smaller slope (i.e., reduced CD signaling) was correlated with more severe restricted and repetitive behaviors on the ADOS-2 ($r_{Spearman} = -.73$, $p = .002$). Moreover, smaller slope also was correlated with heightened interoceptive awareness on the BPQ ($r_{Spearman} = -.52$, $p = .03$). Larger JND (i.e., reduced CD signaling) and smaller slope were both correlated with poorer performance on the Beery Motor Coordination subtest ($r_{Spearman} = -.56$, $p = .02$; $r_{Spearman} = .70$, $p = .001$).

Conclusions: These results suggest that CD signaling may be underlying some of the core motor functioning and sensory processing symptoms in ASD, indicating a shared mechanism for internal preoccupation and repetitive motor symptoms. If such preliminary findings are replicated in a larger sample, this study could provide novel insight into underlying mechanisms of ASD and point toward potential intervention targets.

58 **110.058** Comparing Inhibitory Profiles of Children with ASD, ASD and Inattention Symptoms, and ASD and ADHD Symptoms

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Background: Children with autism spectrum disorders (ASD) often have comorbid attention-deficit/hyperactivity disorder (ADHD) symptoms (Rommelse et al., 2010). Additionally, children with comorbid ASD and ADHD also have deficits in inhibition (Sinzig et al., 2007). Whether profiles of children with ASD and symptoms of inattention (ASD+inattention) differ from those of children with ASD+ADHD (symptoms of hyperactivity/as well as symptoms of inattention) is unknown. Understanding differences in ADHD symptom presentation in children with ASD may improve interventions and clinical outcomes in these stratified populations.
Objectives: To investigate the presentation of inhibition deficits in children with ASD, ASD+inattention, and ASD+ADHD.

Methods: Caregivers of 75 children with ASD (10 females; *M*=9.07±1.37 years) completed the CBCL, which was used to create three subgroups: ASD (*n*=31), ASD+ADHD (*n*=26), and ASD+inattention (*n*=18). T-scores on the BRIEF Inhibition subscale were a subjective, parent-report measure of inhibition. Higher scores on these measures reflect greater impairment in functioning. Children also completed objective measures of inhibition. From the Stroop Task, correct reaction time (cRT) on incongruent-congruent trials indexed interference suppression (i.e., bigger differences reflect worse inhibition). From the Change Task, proactive slowing on the dominant task (i.e., how much children are able to slow themselves down during the dominant task compared to their speed during practice trials) indexed better inhibition (working more slowly and carefully on the dominant task compared to baseline speed). Accuracy on change trials indexed the ability to suppress the dominant response to make the non-dominant response.

Results: Separate univariate ANOVAs compared measures of inhibition between children with ASD, ASD+inattention, and ASD+ADHD. Group was entered as a between-subjects factor and post-hoc comparisons were Bonferroni corrected.

In the model comparing BRIEF Inhibition T-Scores, there was a significant main effect of group, $F(2,72)=9.82$, $p<.05$. Post-hoc tests showed that T-Scores of children with ASD+ADHD were significantly higher than children with ASD+inattention, $p=.027$, and children with ASD, $p=.001$. However, T-scores did not differ between children with ASD and ASD+inattention, $p=.765$.

On the Stroop Task: the main effect of group was also significant, $F(2,66) =4.80$, $p<.05$, with the same pattern by group: children with ASD+ADHD differed from those with ASD+inattention, $p= .037$, and ASD, $p=.024$. The ASD and ASD+inattention groups did not differ, $p=1.0$.

In the model comparing proactive slowing during the Change Task, the main effect of group was significant, $F(2,66)=2.949$, $p<.05$. Children with ASD+ADHD marginally worse than those with ASD, $p=.055$, but not ASD+inattention, $p= .484$. Proactive slowing did not differ between ASD and ASD+Inattention, $p=1.00$.

Groups did not differ on accuracy during change trials, $F(2,66)=.435$, $p<.05$.

Conclusions: Collectively, these analyses suggest that in the domain of inhibition, children with ASD and inattention are more similar to children who have ASD than children who have comorbid ASD and ADHD. A better understanding of these differences may further inform effective interventions and improve clinical outcomes. Future analyses will compare these subgroups on additional measures of executive functioning as well as measures of social functioning given that social problems are more strongly correlated with inattention than hyperactivity (Maton et al., 2010).

59 **110.059** Cortical Processing of Audiovisual Speech Integration in Children with Autism

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Background: The ability to detect auditory-visual correspondence in speech is an early hallmark of typical language development. Infants are able to detect audio and visual mismatches for spoken vowels such as /a/ and /i/ as early as 4 months of age. Event-related potential (ERP) work in our lab on typically developing infants showed a clear N400 response in the centro-frontal electrodes in response to incongruent pairing of audiovisual vowel stimuli. In previous autism research, a deficit in audiovisual speech integration has been reported with the well-known McGurck Effect, which produces illusionary perception such as a fused /da/ percept from combining the auditory /ba/ sound with visual /ga/ articulation. But it remains unclear whether children with autism would demonstrate a similar deficit in audiovisual integration with a much simpler protocol of audiovisual congruency detection that uses vowel stimuli without involving the McGurck-type of fusion.
Objectives: The purpose of the present ERP study was to examine cortical processing of audiovisual speech integration in children with autism. We were particularly interested in identifying the potential neural markers of audiovisual integration deficit with a simpler congruency detection protocol.

Methods: Video clips of two naturally spoken vowels, /a/ and /i/, were digitally edited to create congruent and incongruent pairing conditions for the auditory and visual information. The EEG data were recorded from twelve children diagnosed with autism (5~8 years old) as well as age-matched controls. Randomized blocks of congruent and incongruent trials were presented at approximately 70 dB SPL. The EEG data were collected with a 64-channel ANT (Advanced Neuro Technology, the Netherlands) amplifier and shielded WAVEGUARD EEG cap. Offline EEG data were bandpass filtered (0.5~40 Hz), and further processed with independent component analysis for artifact attenuation. Trials beyond the ± 50 μV range were then rejected.The accepted trials were averaged for ERP waveform analysis. Minimum norm estimation was further conducted for source localization.

Results: Unlike the control group who showed a clear congruency effect in the ERP data, a subgroup of four children with autism did not appear to show this effect. The peak latency of the ERP responses for incongruency detection in the 5~8-year-old children were more adult-like whereas the polarity and scalp distribution was more infant-like. Minimum norm estimation results showed significant activities in the right superior temporal, right inferior frontal, and parietal regions for incongruency detection, which varied as a function of time window.

Conclusions: The ERP data indicate the existence of a continuum of ability to integrate audiovisual speech information at the cortical level among individuals with autism spectrum disorders. Further work with a larger sample size is needed for a better understanding of the individual differences in processing audiovisual speech in relation to language development.

60 **110.060** EEG and Pupillary Response in Children with Autism: Results from the ABC-CT Interim Analysis

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Background: Dysregulated attention and arousal are comorbid features of ASD. These symptoms are associated with differences in noradrenergic activity. Prior work has established that individuals with ASD exhibit attenuated pupil response to light. Despite the broad noradrenergic efferents from the LC to cortex, there have been no studies in humans linking the dynamics of the pupillary light reflex (PLR) to electroencephalography (EEG) features; this relationship may help to parse heterogeneity among individuals with ASD and differentiate brain activity between ASD and controls.

Objectives: We examine: (1) the relationship of the PLR and EEG; (2) the relationship of the PLR and EEG to clinical characteristics; and (3) the relationship of the EEG slope, an index of excitatory versus inhibitory activity in the cortex, to the PLR.

Methods: Data were collected from 225 participants between the ages of 6 and 11 (ASD: N = 161, 131 male; TD: N = 64, 42 male) across five sites. EEG data were recorded at 1000hz, and spectral power was calculated from one second epochs. EEG slope was calculated in the range from 2-50hz. The PLR was calculated in response to a 133ms white flash followed by a black screen. PLR dynamics included relative constriction, latency of constriction, and re-dilation and constriction velocities.

Results: Across all participants and sites, absolute EEG power in all frequency bands decreased with increasing age; thus, age was included as a covariate in all regression analyses. Overall, there was no relationship between the relative constriction amplitude of the PLR and EEG characteristics. However, the latency of the PLR was negatively associated with low (8-10hz; p=.026) and high (10-12hz; p = .042) alpha power and the slope of the EEG power spectrum (p=.01), such that longer latency PLR was associated with decreased alpha power and a more positive slope indicating greater high frequency activity associated with increased cortical excitation. With regard to clinical characteristics, ADOS calibrated severity score was associated with increased power across the delta, theta, beta, and gamma frequency bands (rs = .16, .15, .15, .21; ps =.015, .024, .042, .002, respectively).

Conclusions:

These data provide support for moderate but significant relationships between the dynamics of PLR constriction and cortical activity in ASD. Because these effects are detectable across separate recording sessions on different days, it is unlikely that they are driven by common stimulus effects, e.g., phasic arousal or ambient light. Instead, they likely reflect relatively stable, trait-like relationships among neuromodulatory systems and cortical brain activity. The relationship with PLR and the slope of the power spectrum suggests that these relationships impact the overall shape of the EEG power spectrum and that effects go beyond simple modulation of amplitude of oscillatory activity. Given that cholinergic and noradrenergic systems are the targets of multiple medications, these findings have the potential to inform novel mechanisms of assessing therapeutic effects. Ongoing analyses measure the strength of the association within individuals and its relationship with clinical characteristics.

61 **110.061** Error Monitoring Predicts Executive and Social Functioning in Autism Spectrum Disorder (ASD)

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Background: The error-related negativity (ERN) is an event-related potential component (ERP) indexed by a negative deflection occurring 0 to 100 ms following an erroneous response. The ability to monitor and respond to errors in childhood is important for the development of regulated executive functioning skills (Weinberg et al. 2015). Literature investigating ERN in ASD report smaller amplitudes, indicating reduced sensitivity to errors (South et al. 2010). However, more brain-behavior evidence is needed to fully understand the role of error monitoring in specific domains in and outside of executive functioning in children with ASD.
Objectives: The goals of the following analyses were to: (1) examine the relation between ERN and performance on a behavioral battery of executive function measures, and (2) examine how ERN relates to social functioning in school-aged children with ASD.

Methods: 40 (4 female) children with ASD between the ages of 7-11 years provided ERN data during a Go/No-go task. All children had cognitive ability in the average range with the Full Scale Intelligence Quotient (FSIQ) ranging from 80-135, *M*= 107.8 (*SD*= 12.8). Dependent variables included ERN latency and mean amplitude at Fz. Response-locked epochs were 100 ms long and baseline corrected 150 to 50 ms prior to response on incorrect trials for participants with a minimum of 10 errors (Olvet and Hajcak 2009). The behavioral battery included measures of interference suppression (i.e., Stroop task), behavioral inhibition and cognitive flexibility (i.e., Change Task), and working memory (i.e., Digit Span task). Social functioning was quantified using scores on the Autism Diagnostic Observation Schedule (ADOS-2) Social Affect domain.

Results: For the Stroop, children who had less negative ERNs (i.e., they exhibited dampened neural responses to their own errors) were more disrupted by the incongruent condition (i.e., less able to respond efficiently in the face of interfering information), $r(39)=0.431$, $p=.006$. This relation persisted when age was controlled, $r(36)=0.425$, $p=.008$. No relations were detected between ERN and the ability to inhibit dominant responses or shift between response types on the Change Task. With respect to working memory, children who had longer ERN latencies (i.e., slower to detect their own errors) had larger discrepancies between their forward (i.e., short term) and backward (i.e., working) digit span scores, $r(39)=0.368$, $p=.021$, and this effect persisted when age was controlled, $r(36)=0.403$, $p=.012$. In relation to social functioning, smaller ERN amplitude related to higher social symptoms on the ADOS-2 Social Affect domain, $r(37)=0.322.p=.043$, and remained when corrected for age, $r(37)=0.325$, $p=.043$.

Conclusions: The above findings imply that the regulated ability to monitor errors predicts performance in domains of executive function and social behavior. Executive and social functioning challenges in children diagnosed with ASD may in part arise from atypical neural responses to self-monitoring. Future analyses will include: (1) data from correct-response negativity (CRN) to examine conflict detection on correct trials and (2) additional executive and social measures to capture abilities across multiple contexts.

62 **110.062** Language Experience and the Arcuate Fasciculus in Autism

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Background: Delayed echolalia, altered prosody and speech onset delay are among the main language characteristics of autism spectrum disorders (ASD). At the cerebral level, a very common observation in autism is an atypical frontotemporal functional connectivity. The arcuate fasciculus (AF), is the main white matter tract that connects the posterior temporal region of the brain involved in the comprehension of language (Wernicke's area) with the inferior frontal gyrus (Broca's region), which is involved in language production. The structural properties of the AF have been linked with word acquisition, vocabulary growth (Su et al. 2018) and other linguistic abilities (Salvan et al. 2017). Moreover, lesions damaging the fibers of the AF disconnecting the temporal region from the inferior frontal region result in conduction aphasia, an impairment in the repetition of speech, phonological paraphasias, and impaired speech monitoring and learning.
Objectives: Considering that ASD individuals with speech onset delays (SOD) contrast with those without speech onset delays (No-SOD) in terms of brain activation during speech-like processing (Samson et al, 2015), the aim of this study was to use diffusion imaging tractography protocols to reconstruct the AF and investigate its properties in high-functioning autistic individuals who ranged in age of onset of first words and in language ability.

Methods: Thirty-eight autistic and 28 typically developing individuals, all right-handed and matched for age (14-35 years) and intellectual functioning were scanned using a T1 structural and a diffusion-weighted sequence. Reconstruction of the AF was achieved using a novel deterministic ROI-based approach with FSL, Diffusion toolkit and Trackvis software.

Results: Overall, the autistic group had a significantly smaller left AF volume than the non-autistic group. Within the autistic group, there was a significant correlation between the age of acquisition of speech and the volume of the left AF. Stratifying the autistic group into those with SOD (n=15) or No-SOD (n=23) individuals revealed that the smaller AF volume result was driven by the No-SOD group. Within the SOD group only, greater Fractional Anisotropy (FA) in the AF was also correlated to higher ADOS and ADI Communication scores.

Conclusions: The structural properties of the AF in autism may be associated with communication symptom severity and speech acquisition experience, even in adulthood. Our results are consistent with Moseley et al. (2016), who also found AF reductions in a group of Asperger individuals without SOD compared to typicals. No-SOD autistic individuals, despite a typical age of speech onset, present as adults a less developed AF relative to matched controls. By contrast, in autistics individuals with SOD, their delayed speech is associated with a more developed left AF, that does not differ from the one of typical individuals. Since all the autistic participants under study ended up developing proficient speech as adults, at time of testing, this suggests that SOD and No-SOD autistic people use different neuronal mechanisms for developing speech.

63 **110.063** Neural Bases of Prosodic Processing Differences in ASD: Resting State Functional Connectivity of Right Planum Temporale

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Background: Differences in speech prosody have long been identified as characteristic of autism spectrum disorder (ASD). Transcription-based and acoustic studies of intonation in ASD reveal differences in resonance quality and misplaced utterance stress, as well as elevated pitch, increased pitch range, and pitch excursions. Also reported are deficits in comprehension of affective prosody and discrimination of prosodic tunes. These prosodic differences are observed in individuals who display otherwise normal language development and functioning.
Objectives: In typically-developing (TD) individuals, prosody is right-lateralized, involving particularly the right planum temporale (PT). The neural bases of prosodic processing differences in ASD are poorly understood. To clarify these mechanisms, we use resting-state functional magnetic resonance imaging (rsfMRI) data collected from ASD and TD youth to test the hypothesis that these groups differ in functional connectivity (FC) between right PT and other brain regions.

Methods: Resting-state data for ASD and TD boys aged 7-15 years (y) from the Autism Brain Imaging Data Exchange were analyzed. Inclusion criteria were right-handedness and FSIQ ≥ 80; the ASD group was comprised of participants diagnosed with ASD or Asperger's. Youth were binned into age groups: 7-11y (ASD n = 48, TD n = 55); and 12-15y (ASD n = 69, TD n = 75). FC analysis used the CONN toolbox (v17e) in SPM 12. The default MNI-space preprocessing pipeline was used, with two modifications: removal of initial 4 volumes; smoothing kernel of 6mm^3.Participants for whom >20% of volumes were flagged as having excessive motion (defined as ≥ 0.9mm motion, measured by framewise displacement) were excluded from analyses. Study site, eye status (eyes open vs. closed), and full-scale IQ were covariates of no interest. Seed-to-voxel analyses, correlating activity in right PT (10mm^3 sphere centered at MNI coordinates [52 -31 15]) with activity in the remainder of the brain, were conducted. Multiple comparison correction used an initial cluster defining threshold of p < 0.001, k = 10, and false discovery rate p < 0.05.

Results: 7-11y: ASD > TD: ASD versus TD youth showed greater FC with clusters in left precentral (PrG) and middle frontal gyri (MFG), and right cerebellar posterior lobe (Crus I, VII). **12:15y: TD > ASD**: TD versus ASD youth exhibited increased FC with left parahippocampal gyrus (PHg).

Conclusions: ASD and TD youth differed for FC with the right PT, a key brain region in processing the relatively slow fundamental frequency movements characteristic of intonation. Groups differed in PT connectivity with other brain regions involved in speech production (PrG) or perception (MFG, Crus I), including pitch modulation(PrG) and pitch memory (PHg). These FC differences at rest may plausibly relate to differences seen during prosody processing, given that brain networks identified during rsfMRI are predictive of neural activity during tasks. Future work should directly probe the relationship between PT activation and activity in brain regions reported here during prosody-related task-based fMRI. Additionally, it remains to be determined whether the FC differences shown are attested in ASD girls; ideally, sex-balanced cohorts could be investigated to test for diagnosis- vs. sex-specific differences.

64 **110.064** Neural Mechanisms Underlying Visuospatial Functioning in Different Cognitive Subgroups in Autism Spectrum Disorder

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Background: Strengths in visuospatial functioning have been found in a large proportion of individuals with an autism spectrum disorder diagnosis. Neuroimaging studies have revealed higher activation in occipito-parietal regions and diminished activation in some frontal regions in autism (Kana et al., 2013; McGrath et al., 2012; Silk et al., 2006). However, no such studies have investigated the neural mechanisms underlying visuospatial functioning in distinct subgrouping of autistic individuals based on their visuospatial abilities.
Objectives: The principal goal of this study was to identify the neural network involved in visuospatial abilities and expertise in autism in different subgroupings based on their Wechsler Block Design subtest's performance using functional magnetic resonance imaging (fMRI) technique while performing two visuospatial tasks.

Methods: 28 male autistic participants were matched to 22 male non-autistic participants on age (19-36) and WAIS-IV non-verbal IQ (70-134). Among autistic participants, 13 had a relative strength on Wechsler Block Design (BD) subtest – a performance on BD subtest more than 1 standard deviation above their mean performance at other Wechsler subtests – and 15 had no particular visuospatial expertise. All participants performed two visuospatial tasks presented in an event-related design in a 3T MRI scanner. The first task was a classic mental rotation (MR) task with three-dimensional geometric shapes. Spatial orientation (0, 70, 140 and 180 degrees) was parametrically varied across 104 trials. The second task was an adaptation of the original BD subtest suitable for presentation in the MRI scanner. Perceptual cohesiveness of the target design (neutral, low, high) was varied across the 90 trials.

Results: Despite no between-group differences in accuracy and response times, non-autistic participants recruited a larger network of cortical regions (occipital, parietal, temporal and frontal) during both tasks, compared to autistic participants. No region was more activated in autistic participants with superior visuospatial abilities across both tasks, and in autistic participants without superior visuospatial abilities in the adapted BD task, relative to non-autistic participants. In the MR task, greater activity in some fronto-parietal regions, the insula and the cerebellum was found in autistic participants without superior visuospatial abilities compared to non-autistic participants. Further analyses compared cerebral activity in autistic participants with and without superior visuospatial abilities. Higher activation in occipital, parietal and frontal regions was observed in the autistic group without superior visuospatial abilities while performing both tasks, whereas the autistic group with superior visuospatial abilities showed higher activation in parietal regions in the adapted BD task and in the insula during the MR task.

Conclusions: Despite equivalent behavioral performance, the underlying pattern of cerebral activity is less extended in autistic individuals than in non-autistic individuals during visuospatial tasks. Interestingly, functional resource allocation is similar in autistic without superior visuospatial abilities and in non-autistic individuals when both compared to autistic with superior visuospatial abilities. Together, these results suggest more efficient visuospatial processing requiring less cognitive resources in autism, which is particularly true for those with superior visuospatial abilities.

65 **110.065** Neural Response to Cued Fixation in Children with and without Autism Spectrum Disorder (ASD)

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Background: Accumulating evidence suggests that children with ASD have impaired attention processing. However, the results of studies evaluating deficits in the alerting attention system, which signals readiness to receive information, are mixed. Neural measures of low-level attention processing, such as the P1 ERP component, may clarify group differences in the efficacy of the alerting system. To test this, we compared

P1 amplitude following a cued fixation during a Flanker Task in a sample of children with ASD and typically developing (TD) controls. Additionally, we assessed habituation of the P1 in response to the cue, to explore group differences in sensitivity of the alerting system over time.
Objectives: The objectives of these preliminary analyses were to (1) determine if P1 amplitude in response to a cued fixation differs between children with ASD and TD children, and (2) assess change in P1 amplitude over time during a Flanker task.

Methods: As part of a larger study, ERP data was derived from 24 children with ASD (22 males, M_{age}=9.24±1.16 years) and 21 TD children (19 males, M_{age}=8.83±1.41 years) during a Flanker task. Each trial began with the presentation a fixation cue (450ms) that was paired with a tone (150ms). The cue was then followed by congruent and incongruent stimuli (2000ms). During each trial, children were prompted to respond to the center, target stimulus via button press on a response box.

Only trials with correct responses were included in analyses. In order to evaluate the change in neural response to the cue over time, we computed P1 amplitude separately for the first (54 trials) and second (54 trials) halves of the task. P1 amplitude was derived from electrode Oz 70-170ms after the cue was presented. A repeated-measures ANCOVA (controlling for child age) was run to compare P1 amplitude between diagnostic groups (between-subjects factor) and across time (within-subjects factor).

Results: Counter to our prediction, the main effect of group was not significant (p=0.519). Interestingly, however, the significant main effect of time indicated that children habituate to the cued fixation (F(1,42)=6.255, p=0.016), regardless of diagnostic group (time by group interaction: p=0.905). Although the main effect of age was not significant (p=0.483), the significant time by age interaction (F(1,42)=5.893, p=0.020) suggested that older children habituate to the cue less over time (r=-0.352, p=0.018).

Conclusions: Collectively, these results indicate that children habituate to cued fixations. Importantly, neural responses to the cue were similar among children with ASD and TD children, suggesting that the alerting system may be intact in this clinical population at this stage of development. In the next several months, we plan to (1) increase our sample size to explore the age effect and (2) evaluate relations between P1 in response to the cue and other ERP components that index downstream attentional processes (i.e., N2).

66 **110.066** Predictive Abilities during Visual Narrative Comprehension in Individuals with Autism

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Background:
Individuals with autism spectrum disorder (ASD) often demonstrate impaired narrative comprehension. While the majority of work in this area has used linguistic (i.e. spoken or written) narratives, there is also evidence of comprehension impairments for non-linguistic narratives (e.g. picture sequences or comics), suggesting domain-general impairments in narrative comprehension.

Identifying contributors to comprehension impairments is important for developing effective treatment interventions. One such contributor is that of predictive abilities. Successful narrative and discourse processing entails a high degree of prediction to facilitate comprehension. However, recent work has proposed that autism is a disorder of prediction, such that individuals with ASD are less able to use previous experiences to interpret incoming information. Such deficits in predictive abilities could underlie domain-general comprehension impairments in individuals with ASD.

In language studies, prediction during sentence comprehension is examined by manipulating cloze probability, the expectancy of a specific word given the contextual constraints of a preceding sentence. In “high cloze” sentences, the final word is highly predictable given the context of the sentence; in “low cloze” sentences, the final word is less predictable. In studies using event-related potentials (ERPs), which are derived from the EEG, words in high cloze sentences generate a reduced negative amplitude (the “N400”) compared to words in low cloze sentences. That is, the more predictable a word is given the constraints of the preceding context, the smaller the N400 amplitude. Prediction in visual narrative comprehension can be tested using a similar paradigm, in which a given panel is more or less expected based on the prior narrative context.

Objectives:

In this exploratory study we use a cloze probability manipulation with EEG to determine whether individuals with ASD experience impaired predictive abilities during comprehension of visual narratives.

Methods:

Preliminary data is reported from 4 adults with ASD and 4 typically-developing (TD) adults. Participants viewed visual narrative sequences (*Peanuts* comic strips) one panel at a time during concurrent EEG recording. ERPs were time-locked to a “target” panel which was either highly predictable (“high cloze”) or not predictable (“low cloze”; Figure 1) given the context of the narrative, as quantified with a pretest. An additional “anomalous” condition was included, in which the target panel was highly incongruent with the context of the preceding narrative. This served as a control condition and was expected to elicit the highest N400 amplitudes of the three conditions.

Results:

Preliminary results show a significant group-by-condition interaction from 400-500 ms. Here, the TD group shows a significant modulation of the N400 effect by condition (anomalous > low cloze > high cloze). However, no such modulation of the N400 effect by condition occurs in the ASD group.

Conclusions:

These preliminary data indicate that TD adults show the expected manipulation of the N400 effect by cloze probability, but individuals with ASD do not. Although data collection is ongoing, these results suggest that individuals with ASD have impaired predictive abilities, which may underlie domain-general narrative comprehension deficits in this population.

67 **110.067** Superior Temporal Summation Performance to Detect Near Threshold Tactile Stimulus in Individuals with Autism Spectrum Disorder

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Background: Several studies reported lower detection threshold to vibro-tactile stimuli in individuals with autism spectrum disorder (ASD) than typically developing (TD) individuals as a candidate for underlying basis of the symptom of sensory hyper-responsivity. We previously demonstrated that higher temporal resolution discriminating two successive vibro-tactile stimuli associated severity of sensory hyper-responsivity. This indicates that the high temporal resolution of sensory stimuli may result in superior number of temporal summation of sensory inputs. Therefore, we assumed that the individuals with ASD would perceive strong subjective intensity of the stimuli even if the stimulus is delivered in short time duration.
Objectives: Our purpose in the current study is to elucidate underlying mechanisms of the association between the high temporal resolution and the sensory hyper-responsivity. We hypothesized that the individuals with ASD can detect the near threshold stimuli despite short temporal duration by summarizing sensory inputs in high temporal frequency.

Methods: 8 individuals with ASD (16-24 years old) and 10 TD individuals (16-21 years old) were participated. We first conducted a detection task of single vibro-tactile stimulus delivered for 50 ms. Using the near threshold stimulus intensity in each participant identified in the prior task, we applied 7 duration condition (50 – 1000 ms) of vibro-tactile stimuli in the main experiment. One of vibro-tactile stimuli from the duration condition was delivered to the left index finger in a randomized-order, and they were asked to judge whether the stimulus was presented or not. We calculated detection thresholds representing the stimulus duration that each participant can detect it (defined as *Threshold of stimulus duration*). Low threshold indicates that the participants could detect the stimulus regardless of short duration (Fig.1). We also evaluated the symptomatic severity of hypersensitivity using the adolescent / adult sensory profile (AASP).

Results: The mean degree of *Threshold of stimulus duration* were 96.77 (SE = 48.24) in ASD and 229.03 ms (SE =44.32) in TD groups. The ASD group showed lower *Threshold of stimulus duration* than TD group (t (16) = 2.01, p = 0.03). Although we also conducted correlation analysis between the *Threshold of stimulus duration* and the severity of hyper-responsivity across both groups' data (N = 18) (Fig.2), no significant correlation was found in any sub-scales of AASP (Low Registration, r = −0.30, p = 0.22; Sensation Seeking, r = 0.30, p = 0.23; Sensory Sensitivity, r = 0.12, p = 0.64; Sensation Avoiding, r = −0.06, p = 0.82).

Conclusions: Our data demonstrated that the individuals with ASD can detect the near threshold vibro-tactile stimuli which is delivered in shorter time duration relative to TD controls. This finding is partly congruent with our assumption that the individuals with ASD having high temporal resolution result in more frequent summarizing of sensory inputs. However, association between the *Threshold of stimulus duration* and the severity of sensory hyper-responsivity was not obvious. We need to add more samples in order to make our data robust.

68 **110.068** The Impact of Anxiety and Attention-Deficit/Hyperactivity Symptoms on the Pupillary Light Reflex Among Children with ASD: Results from the ABC-CT Interim Analysis

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Background: Pupillary light reflex (PLR) is an involuntary response to a flash of light mediated by levels of norepinephrine and acetylcholine. Previous literature has found differences in PLR in children with autism spectrum disorder (ASD) compared to typically-developing (TD) individuals (Daluwatte et al., 2013). However, limited research has explored the impact of common co-occuring symptomology, such as anxiety or hyperactivity and attention difficulties, on the PLR in children with ASD. These symptoms may impact the PLR, as the locus-coeruleus and associated norepinephrine activity (LC-NE) are implicated in both attentional control and anxiety (Redmond & Huang, 1979).
Objectives: To examine PLR among children with and without ASD in relation to anxiety and hyperactive symptomology.

Methods: PLR were collected across five sites from 126 children with ASD between 6-11 (mean age=8.7, mean IQ=96.7) and 58 TD children (mean age=8.9, mean IQ=115). Participants were shown white flashes of light during a passive eye-tracking task using a SR EyeLink 1000+. Stimuli consisted of a central fixation point on a black background that flashed white for 75 milliseconds. The flash onset occurred randomly between 1,600 and 2,400 milliseconds during the 6-second stimulus. Participants completed 16 trials with video clips interspersed between trials. The *Autism Diagnostic Observation Schedule, Second Edition* (ADOS-II) was used for clinical characterization. Caregivers completed the *Child and Adolescent Symptom Inventory, Fifth Edition* (CASI-5). Correlations and multiple regressions were used to determine associations between ADOS calibrated severity scores (CSS), anxiety and hyperactivity symptoms (CASI-5 General Anxiety and Hyperactivity subscales *T*-scores), and relative pupil constriction (RPC) and constriction velocity (CV) in the PLR.

Results: Anxiety scores were significantly higher in the ASD group (M=66.9, SD=14.8) than in the TD group (M=47.2, SD=6.3)[t(181)=-9.8, p<.01)]. Hyperactivity scores were also significantly higher in the ASD group (M=14.1, SD=1.3) compared to the TD group (M=7.1, SD=.96)[t(181)=-11.2, p<.01)]. Within the ASD group, when controlling for CSS, anxiety symptoms significantly predicted RPC (β=.22, p=.02). Hyperactivity also significantly predicted RPC when controlling for CSS in this group (β=.18, p=.04). The overall models were statistically significant for both anxiety and hyperactivity, F(2,122)=4.79, p=.01 (R^2=.07); F(2,122)=3.94, p=.02 (R^2=.06). Individuals with ASD who met anxiety symptom cutoff on the CASI-5 (>60) showed a significant negative correlation between anxiety symptomology and CV (r=-.43, p<.01). These relationships were not found in the TD group.

Conclusions: Overall, ASD, anxiety, and hyperactive symptomology predicted unique variance in pupillary dynamics; however, collinearity between anxiety and hyperactivity scores precluded dissociation between these constructs and their relation to the PLR. Ongoing analyses including multiple time points will help to elucidate these relationships. Neither relationship was found in the TD group, though elevated levels of anxiety and hyperactivity were exclusionary, yielding a restricted range. These findings suggest PLR in individuals with ASD may index anxiety and hyperactivity and associated neurological mechanisms, such as LC-NE activity. Ongoing analyses will include the effects of medication impacting adrenergic and cholinergic function in the sample. Future directions include utilizing PLR as a potential biomarker to target treatment for different clinical presentations among those with ASD.

69 **110.069** The Neural Mechanism of Emotionally Metaphorical Comprehension in Schooling Children with and without High-

Functioning Autism Spectrum Disorder

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Background: Several studies have shown different processes for emotion-label and emotion-laden words in typical adults. While emotion-laden words directly describe affective state (e.g., happy), emotion-laden words refer to objects, events or personality traits that could evoke affective responses (e.g. prize). Individuals with autism spectrum disorder (ASD) have been documented deficits in understanding figurative languages (e.g., metaphor, ironic); however, little work investigated the process for the non-literal emotional expressions in terms of emotion-laden words in the clinical population.

Objectives: The current study aimed to explore the neural mechanism underlying comprehension in emotionally metaphoric expressions in related to adaptive behavior in children with high-functioning autism spectrum disorder (HFASD).

Methods: In the task the two-character Chinese emotion words were presented with factors of type (emotion-label, emotion-laden) and valence (positive, negative) in addition to neutral words. 11-14-year-old children with HFASD (N=25) and age-matched typically developing (TD) children (N=25) classified emotion valence of the words during electroencephalogram measurement. Their adaptive behavior were evaluated by parents' questionnaire.

Results: No significant differences in reaction time and accuracy were found between both groups. The reaction time was faster for emotion-label words than for emotion-laden words in the two groups. The late positive component (LPC), an event-related potential (ERP) component usually indexing deeper processing for emotion contents, was larger for negative emotion-label words than for positive emotion-label words in both groups. However, the emotion effects distributed more broadly in the TD group compared to the HFASD group. Regarding emotion-laden words, the LPC differentiated between the two valence words at 600 m in the TD children. On the contrary, no such differences were statistically significant in the HFASD group. There was a trend showing correlations between the LPC amplitude and adaptive problems, particularly for communication domain.

Conclusions: Children with HFASD may have ability to distinguish emotion from straight emotional expressions, with using different strategies from typically developing peers. Comparatively, they fail to extract emotionally semantic efficiently when the expressions are non-literal.

70 **110.070** Towards a Better Understanding of Working Memory and Filtering Efficiency in Autistic and Non-Autistic Adults

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Background:

The ability to memorise task-relevant information while filtering out irrelevant information is essential for many tasks in daily life. Recent studies suggest that the amount of information (both visual and auditory) that autistic individuals can process at any given time (perceptual capacity) is increased compared to non-autistic individuals (Remington et al., 2012, 2017). However, it remains unclear if this enhanced processing also persists when visual information must be maintained for a short period of time in working memory, and whether this impacts the efficient filtering of relevant vs. irrelevant information. Here we test this by examining the contralateral delay activity (CDA, Vogel et al., 2005), an electrophysiological (EEG) index in the form of a negative deflection that can be observed during the retention of information in working memory tasks. Importantly, the amplitude of the CDA is modulated by the number of items that are actively maintained in working memory, as well as by the filtering efficiency of the participants.

Objectives:

The current study investigates visual working memory capacity and filtering efficiency by analysing a well-established neural index of (i.e., CDA) on a change detection task.

Methods:

Thirty-six participants (18 autistic and 18 non-autistic adults, data collection ongoing) aged between 18-55 years, took part in the study. The groups were matched on age, gender and IQ, and clinical autism diagnoses were confirmed with the ADOS-2. Brain activity and concomitant CDA was recorded while participants performed a change detection task based on Vogel et al. (2005). For each trial, participants were shown a bilateral visual array consisting of the following items on each side of the visual field: a) two coloured rectangles in the target colour b) four target-coloured rectangles or c) two target and two distractor items (blue rectangles). Participants were asked to memorise the orientation of items in one visual field (cued with a pre-trial arrow) and after 900 ms delay, participants were presented with a test array and indicated whether the orientation of the target items had changed or not. The CDA was averaged for the electrodes over the visual cortex during the memory delay period and the ipsilateral was subtracted from the contralateral activity to establish the activation in response to the target and distractor items.

Results:

The data analysis is ongoing, nevertheless preliminary ANOVAS on EEG amplitude differences between the three conditions revealed no main effect of condition or group (*F*s<1)on load an interaction that is trending towards significance ($F(2,34)=2.47$, $p=0.09$).

Conclusions:

To our knowledge this is the first study investigating working memory capacity and filtering efficiency in autism using CDA. A better understanding of cognitive control and filtering efficiency may provide fundamental insight into education and workplace experiences, and interventions for autistic individuals.

71 **110.071** Typical and Anomalous Inferior Parietal Lobule Connectivity in Children with Autism: Associations with Motor and Social-Communicative Skills.

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Background:
Children with autism spectrum disorder (ASD) consistently display impairments in skilled motor behavior, of which, there is strong correspondence with primary social and communicative features of autism. In particular, children with ASD show impairment in the representation of everyday actions (praxis) as measured using pantomimed gestures. Healthy and impaired brain states have reliably shown that connectivity of the inferior parietal lobe (IPL) is essential for the representation of everyday motor skills. Despite robust behavioral evidence of abnormal praxis in ASD, there is little understanding of how IPL connectivity affects praxis in children with ASD.

Objectives:

To test if connectivity of specific IPL subnetworks is abnormal in children with ASD, if IPL connectivity is related to praxis, and if connectivity meaningful to praxis is also related to core social and communicative features in children with ASD.

Methods:

We acquired resting-state functional magnetic resonance imaging (rfMRI) scans from 128 (63 ASD, 65 typically developing, TD) children aged 8-12 years. Groups were balanced for age, handedness, and IQ general ability index (GAI). Masked independent components analysis (ICA) and dual regression were used to estimate functional connectivity of the IPL, separately for left and right hemisphere. We tested for brain-behavior relationships by including measures of praxis-based gesture (Florida Apraxia Battery modified for children) and social skill (social responsiveness scale, SRS total raw score) as covariates. Reported results meet FWE cluster correction ($P<0.05$), with initial threshold post-correction for multiple tests at $P<0.005$.

Results:

Children with ASD were less accurate on praxis gesture than TD children ($P<0.0001$). Multiple IPL subnetworks were correlated with praxis, with strongest associations for the left and right central IPL subnetworks (cIPL: posterior supramarginal and anterior angular gyri). For both ASD and TD, greater accuracy on praxis gestures was related to increased connectivity from cIPL to predominantly left primary and secondary premotor cortices, bilateral posterior parietal cortex, and cerebellum (Figure1). Further, we observed ASD-specific praxis effects, particularly right cIPL connectivity with left angular gyrus, primary visual cortex, and right cerebellum (Figure2a). In addition, for children with ASD, SRS was correlated with praxis-related connectivity between right cIPL subnetwork and left angular gyrus, left cerebellum, and bilateral retrosplenial cortex (Figure2b).

Conclusions:

Our findings suggest that the representation of everyday motor skill, or praxis, in children (TD and ASD) relies on cIPL connectivity (predominantly left hemisphere). As such, impaired praxis in children with ASD appears to be associated with reduced connectivity of this cIPL subnetwork. Further, our observation of ASD-specific associations of stronger right cIPL connectivity with better praxis and SRS scores, suggests that for children with ASD, connectivity of the right cIPL may have compensatory influence on development of a wide range of skills – including motor and social-communicative skills. These findings highlight the importance in understanding the involvement of the IPL connectivity in impaired acquisition of skilled behavior in ASD with potential utility for development of movement-based intervention to augment social and communicative skills.

72 **110.072** Unlocking Hidden Voices – Detecting Intact Language Comprehension in Non-Verbal Autistic Children Using Electroencephalography

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Background: A third of the autistic population remains minimally-verbal at school age. In order to tailor early targeted interventions for these individuals, it is crucial that we grasp the scope of their receptive language and cognitive abilities. We are interested in the extent to which minimally-verbal autistic children understand spoken language. Due to difficulties with obtaining reliable scores for this population with standard testing materials, it is necessary to develop passive methods that allow us to assess language comprehension in individual children, without requiring behavioural answers.
Objectives: Our first goal was to develop a neural marker of language comprehension that is sensitive to each individual using electroencephalography (EEG). We sought to compare the individual sensitivity of different child-friendly, covert paradigms, analyses, and EEG systems. Our second goal was to apply these paradigms to test a minimally-verbal child with autism.

Methods: First, we developed three child-friendly paradigms in which we presented identical auditory words (*targets*) in either a semantically congruent or incongruent context. The semantic contexts consisted of either a single probe word that was related or unrelated with the target (Experiment 1), or a sentence frame that was congruent or incongruent with the target (Experiment 2 and 3). In Experiment 3, we added short visual animations that represented the sentence frame to support the semantic context and increase the children's engagement. We measured the brain responses of 50 typically-developing children to the target words. We used both traditional univariate analyses of the N400 event-related potential, an index of semantic integration of words into their context, and Multivariate Pattern Analyses (MVPA) to examine whether we could decode the semantic condition from the brain activity. We also assessed the quality of the signal recorded by a low-cost gaming EEG system, Emotiv EPOC+, to that recorded by a research-grade system, Neuroscan Synamps^2, recording from the two systems simultaneously.
Second, we tested BM, a 9-year-old minimally-verbal autistic child, on Experiment 1, using the EPOC+. We independently verified BM's preserved language comprehension using the K-BIT-2 and PPVT-4 which we adapted so that she could respond non-verbally.

Results: Our three paradigms yielded a medium to high detection rate of differential brain responses to the two semantic conditions in typically-developing children. We found the highest detection rate (88% of participants) in Experiment 2, using congruent and incongruent sentences, when we used MVPA with the Neuroscan's data. EPOC+'s data yielded lower sensitivity (about 50% of participants). Our case-study BM showed N400-like effects in two electrodes, consistent with her known preserved semantic comprehension.

Conclusions: Using EEG to record the brain's response to language, we present a proof-of-concept for a neural index of language processing in typically-developing children and one case with autism. We plan to test the methods in a larger group of non-verbal autistic children. Our results may bring us closer to offering objective and reliable measures of language abilities in this population.

73 **110.073** What's Next? Rhythm-Based Anticipation in Children with ASD

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Background:
Information in the sensory environment tends to be highly predictive of upcoming events, allowing for online planning and decision-making. Numerous studies have shown that the neural processing of predictable stimuli is significantly facilitated compared to that of non-predictable stimuli. Clinical and anecdotal observations have led to the view that people with ASD have deficits in generating and/or applying predictions in their daily lives, and there is some empirical support for this notion. However, the underlying neural mechanisms are not yet well understood. In the face of rhythmic events, such as speech, music, or walking, brain oscillations become aligned with the rhythm - a process referred to as neural entrainment. This way, the brain interacts with environmental cues to prepare for upcoming events. Moreover, neural activity prior to a cued target, the Contingent Negative Variation (CNV), indicates how efficiently the brain is anticipating the upcoming event. A test of the integrity of these neural processes provides insight into what drives impairments of prediction in ASD.

Objectives:

Here we sought to assess the integrity of anticipatory process in a rhythmically cued environment, in children with ASD. To this end, we presented sensory stimuli in a cued context and measured cortical activity with scalp EEG, as well as psychophysics.

Methods:

Children with ASD (n=40) and age-matched controls (n=22), between 6 and 9 years old, were included. The groups did not differ significantly on age or IQ. Participants responded to an auditory stimulus that was either preceded by 4 isochronously presented visual stimuli (with all stimuli in one trial sequence presented at 1.5 Hz), or not. Due to their rhythmicity, the visual cues were highly predictive of the temporal onset of the auditory target stimulus. High density 64-channel scalp EEG (BioSemi) was recorded during the task, as was behavior. The EEG data was analyzed in both frequency and time domains, to examine the coherence of neural entrainment, and generation of the CNV.

Results:

We examined entrainment to the visual cues preceding the auditory target in the low-pass (1.9Hz) filtered data. While both groups showed entrainment at the stimulating rhythm (1.5Hz), this was significantly greater in the control compared to the ASD group. In the broadband data, the expected CNV was clearly observed in both groups, in the interval between the 4th visual cue and the target. However, in the control group it onset 200ms earlier and was of greater amplitude compared to the ASD group. Thus while ASD can bring anticipatory processes online, this is severely delayed compared to controls. Of note, analyses revealed that the sensory evoked responses were highly similar across the two groups of participants.

Conclusions:

Anticipation of events is an adaptive function in the typical brain. Although children with ASD are known for atypical weighting of prior expectations relative to sensory inputs, the brain processes underlying this impairment are not well understood. The delayed anticipation and reduced entrainment to sensory cues that we see here offer evidence of the neural underpinnings of impaired event anticipation in children with ASD.

74 **110.074** Where You Look on a Face Matters! Neural Correlates of Early Face Perception Are Modulated By Featural Fixation in Adults with and without Autism Spectrum Disorder

K. B. Parkington *and R. J. Itier, Psychology, University of Waterloo, Waterloo, ON, Canada*

Background: The eyes play an important role in guiding social communication behaviours, with important cascading effects on social cognition. Recent neuroimaging research has also demonstrated a neural sensitivity to the eyes in neurotypical face perception, such that the N170 event-related potential (ERP) – the earliest neural marker of face and eye perception – demonstrates a consistently larger amplitude when visual fixation is enforced on the left or right eye within a face, compared to enforced fixation to other parts of the face (forehead, nasion, nose, or mouth). A handful of studies have evaluated the N170 ERP in adults with ASD, reporting reduced amplitudes or delayed latencies when adults with ASD perceive faces or eyes compared to neurotypical adults. However, ERP findings in ASD are inconsistent and despite the commonly observed eye avoidance behaviours in ASD, these ERP studies did not control for visual attention, making it difficult to know where participants were looking and how this may have impacted the ERP results.
Objectives: This study sought to control for visual fixation when adults with and without ASD viewed faces to clarify the neural correlates of early face perception in ASD and how this may be similar or different to neurotypical face perception.

Methods: High-functioning adults with ASD and age-, gender-, ethnicity-, and IQ-matched neurotypical adults were presented with faces in which visual fixation was enforced on the left eye, right eye, nasion, nose, or mouth during an oddball detection (to flowers) task. Eye movements and electroencephalography (EEG) recordings were synchronized offline, to ensure that only trials in which fixation was maintained on the feature of interest were included. EEG recordings were then time-locked to face-onset, and the left and right hemispheric electrodes which showed the maximal N170 response for all conditions were selected for each participant.

Results: Preliminary analyses (ASD = 13, neurotypical = 10) revealed a robust effect of featural fixation for both groups. N170 peak amplitudes were significantly larger when fixation was enforced on the left or right eye compared to all other features, and this pattern was largely consistent across groups. Moreover, fixation on the nasion or nose yielded the fastest N170 response in both groups, followed by the left and right eyes, followed in turn by the mouth. Whilst there were no significant group effects or interactions, there was a tendency for adults with ASD to elicit attenuated N170 amplitudes for the left eye, but slightly enhanced amplitudes for the mouth, relative to neurotypical adults.

Conclusions: These findings suggest that the early neural response to features within a face may be similar for adults with and without ASD when fixation is enforced. Therefore, difficulties with eye contact and social communicative behaviours in ASD may not stem from differences in the earliest stages of face perception and may instead be based in free-viewing preferences or later stages of face processing. These findings also highlight the importance of controlling for visual attention in ERP studies in order to more clearly refine neural mechanisms in ASD and neurotypical adults.

Poster Session
111 - Diagnostic, Behavioral, Sensory and Intellectual Screening and Assessment
11:30 AM - 1:30 PM - Room: 710

75 **111.075** Assessing Gender Differences in Autism Spectrum Disorder Using the Gendered Autism Behavioral Scale (GABS)

E. Clarke[1], *L. Hull*[2], *R. Loomes*[3], *C. E. McCormick*[4], *S. J. Sheinkopf*[5] *and W. Mandy*[2], *(1)Rhode Island Consortium for Autism Research and Treatment, Providence, RI, (2)University College London, London, United Kingdom of Great Britain and Northern Ireland, (3)University College London, London, United Kingdom, (4)Purdue University, West Lafayette, IN, (5)Brown Center for the Study of Children at Risk, Women and Infants Hospital, Providence, RI*

Background: Females with autism spectrum disorder (ASD) are diagnosed later than males with ASD (Lai et al., 2015). Some suggest gendered differences in ASD symptomatology, also known as the female autism phenotype, may contribute to delayed diagnoses for females with ASD (Bargiela et al., 2016). However, there are no standardized measures to assess the presence or absence of the female autism phenotype in individuals with ASD. The Gendered Autism Behavioral Scale (GABS) is a coding frame developed at University College London (UCL), measuring hypothesized components of the female autism phenotype in recordings of ADOS-2 administrations (Loomes, 2016). Preliminary GABS results were promising, with females scoring significantly higher than males (Loomes, Hull, Skuse, & Mandy, 2017). This study assessed the feasibility and validity of the GABS in an entirely new sample, the Rhode Island Consortium for Autism Research and Treatment (RI-CART).
Objectives: To assess the inter-rater reliability of the GABS, and replicate pilot findings that the GABS differentiates phenotypic expression of females versus males from video-recorded Module 3 and 4 ADOS-2 administrations.

Methods: A UCL researcher involved in piloting the GABS trained a RI-CART researcher to code the GABS. The first RI-CART researcher then trained a second, independent RI-CART researcher. During this second training, instances in which the RI-CART researchers could not reach consensus on a given item were resolved by the UCL researcher.

This study analyzed recorded ADOS-2 assessments from males (n = 40) and females (n = 20) aged 4-59 years enrolled in RI-CART, a state-wide, community-based sample. Participants had community diagnoses of ASD and a positive ADOS-2. Female participants were matched with two male participants of similar age, IQ, and/or Vineland ABC scores.

Results: Acceptable inter-rater reliability was achieved between the UCL and first RI-CART researcher (k = 0.69) as well as the first and second RI-CART researchers (k = 0.72). Chi-squares indicated male participants received significantly higher scores than female participants on GABS items C2 (externalising difficulties) $X2$ (1, n = 60) = 6.56, p = .010 and D1 (reported interests frequency/intensity) $X2$ (3, n = 60) = 8.81, p = .032, indicating male participants reported more externalizing symptoms and more intense restricted interests than female participants. However, the difference in overall GABS scores between males (M = 14.52, SD = 5.42) and females (M= 16.38, SD= 5.05) was not significant $t(58)$= 0.784, p = .076.

Conclusions: This study found acceptable inter-rater reliability between GABS assessors across UCL and RI-CART. Validity tests resulted in a partial replication of female vs. male differences on the GABS. This lack of differences may be attributable to an overly small and/or heterogeneous sample. The GABS could provide a means of extracting valuable data on the hypothesized female autism phenotype through a widely employed assessment, the ADOS-2. Future research should assess the GABS' reliability and validity in larger samples, and consider additional tests of validity such as differentiating females with ASD and a negative ADOS-2 (i.e., false negatives) from females with concordant ADOS-2 and clinical diagnosis.

76 **111.076** Assessing Theory of Mind and Its Relationship to ASD Symptom Severity

L. A. Oakes*, A. Canfield and L. Rothschild, University of Rochester Medical Center, Rochester, NY*

Background: Theory of mind (ToM) has long been studied as a core weakness in autism spectrum disorder (ASD; Tager-Flusberg, 2007) due to its relationship with social and emotional reciprocity, a core symptom of ASD. The literature indicates that better ToM is associated with higher cognitive functioning and less severe social deficit in ASD (Livingston et al., 2018; Happe, 2015). ToM has been explored as a focus of intervention, but there has been limited evidence that these interventions are effective, partly due to limited outcome measures (Fletcher-Watson, McConnell, Manola & McConachie, 2014). Tasks that measure ToM tend to vary greatly between studies, are lengthy, and require significant training to administer. The NEPSY-II ToM subtest is a relatively new standardized measure of ToM skills that can be used in the assessment of children with and without ASD. Furthermore, while ToM abilities have been compared to measures of ASD symptom severity such as the Social Responsiveness Scale, they have not been compared to the recently released ADOS-2 Comparison score. Due to the high applicability and use of both of these measures, the relationship between ASD severity, as measured by the ADOS-2 Comparison Score, and ToM, as measured by the NEPSY-II, is important to examine.
Objectives: This study evaluates the relationships between ToM as measured by the NEPSY-II and ASD symptom severity, as measured by the ADOS-2 Comparison Score. We hypothesize that ToM skills will predict ASD symptom severity above and beyond cognitive abilities.

Methods: Children with ASD, ages 6-12, with a full scale IQ (FSIQ) score above 50, were assessed with the Stanford-Binet Intelligence Test, 5th Edition, the social perception subtests of the NEPSY-II and the ADOS-2. ToM was regressed onto the ADOS-2 comparison score after controlling for FSIQ.

Results: Fifty-two children (43 males, 9 females) with ASD, a mean age of 9.6 (SD = 1.9), and a mean FSIQ of 92.79 (SD = 19.53, range: 51-126) participated in the study. All participants completed Module 3 of the ADOS-2. FSIQ was a significant predictor of the ADOS-2 comparison score, r = 0.32, $F(1, 49)$ = 5.73, p = 0.02, predicting 10.5% of the variance. Together, FSIQ and ToM predicted 24% of the variance, r = 0.52, $F(2, 48)$ = 8.90, p = 0.001 with ToM accounting for significantly more variance, R^2 Change = 0.17, $F(1, 48)$ = 10.9, p = 0.002.

Conclusions: Theory of Mind skills significantly predicted ASD symptom severity, even when controlling for overall IQ. These results suggest that ToM is associated with ASD symptoms, even when accounting for broad differences in cognitive functioning. Given the age range of our sample and the relative stability of their IQ, this highlights the impact ToM skill training may have for school-age children with ASD. While ToM interventions that use visual aids show promise (Paynter & Peter, 2013), many studies have mixed results due to limitations in outcome measures. Our results support the use of the NEPSY-II ToM assessment in ASD research and clinical practice, as a brief, standardized, easy-to-administer measure of ToM.

77 **111.077** Assessment of the Female ASD Phenotype: The M-ASD Questionnaire

*M. L. Bezemer, R. H. Grondhuis and **E. M. Blijd-Hoogewys**, INTER-PSY, Groningen, Netherlands*

Background:

ASD diagnostics are based mainly on the male ASD phenotype. People with a female ASD phenotype are often under- or misdiagnosed. This phenotype seems more subtle due to better camouflaging techniques (Lai et al., 2011), a higher social motivation and gender specific preoccupations (Hiller et al., 2014). However, an ASD diagnosis is indisputably present.

A questionnaire taking into account the female ASD phenotype could aid in a faster identification of these women, but also of men with this more subtle phenotype. This could lead to a better prognosis, prevent secondary problems, reduce family stress and societal costs (García-Primo et al., 2014).

In 2016, we developed the Miss-ASD questionnaire (M-ASD). It consists of 120 items derived from literature search on female ASD expressions, clinical impressions of the authors, and data analysis of sex differences in adults with ASD on other questionnaires. The M-ASD covers 6 domains: Social interaction and communication, Rigidity, Coping and camouflaging, Sensory issues, Information processing, and Miscellaneous (INSAR, Grondhuis et al., 2018).

Objectives:

Shortening the M-ASD for clinical use.

Methods:

Adults suspected for ASD underwent an extensive ASD diagnostic assessment. At start, they also completed the M-ASD. Independent researchers scored these questionnaires.

The research group ultimately consisted of 183 patients (age: M=35.07, SD=12.54), of which ultimately 83% received an ASD diagnosis. There were 88 women with ASD, 63 men with ASD, and also 25 women and 7 men with other psychiatric diagnoses (non-ASD group).

Qualitative analyses were based on recent literature (2016-2018) and two focus groups: 1) 3 women and 1 men with ASD, and 2) 4 psychologists with elaborate ASD expertise. Quantitative analyses consisted of individual item analyses, including discriminant indices and Fisher-Z exact tests. Item judgement, based on focus groups and statistical analyses, was categorized as a 'keep', 'reject' or 'doubt' classification.

Results:

ASD patients scored higher than non-ASD patients on every M-ASD item. Based on the combination of focus groups and statistics, the best 47 items were retained. Among them are the items that differentiated the most clearly between ASD/non-ASD, and more specifically between ASD/non-ASD women (DI 0.3-0.7, significant Fisher test). The items that best captured the female ASD phenotype (differentiation ASD women/ ASD men) concern sensory and camouflage issues.

Based on the focus groups and new literature, 15 items of the 47 items were rephrased and 7 novel items, mostly on camouflaging, were added.

Conclusions:

The new, abbreviated version of the M-ASD (54 items) is more appropriate for clinical use than the initial version. The M-ASD seems to be able to capture the female ASD phenotype. The most prominent items concern sensory and camouflaging issues, as was expected from literature.

Most ASD screening instruments are developed and validated in the general population. Those instruments perform less well in clinical practice, in terms of sensitivity and specificity (Bezemer et al., submitted). This is not the case for the M-ASD. Follow-up research will focus on the further validation and standardization of this promising new screening tool in a larger clinical sample, also including non-ASD samples.

78 **111.078** Association between Self-Reported and Clinician-Rated Anxiety in Adults with Autism Spectrum Disorder and Adults with Schizophrenia Spectrum Disorders

***K. S. Ellison**[1], J. Wolf[2], T. Winkelman[2], E. Jarzabek[2], A. Naples[2], J. Foss-Feig[3], V. Srihari[4], A. Anticevic[4] and J. McPartland[2], (1)Department of Psychology, Louisiana State University, Baton Rouge, LA, (2)Child Study Center, Yale University School of Medicine, New Haven, CT, (3)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (4)Division of Neurocognition, Neurocomputation, and Neurogenetics (N3), Yale University School of Medicine, New Haven, CT*

Background: The prevalence of anxiety in adults with Autism Spectrum Disorder (ASD) and adults with Schizophrenia Spectrum Disorders (SSD) is high. Typically, multiple assessment modalities are used to capture specific symptomology, yet there is limited research examining self-report vs. clinician ratings of anxiety transdiagnostically in adults with ASD and with SSD.

Objectives: The current study investigated demographic factors and clinical features as predictors of clinician-assigned anxiety diagnoses transdiagnostically. It was hypothesized that self-report ratings of anxiety in both ASD and SSD diagnostic groups would be associated with increased probability of meeting diagnostic criteria for a comorbid anxiety disorder on a clinician-rated measure.

Methods: Collected as part of a larger research study, the sample included 36 adults with ASD (27 male; *M*=25.06 years old) and 27 adults with SSD (22 male; *M*=23.29 years old). Diagnoses were confirmed by the *Autism Diagnostic Observation Schedule, Second Edition (ADOS-2)* and *Structured Clinical Interview for DSM-IV (SCID-IV)*. IQ was measured using the *WASI-II* (ASD *M*=105.11, *SD*=15.51; SSD *M*=95.96, *SD*=11.43). Anxious symptomology was measured using the self-report *Beck Anxiety Inventory (BAI),* and the clinician-rated *Mini International Neuropsychiatric Interview (MINI).* A dichotomous (yes/no) variable was created to indicate the presence (ANX)/absence (N-ANX) of an anxiety disorder based on the *MINI*. ASD symptomology was measured by the *ADOS-2* Severity Score (DSM-5 *ADOS-2* Module-4 algorithm) and *SRS-2* self-report and SSD symptomology was measured by the *SAPS*/*SANS*.

Results: An independent-samples t-test was conducted to investigate differences in self-report ratings between the ANX-group and N-ANX-group. As expected, the ANX (*M*=13.28, *SD*=9.49) and the N-ANX (*M*=7.56, *SD*=9.63) groups differed significantly; $t(61)=2.14$, $p=.04$. There was a significant point bi-serial correlation between clinician and self-report ratings, $r_{pb}(63)=-.26$, $p=.04$, with anxiety diagnoses associated with higher ratings on the self-report. To further explore this relationship, a binomial logistic regression was performed to ascertain the effects of age, gender, IQ, level of autism and SSD symptomology, and self-report ratings on the likelihood of receiving an anxiety diagnosis on the *MINI.* The logistic regression model was statistically significant, $\chi^2(7)=55.23$, $p<.001$. The model explained 87.5% (Nagelkerke R^2) of the variance in clinician ratings and correctly classified 94.8% of cases (sensitivity 94.1%, specificity 95.1%, positive predictive value 83.3%, negative predictive value 93%). Of the seven

predictors, three were statistically significant: gender (*B*=-5.16,*Wald*χ^2 =5.14,*p*=.02), *ADOS-2* Severity Score (*B*=.52,*Wald*χ^2=6.47,*p*=.01), and *SRS-2* Total Score (*B*=-.358,*Wald*χ^2 =10.31, *p*=.001). Males had 5.16 times lower odds of being diagnosed with anxiety than females. Increasing *ADOS-2* severity scores were associated with an increased likelihood of clinician-rated diagnosis but increasing *SRS-2* scores were associated with a reduced likelihood. Age and SSD symptomology approached significance (*p*=.06 and *p*=.07), respectively.

Conclusions: Results demonstrate an association between self-report and clinician ratings of anxiety, but surprisingly, self-report of anxiety was less predictive of an anxiety diagnosis than other factors such as gender or ASD symptomology. SSD symptomology was approaching significance as a predictor, which may suggest that individuals, regardless of primary diagnosis, are reporting symptomology related to both ASD and SSS that lead to a greater likelihood of a clinician-rated anxiety diagnosis.

79 **111.079** Associations Among Adaptive Behavior, Cognition, and ASD Status Among Young, Underserved Children

J. Harris[1], *C. N. Coffield*[2], *Z. Cidav*[3], *M. Lopez*[4], *N. V. Gonzalez*[4], *Y. M. Janvier*[5] *and D. S. Mandell*[6], *(1)Children's Specialized Hospital, Mountainside, NJ, (2)Pediatrics, Rutgers RWJ Medical School, New Brunswick, NJ, (3)University of Pennsylvania, Philadelphia, PA, (4)Autism, Children's Specialized Hospital, Fanwood, NJ, (5)Medical, Lehigh Valley Medical Center, Allentown, PA, (6)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background: People with ASD often experience impairments in adaptive behavior, regardless of intellectual ability. Typically, IQ is higher than measures of adaptive behavior would predict in the general population. This association has not been explicitly examined among traditionally under-resourced children. Adaptive behavior is typically assessed based on caregiver report whereas intellectual functioning is measured by a trained professional. While there has been some investigation of the relationships among adaptive behavior, IQ and ASD status, little is known about the relationship of these indices among low income or racial/ethnically diverse young children. Quantifying these relationships among populations with known disparities in accessing healthcare may help explain some of these disparities. That is, if these families rate adaptive behavior higher relative to IQ, it may result in missed diagnosis of ASD because parent level of concern may not be high enough to trigger a formal diagnostic referral.

Objectives: To examine the associations among adaptive behavior, cognitive functioning and ASD status among young children from low income, racial/ethnic minority or limited English proficiency families.

Methods: Young children referred for developmental evaluation (at-risk group) and those who screened positive on ASD screening tools from a general population received evaluations including ADOS-2, cognitive functioning (Mullen Scales of Early Development) and adaptive behavior (Adaptive Behavior Assessment Scale-2) measures. Both groups were from low-income, ethnic/racial minority or limited English proficiency families.

Results: Among the 288 at-risk children, adaptive behavior and cognitive functioning were positively associated and adaptive behavior was significantly higher than cognitive score. ASD status was negatively associated with both composite adaptive behavior scores and composite cognitive scores. Neither cognitive score nor adaptive behavior was associated with parent primary language or ethnicity.

Among the 179 children from the general population who screened at-risk for autism, adaptive behavior and cognitive functioning were also positively associated, and adaptive behavior score was significantly higher than cognitive score. ASD status was not associated with adaptive behavior, but was negatively associated with cognitive score. Neither cognitive score nor adaptive behavior was associated with primary language or ethnicity.

Conclusions: Adaptive behavior, cognitive functioning and ASD status are correlated for young underserved children already identified as at-risk for ASD. When identified through population based-screening, the same relationships hold, except that parent-reported adaptive behavior scores are not significantly associated with ASD status. In both at risk and population-based underserved groups, parent-reported adaptive behavior was significantly higher than measured cognitive functioning. This differs from previous ASD research which more typically finds IQ to be higher than parent-reported adaptive behavior. It is noteworthy that within this underserved population of young children, parent ethnicity and primary language were unrelated to the adaptive behavior or cognitive functioning of the child. Implications for screening and diagnosis will be discussed.

80 **111.080** Behavioral Coding of Social-Communication and Conversational Skills for Adolescents

S. Hurwitz*, Special Education, Indiana University, Bloomington, IN*

Behavioral Coding of Social-Communication and Conversational Skills for Adolescents with Autism

Background: The social and communication skills of adolescents with autism are frequently evaluated using parent and self-report tools like surveys and questionnaires. Although observational measures of behavior change are more objective and add ecological validity, few such assessments exist (Dolan et al., 2016).

Objectives: To develop a behavioral coding system to evaluate conversational reciprocity skills and nonverbal communication skills exhibited by adolescents with autism during naturalistic conversations.

Methods: Using definitions of social communication skills from the literature, we created a video coding system of conversational behaviors. Two categories were made: Conversational Reciprocity (which includes 12 codes) and Nonverbal Communication (which includes 5 codes). Doctoral students from School Psychology and Special Education were trained to code videos of 10-minute naturalistic conversations using the coding system. Videos were evaluated using partial-interval coding, with 20-second intervals. A computer program (MATLAB and Statistics Toolbox Release, 2012) broke the videos up into 20-second bins, which were scored for the presence of each of the 17 codes. To test the coding system, 60 videos of adolescents with autism engaged conversations with adults were coded.

Results: Most codes were clear enough for coders to accurately identify across individuals and over time. Only one code was dropped ("Appropriate eye contact"). Coders found it too difficult to reliably identify, as it was written. It was replaced with "Inappropriate eye contact," as coders were able to consistently identify when there was a lack of eye contact or when the quality of a stare was too intense. Reliability: Inter-observer agreement (IOA) was calculated and coders reached between 85%-94% reliability.

Conclusions: Changes in conversational skills can be accurately identified and tracked using this partial-interval video coding system. Future applications: This tool could be useful to evaluate social skills and/or communication interventions for adolescents with autism who are able to

engage in reciprocal conversation.

81 **111.081** Behavioral Phenotyping of Propionic Acidemia: A Neurometabolic Disorder with Prominent Neurodevelopmental Sequelae

C. Chlebowski[1], *O. Shchelochkov*[2], *A. Thurm*[1], *D. Adedipe*[1], *G. Muldoon*[1], *S. Ferry*[2], *J. Sloan*[2], *I. Manoli*[2] *and C. Venditti*[2], *(1)National Institute of Mental Health, Bethesda, MD, (2)National Human Genome Research Institute, National Institute of Health (NIH), Bethesda, MD*

Background: Although neurometabolic disorders have been associated with neurodevelopmental problems, few natural history studies exist. Propionic acidemia (PA) is an autosomal recessive condition (OMIM**#** 606054), wherein mutations in the *PCCA* and *PCCB* genes cause propionyl-CoA carboxylase deficiency and accumulation of toxic propionate-related metabolites. While Intellectual Disability (ID) has been documented as a complication of PA, autism spectrum disorder (ASD) in PA has only been assessed recently. Recent reports suggest a potential relationship between PA and ASD, with two small studies indicating the rate of ASD in PA may be between 20-40% with ID and anxiety prominent in those diagnosed with ASD (de la Batie et al., 2017).

Objectives: The current study reports on 24 patients diagnosed with PA who received neurodevelopmental evaluations, including comprehensive ASD assessments, as part of a natural history protocol in order to characterize the sample and explore the relationship between PA and ASD.

Methods: In this observational case series, participants with PA received behavioral evaluations of cognitive and adaptive functioning, and autism symptoms. The appropriate Wechsler test for an individual's age was attempted as a cognitive assessment; if the participant was unable to achieve basal, the Mullen Scales of Early Learning or Differential Ability Scales (DAS-II) was administered. Adaptive behavior was assessed with the Vineland Adaptive Behavior Scales-II. The autism assessment battery was administered by clinical psychologists with research reliability on the Autism Diagnostic Observation Schedule (ADOS-2) and Autism Diagnostic Interview-Revised (ADI-R). ASD assessments were administered to 16/24 participants; 3 did not complete extended testing due to fragile medical condition, 2 due to time constraints, and 3 did not present with clinical indications of ASD (i.e., SCQ scores ≤5, SRS-2 t-scores ≤56). In the ASD sample, 14 participants received both the ADOS-2 and ADI-R; 1 received only ADI-R and 1 only the ADOS-2.

Results: Participants were primarily female (n=13; 54%) with an age range from 3.5 to 34.4 years (mean =12.89, SD=8.03). Cognitive assessments were completed using a Wechsler scale (n=18), Mullen (n=5) or the DAS-II (n=1). Standard scores (IQ) were calculated, with developmental quotients (DQ) for children who received assessments out of age range. Mean cognitive IQ/DQ were 60.84±27.2. Adaptive skills were low with a mean Vineland-II ABC SS of 63.75±23 (range 20–100) and low range Communication (64.7±25.2), Daily Living (63.5±23) and Socialization (67.5±2523.4) scores.

ADOS-2 Modules 1 (n=3), 2 (n=2), 3 (n=9) and 4 (n=1) were administered. Across all modules, 9/15 children (60%) met for autism and 3/15 (20%) met for ASD. Mean ADOS severity score for the assessed sample was 6.58 (SD=3.3). The ADI-R was completed for 15 patients; 10 (67%) met ADI-R overall criteria for autism. Twelve of the 16 assessed participants were determined by clinical judgment to meet criteria for an ASD diagnosis.

Conclusions: A high rate of ASD was observed in the PA cohort, which approaches rates found in other genetic conditions traditionally associated with ASD (e.g. Fragile X). Further exploration of the neurometabolic effects of PA and related disorders and the underlying pathophysiology can help develop therapy approaches.

82 **111.082** Behavioural Profile of Anxiety in Individuals with Autism Spectrum Disorder (ASD) Who Speak Few or No Words and People with Genetic Syndromes Associated with ASD Symptomology

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Background: Individuals diagnosed with Autism Spectrum Disorder (ASD) are at heightened risk of experiencing mental health problems. Morespecifically,the prevalence of anxiety is estimated at 11-84% with most studies reporting a rate of approximately 40%. The majority of anxiety research has focused on individuals with ASD who have an IQ>70. The presence of severe to profound intellectual disability (ID) in ASD, and associated communication impairments, poses a challenge for the identification of anxiety because many individuals are unable to report internal states. Observational assessments and parental rating scales of anxiety for people with ASD and severe to profound ID are confounded by significant overlap between behavioural markers of anxiety, depression and pain. Developing a deeper understanding of the profile of anxiety and the behavioural markers associated with anxiety in this population will aid clinicians in the assessment and identification of anxiety.
Objectives: To explore the parent-reported profile and behavioural markers of anxiety in autistic individuals and individuals with genetic syndromes associated with ASD who have severe to profound ID (non-verbal or odd words only on the Wessex Questionnaire).

Methods: A semi-structured bottom-up interview was completed with parents/carers. Interviews followed a schedule and a coding scheme. The interview focused on identifying behaviours that are present when individuals display anxiety and triggers of anxiety.Inter-rater reliability was established between two raters.Parents/carers completed questionnaires including the Social Communication Questionnaire (SCQ), the Wessex Questionnaire (a proxy measure of adaptive ability) and the Anxiety, Depression and Mood Scale (ADAMS).

Results: To date, 25 interviews have been completed with parents/carers of individuals with ASD (n=20; 85% male; mean age=18.9 years) and parents/carers of individuals with genetic syndromes associated with ASD (n=5; 40% male; mean age=11.8 years). The behaviours most frequently endorsed by parents/carers as being markers of anxiety were increased vocalisation (n=18), self-injury (n=13), repetitive behaviour (n=13), the need to flee (n=12) and pacing/restlessness (n=12). The most frequently endorsed triggers of anxiety were routine changes (n=17), sensory overload (n=15), specific phobias (n=12), social interactions (n=11) and new situations/unfamiliar settings (n=11). In the interview, parent-reported anxiety severity and the total number of anxiety triggers correlated with the general anxiety subscale of the ADAMS (r_s=.434,p<0.05; r_s=.462, p<0.05 respectively). Individuals with a clinical diagnosis of ASD scored higher on the general anxiety subscale of the ADAMS and had a significantly higher number of parent-reported triggers when compared to individuals with genetic syndromes (U=14.5, p<0.05; U=19.5, p<0.05 respectively). However, no relationships were identified between SCQ score, Wessex score and any of the anxiety/mood subscales from the ADAMS. By May 2019, we aim to present data from 50 families (ASD individuals, n=25; genetic syndromes, n=25) following the completion of additional interviews.

Conclusions: Parents/carers could describe behavioural markers observed in their children as a response to anxiety-provoking triggers.The information gathered from these interviews will be used to develop a clinical assessment tool for anxiety for autistic individuals with ID, which will then be validated by comparing scores on this measure to consensus clinical diagnosis.

83 **111.083** Can Screening Measures for Autism in Adults Predict Diagnosis?

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Background: Clinic referrals for the diagnosis of autism spectrum conditions (hereafter autism) in adults of average or above IQ are on the rise. The increase is placing pressure on clinical services to meet demand. This may partly reflect under-diagnosis of this subgroup of autism for historical reasons. Screening measures at the point of referral may aid adult services to identify those individuals who are highly likely to receive a diagnosis, enabling more efficient diagnostic procedures.
Objectives: We tested three screening measures: the Autism Spectrum Quotient (AQ) and Empathy Quotient (EQ) (both self-report), and the Relatives Questionnaire (RQ) (retrospective, parent/informant-report version of the Childhood Autism Spectrum Test) to establish which measure or combination of measures best predicted a clinical diagnosis of autism in adults.

Methods: We conducted a retrospective case review of 460 adults attending a specialist diagnostic service between January 2011 and December 2014 in England. They had been screened using the AQ, EQ, and RQ. The criterion for a diagnosis of autism was a score of >10 on the Adult Asperger Assessment (AAA) in combination with expert clinical judgement.

Results: 88% (N= 405) of the adults assessed met the criterion for a diagnosis of autism, with those who were diagnosed scoring, as predicted, significantly higher on the AQ and RQ and lower on the EQ. 9.8% (N=45) reached the cut-off score on only one measure, and 35% (N=161) reached the cut-off score on 2 measures. 51.3% (N=236) met the cut-off score on all 3 measures. Meeting the cut-off on all three measures indicated a 98% likelihood of a clinical diagnosis of autism in assessed individuals.

Conclusions: The findings from this study confirm that the combination of all 3 screening measures strongly predicts diagnosis, compared with using one or two measures alone. The results have clear implications for future research into the development and performance of short-forms of the 3 measures and the examination of the 3-measure screening protocol to inform more efficient diagnostic pathways. With a combined PPV of 98% services can be confident that those who do screen positive on all three measures are in fact likely to be affected by the condition. Screening profiles of referrals can be triaged for progressing to an accelerated assessment for those screening positive on all measures, saving resources for the more complex referrals, or those with an atypical screening presentation.

84 **111.084** Characterizing Potential Implementation Processes and Influences in a Community Effectiveness Trial of Standardized Pediatric Screening for ASD

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Background: Children with autism spectrum disorder (ASD) who start treatment earlier have better outcomes; although universal toddler screening can detect many cases of ASD much younger than the national average (Robins et al., 2014), inconclusive outcome data means standardized screening is not always recommended (Siu et al., 2016). A current randomized trial aims to fill this gap, connecting the dots between the screening and treatment literatures, and demonstrating that standardized, high-fidelity, universal screening lowers the age of diagnosis and

treatment onset, leading to improved short- and long-term outcomes. If the study has positive outcomes, a remaining challenge will be the translation of standardized screening into usual pediatric care. Currently, even when physicians report using ASD screening methods, they are not using evidence-based methods to ensure accurate identification of ASD risk.

Objectives: The purpose of this paper is to capitalize on this effectiveness trial to undertake an in-depth examination of implementation factors impacting standardized use of the Modified Checklist for Autism in Toddlers with Follow up (MCHAT-R/F) using the Exploration, Preparation, Implementation and Sustainment (EPIS) framework.

Methods: An implementation researcher is conducting semi-structured interviews with the MCHAT-R/F developers and experts from the three study sites across the recruitment and early implementation phases of the project to gather first-hand accounts potential facilitators and barriers to screening implementation process. An interview guide was developed by independent implementation scientists to gather PI and coordinator perspectives on barriers and facilitators to MCHAT-R/F adoption and early implementation. Transcripts are analyzed in an iterative process using the "coding, consensus, co-occurrence and comparison" methodology rooted in grounded theory (Williams et al., 2009).

Results: Preliminary results suggest that both outer and inner context factors influenced study participation and implementation across study sites and practices. Preliminary analyses indicate the adoption phase was influenced by perceived value of universal screening by physicians and access to timely evaluation and treatment. Implementation barriers included challenges with integrating the screening into workflow and time. Specific influences including leadership, site, provider and patient factors will be described across the preparation and implementation phases.

Conclusions: Standardized ASD screening implementation in community pediatric offices is a complex process involving interactions between intervention developers, and community stakeholders including systems, organizations, and providers. The use of the EPIS framework helps to identify and organize both outer and inner context factors that may impact implementation across the phases of the process. Data gathered during this efficacy trial will provide recommendations for future scale up of universal screening.

85 **111.085** Childhood Autism Screening Test (CAST) As a Screening Tool for ASD: Utility in a Community Population in Lagos, Nigeria

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Background:

Autistic spectrum disorder (ASD) is routinely screened during childhood in developed countries but still missed in developing countries. With increasing awareness about ASD, it has become pertinent for us to use simple tool to assist in early identification due to scarcity of manpower especially in our rural communities.

Childhood Autism Screening Test (CAST) a screening instrument developed as a combination of behavioural symptom of ASD according to International Classification of Disease (ICD-10) and Diagnostic and Statistical Manual fourth edition (DSM-IV) has been widely used in western societies. A few studies have reported use among African-American but none among Africans.

Objectives: To determine the utility of CAST for screening for ASD among individuals with neurodevelopmental disorders in Lagos state, Nigeria

Methods:

Participant were recruited during an annual community screening for autism and other neurodevelopmental disorders which is a collaboration between a bank, Blazing Trail International USA (a Non-Governmental Organization) and Centre for Autism and Neurodevelopmental Disorders (CAND-Do) of the College of Medicine, University Lagos. Participants were reached via mails, radio jingles, word of mouth and text messages. They were screened in stages using a sociodemographic questionnaire, CAST for those aged 4 and above and diagnosis was based on DSM V criteria for ASD. A score of 15 and above was used to determine positivity on CAST.

Results:

A total of 268 participants attended the screening exercise. Two hundred and eighteen individuals were attending for the first time (81.3%). More than three quarters were eligible for CAST (76.9%) and majority of them (83%) completed CAST. Sensitivity is 70.8%, specificity 60.4% and positive predictive value 52.3%.

Conclusions:

CAST was found to be a user friendly instrument with high specificity and sensitivity in diagnosis of ASDs. It should be considered for larger validation study for autism in Africa.

86 **111.086** Clinical Profiles of Children with Early Diagnosis of Autism Spectrum Disorder

ABSTRACT WITHDRAWN

Background: Early identification of developmental disabilities is a high priority for the WHO to allow action to reduce impairments through Gap Action Program on mental health. In India, early diagnosis of developmental disorders in children is a challenge on account of poor awareness about developmental milestones, delayed help seeking behavior of parents, poor compliance to well baby clinic visits and limited resources. The average age of diagnosis in India, according to published studies, ranges from 42 months to 55 months.In cities of India, however the scenario is changing on account of higher education, awareness among parents and referring pediatricians and need to seek timely help from Pediatricians. The centre at which the current study was conducted has seen a drop of average age of referral from 5 years and above for children suspected of Autism Spectrum Disorder in 20012 to 3.7years in 2017.

Objectives: To provide a review and meta-analysis of children referred with high index of suspicion for ASD.

Methods: Sample was obtained from a multidisciplinary child development centre in Mumbai, India. Children diagnosed with ASD (based on DSM V) or with a provisional diagnosis of Autism Spectrum Disorder were included in the study. Detailed developmental pediatric evaluations included pre natal, peri natal history and assessment of neurodevelopmental achievement. These children underwent a trans-departmental evaluation which included a Neurodevelopmental exam by a Developmental Pediatrician, hearing evaluation, DSM V and DQ/IQ evaluation by qualified Psychologists, Occupational Therapy and Speech and Language evaluation. Retrospective quantitative analysis revealed key findings.

Results:

915 children were referred to the centre in the year 2017 with developmental concerns. Of these, 260 children underwent a DSM V Evaluation for ASD (Mean Age 3.7 years).55 percent children were above 3 years of age and 113 (43%) children were below 3 years of age and had a provisional diagnosis of ASD. Majority of the children (75%) had moderate degree of autism. 13%of these children had mild autism and 11%had severe degree of autism. 27 percent children had an NICU stay most commonly due to neonatal hyperbilirubinaemia.

A similar study at the centre in 2016 showed **98.3%** had no significant neonatal event. About 46 percent of mothers had an antenatal illness in the form of hypothyroidism, PIH, anaemia or infections. The average age of the mother at the time of delivery was 29 years. 32 of the 260 children had average DQ/IQ.86 children had mild subnormality, 48 had moderate subnormality and 11 had severe subnormality in social or intellectual functioning.

Conclusions: Increasing number of children referred at an early age with high suspicion of ASD in metropolitan cities of India necessitates rigorous follow up to provide holistic intervention programs and harness their developmental potential during critical period of brain develpoment. the study emphasises the need to longitudinally map the course of these early diagnosed group for assessing stablity of diagnosis and measure outcomes of intervention when compared to late diagnosis group.need for large scale training of trainers across the country and a model worth emulation for other developing countries.

87 **111.087** Cognitive Control Development in Autism Spectrum Disorder: Can Rdoc Help Us to Better Understand Behavioral Phenotypes and Pathophysiology?

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Background:
Many individuals with Autism Spectrum Disorder (ASD) exhibit executive function deficits which persist into adolescence and young adulthood, and map closely to RDoC Matrix components of cognitive control (CC). Adolescents and young adults with typical development (TYP), show significant increases in functional connectivity (fc) between the lateral prefrontal (LPFC) and parietal cortices which is thought to permit mature levels of goal maintenance and response inhibition. Implementing an RDoC perspective to examine CC development holds the potential to provide insights related to ASD phenotypes, pathophysiology, and treatment-matching.

Objectives:

To initiate an RDoC-oriented examination of CC in ASD by: 1) Determining the proportion of those with ASD who are impaired in CC compared to those with TYP, 2) Investigating the neural correlates of cognitive control in ASD who are compared to those with TYP with better and poorer task performance, and 3) Examining whether the reduced fronto-parietal connectivity associated with attention deficit hyperactivity disorder (ADHD) symptoms is also found in ASD (Solomon et al., 2009).

Methods:

Participants included 56 individuals with ASD (mean age = 18.4; mean IQ = 104), and 70 individuals with TYP (mean age = 18; mean IQ = 109) from the first wave of a cohort-sequential study of CC in youth ages 12-22 years. We implemented a rapid event-related version of the Preparing to Overcome Prepotency (rPOP) task during scanning. Seed to voxel whole brain fc analyses were implemented using PPI in the CONN fc toolbox (http://www.nitrc.org /projects/conn). Dorsolateral prefrontal cortex (DLPFC) and dorsal anterior cingulate (dACC) seeds were used. ADHD symptoms were assessed using the ASEBA.

Results:

Both ASD and TYP were slower to respond to red versus green trials, with a greater RT difference in ASD ($F(1, 123) = 4.4$, $p<.05$). Two thirds of participants with ASD showed red-green RT greater than the TYP mean and were grouped as poorer performers (n=37; ASD-poorer); remaining participants were grouped as better performers (n=19; ASD-better). There were no univariate differences in neural activation between ASD or TYP. TYP versus ASD-better showed greater recruitment of temporal cortical regions at the cue, with no other diagnostic group differences across the performance groups. TYP exhibited more extensive fc between CC network regions than ASD throughout the task, while ASD showed more connectivity between prefrontal and posterior regions that was inversely associated with task performance. At the probe, TYP versus ASD also showed increased DLPFC fc with the insula and left inferior frontal gyrus. ASD-better showed fc more similar to TYP. Fronto-parietal connectivity was not associated with ADHD symptoms.

Conclusions:

CC deficits were not universal in ASD. Univariate analyses illustrated that the ASD, TYP, and better and poorer performers, exhibited minimal differences in neural recruitment during the task. Greater differences were found in fc where TYP engaged more extensive networks traditionally associated with preparatory control (ACC, parietal cortex), and response inhibition (insula), which were also used by ASD-better. Results thus far, suggest that support for RDoC CC in ASD is equivocal, however, developmental and other analyses are ongoing.

88 **111.088** Cognitive and Adaptive Profiles in Three Single-Gene Causes of Autism Spectrum Disorder and Idiopathic Autism Spectrum Disorder with Intellectual Disability

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Background: Phelan-McDermid syndrome (PMS), ADNP syndrome, and FOXP1 syndrome represent three of the most common single gene causes of autism spectrum disorder (ASD) and intellectual disability (ID). As genetic testing becomes more accessible, a broader spectrum of individuals

with single-gene causes associated with ASD are presenting to clinics, however, little is known about the cognitive and adaptive profiles of individuals with single-gene causes of ASD who are able to complete standardized measures of intellectual functioning and how those results compare to individuals with idiopathic ASD (iASD) and ID.
Objectives: To compare cognitive and adaptive profiles in children with iASD and ID relative to children with single-gene causes of ASD and ID.

Methods: Participants included 20 children with a single-gene causes associated with ASD including PMS (n=10), FOXP1 syndrome (n=7) and ADNP syndrome (n=3) and 15 children with iASD and ID. Participants were between the ages of three and 17 with full scale IQs below 70. Participants were selected based on their ability to complete standardized IQ testing as measured by the Stanford Binet Intelligence Scales, Fifth Edition, Wechsler Intelligence Scales for Children, Fifth Edition, or Differential Ability Scales, Second Edition. Those unable to complete age-appropriate IQ tests and one individual with single-gene ASD without ID were excluded from analyses. Adaptive functioning was measured using the Vineland Adaptive Behavior Scales, 2nd and 3rd Editions.

Results: There were no significant differences between single-genes associated with ASD and single-gene groups on verbal IQ (VIQ; *p*=.81), nonverbal IQ (NVIQ; *p*=.97), or full scale IQ (FSIQ; *p*=.43). Within and across groups, VIQ and NVIQ were similarly developedFSIQ ranged from 40-68 in the single-gene group (*M*=50, *SD*=9.34) and 40-69 in the iASD group (*M*=53 *SD*=10.54). Results from the Vineland indicated no significant differences on the Adaptive Behavior Composite (*p*=.47) or within individual domains (*p-values* >.13). Considering each single-gene group independently, the ADNP group was reported to display weaker communication skills relative to other groups, while socialization and daily living skills were reported as similarly developed across groups.

Conclusions: Our findings suggest similar cognitive and adaptive profiles in children with single-genes associated with ASD and mild-to-moderate ID compared to children with iASD and mild-to-moderate ID. Verbal and nonverbal abilities were equally developed in both groups, which diverges from reports of better developed NVIQ than VIQ in a number of ASD studies inclusive of individuals with a broader range of cognitive ability. Data collection in single-gene causes is ongoing and future studies will examine whether single-gene specific cognitive or adaptive profiles emerge.

89 **111.089** Comorbidity in Females Referred for Clinical Autism Spectrum Disorder (ASD) Evaluation

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Background: Studies comparing males and females with ASD show females display higher levels of impairment in social communication, lower levels of restricted and repetitive behaviors and interests, poorer cognitive functioning, and weaker adaptive skills (Frazier et al., 2014). Although females diagnosed with ASD typically present with more deficits than males with ASD, less is known about the presentation of females presenting for clinical assessment of ASD.
Objectives: To compare females with and without ASD and comorbid diagnoses on overall presentation (i.e., age, cognitive score, language score, and ADOS comparison score).

Methods: Data regarding 107 females were selected from a database of clinical evaluations conducted by licensed clinical psychologists between 2006 and 2017. All individuals had been referred for a clinical ASD evaluation at a tertiary care clinic. (Final sample sizes: 107 for age, 87 for cognitive, 74 for language, and 107 for ADOS comparison) The dependent variable was clinical consensus diagnosis (using the ADOS-G/2, ADI-R, and clinical opinion) with and without comorbid diagnoses (other behavioral, medical, and developmental diagnoses by history and/or direct clinical observation). The sample was split into four groups: ASD-No Comorbidity, Non-ASD-No Comorbidity, ASD-Comorbidity, and Non-ASD-Comorbidity. Independent variables included age at evaluation, language score (using the CELF 3/4, CELFP-2, OWLS, and PLS 3/4/5), ADOS comparison score, and cognitive score (using the WISC-IV, Leiter-R, DAS, DAS II standard total IQ scores or ABAS Parent or Teacher forms, AGS Self-Help Profile, and Vineland I/II).

Results: The mean age at evaluation of the sample was 5.76 (*SD* = 2.81). The sample consisted of 49.5% white, 31.8% non-white, and 18.7% unknown. Overall, 54% of the sample had no other reported diagnoses. The mean cognitive score for the sample was 74.28 (*SD* = 18.05), while the mean language score was 67.66 (*SD* = 20.18). No significant group differences were found except that girls diagnosed with ASD received higher ADOS comparison scores than those with non-ASD for both single diagnosis and comorbidity groups (see Table 1 and Table 2). When compared between ASD and non-ASD without sorting for comorbidity, only ADOS comparison score was significant (p<0.001).

Conclusions: Results suggest that the ADOS comparison score was the most distinguishing feature within this referred sample of females. Furthermore, girls with multiple diagnoses did not present differently in terms of language and cognitive ability compared to girls with a single diagnosis. This may be due to low power given the small sample size, as means indicate girls with ASD may have lower cognitive and language standard scores in the comorbid and no-comorbid groups. The overall cognitive and language skills mean, while not significant between groups, was considered below average indicating significant deficits. This suggests that females with moderate to mild deficits may be missed and not referred for evaluation. It is important to understand the characteristics of this population and recruit more females with ASD for research, as it may help in identifying females earlier, and correctly identifying females with and without developmental concerns using high quality assessments and shortening waitlists.

90 **111.090** Comparing the Perspectives of Service Users and Clinicians on the Characteristics of Current and Optimal Autism Diagnostic Assessment Services for Adults

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Background: a diagnosis of autism spectrum disorder can give insight into an individual's strengths and difficulties. However barriers to accessing adult autism diagnostic pathways have been identified. In 2012 the UK NICE guideline (142) advised on ways to facilitate timely and accurate diagnosis of autism in adults.

Objectives: this study aims to (1) examine the characteristics of current services as described by multidisciplinary team clinicians and autistic adults and relatives accessing UK diagnostic assessment services within the last 5 years (2) compare these perspectives with service specifications described in NICE guidance, and clinicians' consensus view on the characteristics of optimal services, and (3) reach a consensus about optimal services that can be commissioned.

Methods: 346 adults receiving an autism spectrum diagnosis completed a national survey about their experiences of the diagnostic process, and possible adjustments; 46 relatives completed a parallel survey. 36 UK diagnostic teams were surveyed to capture the characteristics of current services, and suggestions about modifications. A modified Delphi survey process was then used to seek consensus on the characteristics of optimal diagnostic services. Data analysis comprised content analysis, plus descriptive statistics, tests of correlation, difference and agreement.

Results: the median age of autistic adults was 44 years (and 41 years at diagnosis, range 18-89); 54% of respondents were female. Two thirds reported a mental health condition (55% anxiety; 54% depression). 79% of adults said their assessment was appropriate to their gender and age; and 74% of adults reported that consideration was given to their sensory needs. Not all clinical services had resources to make adjustments; 92% of diagnostic teams said their assessment process was the same for men and women. Clinical consensus agreement was reached on 11 statements describing optimal autism diagnostic services including the following: that services should provide individuals on the waiting list with periodic updates about the waiting time for assessment (a third of diagnostic teams reported waiting time from referral to first diagnostic assessment was within the recommended 12 weeks); that information about what to expect during the diagnostic assessment should be provided to individuals before their assessment (currently 36% of adults reported receiving this); that services should always try to gather information from someone who knows/knew the person well; should include a clinician with expertise identifying mental health conditions; and should include someone 'trained in the use of a standardised observational tool so it can be used if needed'. Multidisciplinary assessments were not always possible nor was access to third party reported developmental history. A large role of diagnostic teams was delivering training to clinical and other agencies; providing training on a commissioned rather than ad hoc basis was identified as a characteristic of optimal services.

Conclusions: information from autistic adults and clinical services about the characteristics of current services, and consensus views on optimal services identified are important for informing service providers, policy makers, and commissioners of services. We anticipate the findings will lead to improvements in autism diagnostic services, ensuring they meet the needs of service users and clinical teams.

91 **111.091** Comparison of M-CHAT-R and Itsea Scores in an Early Detection Sample of Children with ASD

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Background:

Early intervention is associated with positive long-term outcomes for individuals with Autism Spectrum Disorder (ASD; Landa 2018). In response to growing evidence promoting the value of early detection, researchers have developed measures designed to identify ASD in young children. Comparing results from screening tools to more comprehensive questionnaires that characterize developmental domains provides insight into the areas of common dysfunction that screeners identify. Understanding the domains that screening tools are likely to detect can inform the initial conceptualization of the child's developmental profile.

Objectives:

To compare the Modified Checklist for Autism in Toddlers, Revised (M-CHAT-R), an effective screener for ASD risk, and the Infant-Toddler Social and Emotional Assessment (ITSEA), a questionnaire to characterize social emotional behaviors, in infants who were diagnosed with ASD. Specifically, to test the hypothesis that an increased M-CHAT-R total score correlates with ITSEA domains and subscales that exhibited a pattern of impairment in the ITSEA ASD validity sample (Social Relatedness and Atypical Item Clusters; Competence Domain; Negative Emotionality, Depression/Withdrawal, Eating subscales; Carter & Briggs-Gowan 2006).

Methods:

Infants participating in a multi-site early detection study were screened at 18-month checkups with the M-CHAT-R (Robins et al. 2009). Children who screened positive on the M-CHAT-R or another screener or were referred based on provider concern attended a diagnostic evaluation that included the ITSEA (Carter & Briggs-Gowan 2006). Data were included for infants (n=89, age=21.83 (*SD*=4.65) months) who met ICD-10 criteria for Childhood or Atypical Autism based on the Autism Diagnostic Observation Schedule, Second Edition (Lord et al. 2012) and clinical judgment. The M-CHAT-R is a 20-item screening measure designed to identify risk for ASD. Parents respond to Yes/No questions based on the usual behavior of their child. The ITSEA is a 166-item questionnaire with 4 domains and 17 subscales designed to evaluate social emotional behaviors. Items are rated on a 3 point scale (0=not true/rarely, 1=somewhat true/sometimes, 2=very true/always). Scores were skewed, so Spearman correlations were calculated between M-CHAT-R total scores and ITSEA scores.

Results:

Significant associations were found between M-CHAT-R scores and the ITSEA Competence Domain (ρ=-.48, p<.001). With the exception of Prosocial Peer Relations, all subscales within the Competence Domain were related to M-CHAT-R scores (p<.05). Other correlated ITSEA subscales included Peer Aggression (ρ=.25, p=.025), Depression/Withdrawal (ρ=.31, p=.003), Sensory Sensitivity (ρ=.22, p=.040), and Sleep (ρ=.22, p=.039). M-CHAT-R scores also significantly related to Maladaptive (ρ=.23, p=.033), Social Relatedness (ρ=-.37, p<.001), and Atypical (ρ=.47, p<.001) Item Clusters.

Conclusions:

Findings support the hypothesis that M-CHAT-R scores for children who are subsequently diagnosed with ASD relate to impairment on the Social Relatedness and Atypical Item Clusters, as well as the Competence Domain and Depression/Withdrawal subscales. Interestingly, the M-CHAT-R scores were also associated with Peer Aggression, Sleep, Sensory Sensitivity, and Maladaptive scores. These findings suggest that the M-CHAT-R is sensitive to some core symptoms of early ASD, including atypical social relatedness, compliance, attention, sensory, and sleep difficulties, but does not reflect other problems that may be present, including negative emotionality or eating problems.

92 **111.092** Concordance between Community Supervisor and Provider Ratings of Fidelity: Examination of Predictors and Outcomes

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Background:
Fidelity is a key mechanism impacting treatment outcomes (McLeod et al., 2013), yet community examination is limited, partly due to limited feasible tools for community use (Schoenwald et al., 2011). Provider-report represents a feasible method for improving routine fidelity monitoring, but this method may be biased, with limited concordance with other fidelity measures (Hurlburt et al., 2010). The literature points to several provider and client factors known to impact both evidenced-based intervention implementation (Aarons et al., 2011) as well as interrater concordance (Dickson et al., 2018) but their impact on fidelity measurement is poorly understood. Further, data exploring the impact of concordance on provider's actual implementation are limited.

Objectives:

The objectives of this study are to examine the impact of these factors on concordance, data were drawn from a train-the-trainer study evaluating the feasibility of an adapted fidelity tool for pivotal response training (PRT) developed for community use.

Methods:

Participants were five supervisors enrolled with corresponding therapist-child dyad participants. PRT intervention sessions (N=110; M=6.4 per therapist) were independently coded by supervisors and therapists using our PRT fidelity tool, which involved rating therapist fidelity using a 3-point Likert scale (1- limited/no use; 3-appropriate use). Trained observational coders coded recorded sessions, which served as the "research-standard" for fidelity comparison. Concordance was examined using percent of agreement in fidelity ratings. Predictors of concordance included: child cognitive and language level, autism symptom severity, therapist education and experience.

Results:

Results suggest variable but good concordance (Mean supervisor-coder = 61.11%; Mean therapist-coder =53.74%), with a trend towards supervisor-coder concordance being significantly higher than therapist-coder agreement ($t(109)=1.97$, $p=.05$). Child language level had a marginal impact on therapist-coder agreement. Therapist years' experience also impacted on supervisor-coder and therapist-coder agreement. Therapist education also impacted therapist-coder agreement. Finally, supervisor-coder agreement predicted provider PRT implementation.

Conclusions:

Our results suggest that supervisors and therapists were able to learn to use our PRT fidelity tool, providing initial support for its feasibility. Therapist and child factors impacted the use of this tool and supervisor accuracy predicted therapist implementation, highlighting the importance of considering cross-level factors impacting the adoption and implementation of fidelity tools.

93 **111.093** Construct Validity of the ASRS in a Non-Clinical Diverse Sample

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Background: For accurate identification of autism spectrum disorder (ASD), the selection ofappropriate, valid, and reliable measures is critical. This is particularly crucial when conducting ASD evaluations for culturally and linguistically diverse (CLD) populations. Research suggests Latino children are less likely to receive diagnosis than their White peers, and Black children are diagnosed at older ages than White children (Centers for Disease Control, 2006). ASD identification disparities have also been documented in the educational identification of ASD (Sullivan, 2013). If a child with ASD identified is late or incorrectly, they are missing critical early intervention services.
The majority of service providers use rating forms during ASD evaluations. One of the more utilized rating forms is the Autism Spectrum Rating Scales (ASRS; Goldstein & Naglieri, 2010). The ASRS measures ASD related symptoms, behaviors, and features using parent and teacher reports. Although there are several forms, the current study focuses on the ASRS Parent Form (6-18). The manual reports strong reliability and satisfactory content and criterion validity. An exploratory factor analysis (EFA) was conducted to determine construct validity. Results from the EFA suggested a three-factor structure that measures Social/Communication (SC), Unusual Behaviors (UB), and Self-Regulation (SR) as seen on the rating scales. Notably, no confirmatory factor analysis (CFA) was conducted to corroborate this.

Objectives: The purpose of this research was to investigate the factor structure of the ASRS in a diverse sample and compare said factor structure across subsamples in a non-clinical sample.

Methods: Parents (N=405) with children between the ages of 6 and 18 participated in the current study. Participants identified as Black (n=181), Latino (n=106), or White (n=181). Participants were recruited through Amazon's Mechanical Turk. Following consent, participants completed demographic information and the ASRS. Internal consistency analyses and multiple CFA were performed.

Results: All three subscales exhibited high internal consistency in the combined sample. However, the CFA fit was poor for the combined and all three subsamples, with Black and Latino subsamples displaying the worst fit. Latent factor correlations were similar for the combined and White samples, although Black and Latino subsamples exhibited higher correlations between SR and UB (r=.95 and .93) subscales. SC was differentially related to the SR and UB subscales across subsamples. Subgroup CFAs also revealed disparities in the loading of two items across groups.

Conclusions: Results do not support the three-factor model found in the initial EFA (Goldstein & Naglieri, 2010). This may imply that the factor structure of the ASRS is not comparable across racial/ethnic groups. The high correlation between SR and UB subscales in Black and Latino subsamples may suggest that these latent factors are differentially related across subsamples. Results also suggest the social communication construct may differ across groups. Furthermore, some items may be more or less important in measuring ASD symptoms across groups. Future research specific to the ASRS should investigate measurement invariance, differential item functioning, and the role of core symptoms of ASD across various racial/ethnic groups.

94 **111.094** Correlation between Severity and Cognitive Functioning in Autism Spectrum Disorder

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Background: Previous research has shown that the severity of autism spectrum disorder (ASD) is associated with general intelligence (Coplan, 2003). Intellectual functioning and ASD severity varies on a case-by-case basis.
Objectives: The current study investigated the relationship between General Conceptual Ability (GCA) on the Differential Ability Scale, Second

Edition (DAS-II) and severity of ASD. It was expected that GCA and ASD severity would be associated.

Methods: Participants included 160 children diagnosed with ASD (Males n= 123, females n= 37) and data was collected over a two-year period from a community-based developmental assessment clinic in South Florida. Ages of the participants ranged from two to nineteen years. Participants were assessed using the DAS-II and the Autism Diagnostic Observation Schedule, Second Edition (ADOS-II).

Results: As hypothesized, there was a significant negative correlation (r=-.334, p<.01) found between the two variables.

Conclusions: These results suggest that as ASD severity increases, general conceptual ability decreases. These findings provide useful information to inform prognosis and intervention strategies (Coplan, 2003). These findings may also help to inform appropriate treatment plans based on severity of ASD symptoms and cognitive functioning.

95 **111.095** Cortisol, Sleep and Heart Rate Variability in Resting Neurotypical and Autistic Adults

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Background: The autonomic nervous system modulates heart rate via two antagonistic systems: sympathetic and parasympathetic. Individuals with an autistic spectrum disorder (ASD) are reported to display high sympathetic activity and atypical diurnal cortisol secretion patterns.
Objectives: The objectives of the present study were two-fold: a) to compare evening and morning cortisol levels in ASD and typically developing (TD) adults; b) to explore the association between cortisol, self-reported sleep habits and heart rate variability (HRV).

Methods: Sixteen unmedicated ASD adults (22.0±3.7 years, 15M, 1F) without sleep complaints, intellectual disability and psychiatric nor neurological comorbidity were compared to 17 TD healthy participants (21.7±4.0 years, 16M, 1F). Five salivary cortisol samples were collected in the evening and two in the morning, 20 minutes apart. Sleep latency, nocturnal awakenings, total sleep time and sleep efficiency were assessed by self-reports. The electrocardiogram was recorded in the evening and in the morning to compute low (LF) and high (HF) spectral frequencies. Cortisol and HRV parameters were compared using two-way ANOVAs (ASD vs TD X evening vs morning). Sleep parameters were compared between the 2 groups using independent Mann-Whitney U tests. Pearson correlations between cortisol levels, sleep measures and HRV parameters were calculated.

Results: Groups did not differ on cortisol levels. Compared to the TD group, ASD self-reports showed longer sleep latencies (38.6±12.6 vs 13.3±2.3 minutes; p<0.01), longer nocturnal awakenings (11.6±3.3 vs 2.5±0.8 minutes; p<0.01), lower sleep efficiencies (90.2±3.3 vs 95.3±1.6 %; p=0.01) but same total sleep time (7.9±0.3 vs 8.0±0.2 hours). Morning HF values were higher in ASD than TD (p=0.05). In the TD group, higher evening cortisol levels correlated with longer nocturnal awakenings (r=0.7; p=0.02); higher morning cortisol levels correlated with longer total sleep time (r=0.7; p=0.02), lower morning LF (r=-0.9; p=0.002) and higher morning HF (r=0.9; p=0.002). No significant correlations were found in the ASD group.

Conclusions: Only the TD group showed significant correlations between cortisol levels, sleep and HRV. The lack of significant correlations in the ASD group could reflect the presence of poor self-reported sleep despite the lack of complaints or an alternative coupling between neuronal and endocrine mechanisms of sleep control in ASD.

96 **111.096** Creation of a Novel Measure to Assess Social Motivation in Youth with Autism Spectrum Disorder

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Background: Diminished social motivation in ASD has been conceptualized as a trait marker that influences the emergence and maintenance of ASD symptomology. Measurement of social motivation to date has largely relied on indices of overt social behavior with little regard for the cognitive processes that can influence goal-directed tasks involved in social interaction. Understanding internalized cognitive processes may distinguish underlying motivations which influence engagement in social behavior. This study aims to assess how beliefs, mindsets, and attitudes can influence one's motivation to engage in social interaction.
Objectives: The primary aim of the present study was to create and evaluate a novel measure of social motivation for youth aged 8-17 with ASD.

Methods: A two-phase study design was adopted. Phase 1 created and refined an interview item pool based on expert consultation. The content validity index (I-CVI) was used to quantify expert feedback and establish construct integrity. Phase 2 conducted pilot testing and established psychometric properties of the measure from an item response theory (IRT) framework.

Results: The Social Motivation Interview (SMI) is a theoretically-informed, clinician-administered interview designed to assess interest or desire to engage in social situations. To establish content validity, each item of the SMI was evaluated by a panel of 5 experts ($M_{years\ of\ experience}$ = 20.33, *SD* = 10.89, *Range* = 7-40). I-CVI ratings < 0.667 were revised or deleted. After external review, twenty-three items were retained for the final iteration of the SMI, with items loading on two distinct subscales. Clinicians assigned a rating for each item on a latent continuum.

Eighteen individuals with ASD (M_{age} = 12.84, *SD* = 2.61, *Range* = 8-17, 4 female) and their caregivers jointly participated in the pilot psychometric evaluation of the SMI. Participants were communicative (M_{IQ} = 100.12, *SD* = 18.0, *Range* = 63-127) and had a clinical diagnosis of ASD, confirmed by a research-reliable administration of the ADOS ($M_{Comparison\ Score}$ = 7.44, *SD* = 1.98). SMI administration was brief (M_{mins} = 45, *Range* = 21-60) and the scale had strong internal consistency (α = 0.96). The spread of scores was adequate, *M* = 19.889 (*SD* = 13.634, *Range* = 4-53). Discriminant validity was demonstrated as the total score was not significantly correlated with age, r (17) = 0.020, p = 9.83. Convergent validity was satisfactory as measured by the correlation with the ADIS- ASD Social Motivation Subscale, r (17) = 0.49, p = 0.04. The Standard Error of Measurement (SEM) was 2.98. Participant acceptability ratings were high (*M* = 4.50, out of 5).

Conclusions: The development of the SMI followed stringent criteria to create a unified measure that was methodologically sound and theoretically-informed. SMI development followed guidelines to ensure item pool development was consistent with the proposed construct. Pilot testing suggests feasibility of administration, user satisfaction, and promising psychometric properties. Future examination of the SMI in large-scale field testing is warranted.

97 **111.097** Delays in Motor Milestones Do Not Differ between Children with Autism Spectrum Disorder (ASD) with and without Co-

Occurring Developmental Coordination Disorder (DCD) and Children with DCD Alone

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Background: Motor symptoms in ASD have long been acknowledged by clinicians and documented using standardized motor assessments of gait, balance, and coordination (Ozonoff et al., 2008). Under DSM-5 guidelines (APA, 2013), Developmental Coordination Disorder (DCD) and Autism Spectrum Disorder (ASD) can be diagnosed as co-occurring (ASD+DCD). There is emerging literature demonstrating neurobiological (Caeyenberghs et al., 2016) and behavioral (Caçola et al., 2017) similarities and a high rate of co-occurrence (Miller et al., under review). However, the treated prevalence of ASD+DCD remains low, and the specific overlap between motor symptoms of ASD, DCD, and ASD+DCD is unknown.
Objectives: Our aim was to assess differences in developmental milestone acquisition among patients with ASD, DCD, and ASD+DCD in a local children's hospital network. We expected that all three groups would have delayed gross and fine motor skills. We hypothesized that the ASD and ASD+DCD groups would have greater delay in age of acquisition for language than the DCD-only group, but the groups would not differ in age of acquisition for fine motor skills, activities of daily living (ADL), or gross motor skills.

Methods: We retrospectively evaluated electronic medical record (EMR) from 1994 to 2018 for patients who were 0-21 years old at the time of first chart entry, with a diagnosis of DCD or ASD+DCD. The number of patients since 1994 was 6,003 (ASD = 5,520, DCD = 424, ASD+DCD = 59). We conducted preliminary analysis on a subset of charts (2007-2018), with a total sample size of 2,239 (ASD = 2010, DCD = 205, ASD+DCD = 24). We collected data using a REDCap form including primary and co-occurring diagnoses, age in months at which patients met developmental milestones, and demographics as part of a larger study.

Results: We used multivariate analysis of variance to test diagnostic group (ASD, DCD, ASD+DCD) differences in age of developmental milestone acquisition (Table 1). Patients did not differ in age of acquisition for either gross motor or fine motor/ADL skills. The DCD group had an average age of language acquisition 12.36 months earlier than the ASD group.

Conclusions: The lack of group differences in age of acquisition for gross and fine motor skills supports our hypothesis that motor problems are profound in ASD. For many children, these likely warrant a co-occurring DCD diagnosis. This may lead to more targeted interventions for delayed or impaired motor skills greatly improving outcomes and quality of life (Blauw-Hospers & Hadders-Algra, 2005). Motor delays were similar between the ASD and DCD group, but the DCD group did not exhibit language delays. The link between ASD and DCD appears specifically rooted in motor skills, rather than reflecting global developmental delays. Missing information in the EMR limited our sample size, particularly for the ASD+DCD group where the treated prevalence was already quite low. This study highlights the need to clarify overlap versus independent presentation of motor symptoms in these two disorders.

98 **111.098** Development of T-STAT for Autism Spectrum Disorder Screening Under 2 Years Old

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Background: Prevalence of autism spectrum disorder (ASD) has increased markedly. Previous studies reported that early intervention improved outcomes for toddlers with ASD (Dawson et al., 2010; Landa et al., 2011). The benefits of early intervention highlighted the importance of earlier identification of toddlers with ASD. Due to the importance of early identification, the American Academy of Pediatrics has recommended that all infants receive universal screening for autism less than 24 months old (Johnson et al., 2007). However, the diagnosis of ASD is still often delayed because diverse factors, including limitations in utility of screening instruments etc. There are few level 2 screening tools to distinguish ASD from other developmental disorders for toddlers before 24 months.
Objectives: The current research, there are two studies to test utility of using the Screening Tools for Autism in Two-Year-Olds, Taiwan version (T-STAT) (Chiang et al., 2012) for toddlers with autism spectrum disorders (ASD) from 18 to 24 months of age.

Methods: The T-STAT is a 12 items interactive autism-specific screening tool, including four behavioral domains: play (2 items), requesting (2 items), joint attention (4 items) and imitation (4 items). Within both play and requesting, if a toddler fails one item, he would receive a score of 0.50. Within both joint attention and imitation, if a toddler fails one item, he would receive a score of 0.25. The scores of four domains are from 0 to 1. The scores of four domains are summed, obtaining a total T-STAT scores which from 0 to 4.

Results: Study 1, there are 32 toddlers, including 16 toddlers with ASD and 16 toddlers with developmental delayed (DD). A diagnosis of ASD by a research team based on the DSM-5 criteria (Frazier et al., 2012). Using signal detection procedures, the optimal cutoff of the total T-STAT score was decided. The results revealed that 2.5 was the best cutoff, the sensitivity and specificity are 1.00 and 1.00, respectively. Study 2, there are 137 toddlers, including 62 toddlers with ASD and 75 toddlers with DD. Using the 2.25 as cutoff, the sensitivity and specificity were .92 and .80, respectively. In addition, PPV is .84 and NPV is .92. Using the 2.50 as cutoff, the sensitivity and specificity were .89 and .84, respectively. In addition, PPV is .80 and NPV is .92.

Conclusions: The T-STAT is a promising good tool to differentiate the toddlers with ASD and toddlers with DD.

99 **111.099** Development of a Brief Screening Tool for Repetitive Behaviors and Restricted Interests

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Background:
Repetitive behaviors and restricted interests (RB/RIs) have proven a difficult construct to accurately and validly measure, in part due to the heterogeneity of RB/RI symptom presentation by demographic and clinical characteristics. Additional work is needed to understand phenomenology and further refine existing measures.

Objectives:

The present study aimed to (1) use an existing measure of RB/RIs (Repetitive Behavior Scale – Revised; RBS-R) to identify RB/RIs that are present among individuals with ASD regardless of cognitive level, gender, or age and (2) propose a brief screening instrument for RB/RIs.

Methods:

Participants included cross-sectional data compiled from the National Database for Autism Research, Autism Genetic Resource Exchange, and Simons Simplex Collection (N=3203). To evaluate frequency of endorsement across demographic and clinical characteristics, the sample was divided into 6 age and cognitive subgroups (age<6 & NVIQ<70, age 6-12 & NVIQ<70, age>=12 & NVIQ<70, age<6 & NVIQ>=70, age 6-12 & NVIQ>=70, age>=12 & NVIQ>=70), and 3 language subgroups based on ADOS module administered (Module 1 – single words, Module 2 – two word phrases, Module 3/4 - fluent speech). RBS-R item responses were recoded as either symptom present or absent. Items were selected as possible screening items if 50% of 5 of the 6 NVIQ/age subgroups (N=14) and all 3 of the ADOS subgroups (N=5) endorsed the item.

Results:

The sample included N=3203 participants with a diagnosis of ASD. Participants were 84% male, 67% Caucasian, 8.97 years of age on average (*SD* = 3.85; range 2-33), and had an average NVIQ of 83.36 (*SD* = 27.26). A total of N=14 of the 43 RBS-R items were endorsed by at least 5 of the 6 NVIQ/age subgroups and N=5 items by all 3 of the ADOS subgroups. The final item set included items that were endorsed by both at least 5 of the 6 age/NVIQ subgroups and all 3 of the ADOS subgroups (N=5). These items included "sensory (e.g., covers eyes)", "becomes upset if interrupted in what he/she is doing", "likes the same movie/music played continually", "resists changing activities/difficulty with transitions", and "fascination/preoccupation with one subject or activity". These 5 items represented 3 of the 6 RBS-R subscales (stereotyped behavior, sameness behavior, restricted behavior). If the selection criteria were modified to include items endorsed by 2 of the 3 ADOS subgroups, "eating/mealtime (e.g., eats/drinks items in a set order)", and "communication/social interaction (e.g., repeats same topics during social conversation)" would also be included (subscale: ritualistic behavior).

Conclusions:

The present study supports the variability in presentation of RB/RIs by age, cognitive level, and language level. Despite the substantial differences in symptom presentation, there are several RB/RIs – notably sensory sensitivity - that are endorsed across individuals with ASD of different ages, cognitive abilities, and language levels. The items have the potential to serve as a more uniform screening tool for assessment of RB/RIs. Future work should confirm the results in other large population-based samples and determine if items can discriminate between ASD and other neuropsychiatric disorders that are characterized by repetitive behaviors (e.g., OCD).

100 **111.100** Development of the Stanford Social Dimensions Scale (SSDS): Initial Validation in Autism Spectrum Disorder

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Background: Social motivation theory has been put forward as a useful framework for understanding the emergence of social impairments in autism spectrum disorder (ASD), highlighting deficits in social motivation as a potentially important target for treatments. However, despite the noted prominence of the construct, there is a paucity of instruments specifically designed to capture individual differences in social motivation. Objectives: To provide an initial validation of a newly developed instrument—the Stanford Social Dimensions Scale (SSDS), designed specifically to capture individual differences in different components of social motivation as well as along other distinct dimensions of social functioning in a quantitative and comprehensive manner.

Methods: Parents of 167 individuals with ASD (age range: 2-17 years) completed the SSDS, the Social Responsiveness Scale (SRS-2) and the Child Behavior Checklist (CBCL). Data on children's verbal and non-verbal intellectual functioning (VIQ, NVIQ) was also collected.

Results: Exploratory Structural Equation Modelling indicated that a five-factor model provided adequate to excellent fit to the data (comparative fit index [CFI]= .940, Tucker Lewis Index [TLI]= .919, root mean square error of approximation [RMSEA]= .048 [90% CI: .039, .056], standardized root mean square residual [SRMR]= .038). The identified five factors were interpreted as Social Motivation, Social Affiliation, Expressive Social Communication, Social Reception and Unusual Approach. Internal consistency was in the good to excellent range as indicated by Composite Reliability scores of ≥ .72. Convergent and divergent validity across all SSDS scales was strong as indexed by the pattern of correlations with relevant SRS-2 and CBCL domains and with NVIQ and VIQ scores.

Conclusions: Ability to capture this phenotypic heterogeneity and identify individual patterns of strength and weakness across different domains of social functioning is an essential step in informing personalized intervention and case management plans as well as prediction of long-term outcomes. Our findings provide initial validation of a new scale designed to comprehensively capture individual differences in social motivation and other key social dimensions in ASD.

101 **111.101** Developmental Changes in Sensory Profiles in Autism Spectrum Disorder and Williams Syndrome

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Background: Autism spectrum disorder (ASD) and Williams syndrome (WS), a rare genetic neurodevelopmental disorder associated with mild to moderate intellectual disability (ID), can be seen as contrasting disorders in the social interaction domain, with clear deficits present in ASD and hypersociability in WS. Yet, the disorders have many similarities, including sensory atypicalities, which play an important role in the manifestations of both conditions.
Objectives: The aim of this study was to compare the sensory patterns and modalities of children and adolescents with ASD, WS and typically developing individuals, and explore differences in sensory symptoms across different age groups. Comparison of sensory patterns and modalities of individuals with ASD (with and without additional ID), to those presented in WS and in typically developing (TD) children, will allow us to explore syndrome-specific characteristics which are crucial to the formulation of theories of sensory processing.

Methods: Parents of 149 children between 3 and 16 years of age of whom 44 were TD, 73 had an ASD diagnosis (37 had additional ID) and 32 had WS, completed the Sensory Profile (SP; Dunn, 1999) to provide information about their children's sensory experiences.

Results: Two multivariate analysis of variance (MANOVA) were conducted with the four sensory processing patterns and five sensory modalities as repeated measures, with diagnostic group (WS, ASD with ID, ASD no ID, TD) and age (3 categories: under 6,5 years old; between 6,5–9,5 years old;

above 9,5 years old) as between-group factors.

There was a significant sensory processing pattern by group effect ($F_{(9, 51)}$ = 2.76, p = 0.01), indicating that there were significant differences between the participants across different diagnostic groups on sensory processing pattern scores. No significant main effect of age or interaction between group and age was found. In addition a main effect of sensory modality by group ($F_{(12, 72)}$=7.51, p<.001) was found. Finally a significant interaction was found between sensory modality and age ($F_{(8, 72)}$=2.40, p=.024).

To test for specific differences, a two-way ANOVA was conducted separately for each of the sensory symptoms and Bonferroni post-hoc tests were applied. For all sensory features the TD group had significantly higher (more typical) scores than the WS, ASD with ID and ASD without ID groups. No significant main effect for age was found for either sensory processing patterns or sensory modalities. Two significant group by age category interactions were found – for auditory ($F_{(6, 134)}$=4.04, p=.001) and visual ($F_{(6, 134)}$=2.48, p=.026) modalities.

Conclusions: Children with ASD and WS have very similar sensory profiles that are distinct from those present in TD children. Similar levels of sensory atypicalities in WS and ASD across both sensory processing patterns and sensory modalities across age groups suggests that sensory difficulties remain a persistent characteristic of both disorders in childhood and adolescence. Further investigation is needed to examine whether a decrease in severity of sensory symptoms takes place in adulthood.

102 **111.102** Developmental and Autism-Specific Screening Practices Among Primary Care Providers

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Background: Early identification of autism spectrum disorder (ASD) is essential for facilitating access to early intervention. However, the average age of ASD diagnosis in the United States is over 4 years, with many parents waiting ≥3 years between first concerns and diagnosis. The use of standardized screening tools is more accurate for early identification than informal discussion or clinical judgment alone, and the Academy of Pediatrics (AAP) recommends systematic general developmental screening at all 9, 18, and 24- or 30-month well-child visits (WCVs) and autism-specific screening at all 18- and 24-month WCVs. However, in the decade since these guidelines were published, the extent to which they have been adopted has not been directly examined. A few studies have used self-report surveys to estimate developmental screening practices; however, potential response bias and/or difficulties with recall may limit the accuracy of these estimates.

Objectives: The study objectives were to: 1) directly examine the extent to which primary care providers (PCPs) are administering developmental and autism-specific screenings at regular well-child visits in accordance with AAP-recommendations, and 2) examine potential provider-level factors that are associated with screening practices, including provider type, years of practice, previous autism training, and self-efficacy regarding ASD screening.

Methods: Participants included 114 PCPs enrolled in a larger study of a new ASD training program. The sample included general pediatricians (72%) and other PCPs (28%) providing care for underserved children in 14 states. Data collected at baseline (prior to training) were examined in the current study, including demographic information and self-efficacy regarding autism screening and identification. Screening practices were directly assessed through chart review for all 9, 18, 24, and 30-month WCVs in the 30 days prior to the date of chart review. Note that most PCPs did not conduct WCVs for all age ranges within the 30-day baseline assessment window.

Results: Regarding general developmental screening, 64% (57/89) of PCPs administered tools at all 9-month WCVs, 62% (54/87) at all 18-month WCVs, 57% (50/88) at all 24-month WCVs, and 73% (40/55) at all 30-month WCVs. Regarding ASD-specific screening, 52% (45/87) administered tools at all 18-month WCVs, and 42% (37/88) at all 24-month WCVs. Neither PCP general developmental screening practices (percentage of relevant visits in which screening tools were used) nor ASD-specific screening practices varied by provider type (pediatrician vs. other). Providers with prior training in ASD demonstrated similar use of ASD-specific screening tools compared to those with no prior training, and years of experience were not significantly associated with ASD screening. However, PCP-reported self-efficacy regarding autism screening and identification was significantly associated with percent of children the PCP screened for ASD at month 18- and 24-month WCVs (r=0.3, p=0.002).

Conclusions: AAP guidelines for developmental and ASD-specific screening have not been uniformly adopted in actual practice, ranging somewhat across visit timepoint and screening tool. Screening practices do not appear to be related to provider type or experience, but providers with greater self-efficacy regarding ASD screening had greater use of ASD screening tools. Results suggest a need for PCP training in screening implementation.

103 **111.103** Diagnostic Accuracy of the ADOS-2

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Background: The Autism Diagnostic Observation Schedule, 2nd Edition (ADOS-2) is an observational assessment component for the identification of autism spectrum disorder (ASD). The ADOS-2 has come into routine use and is widely regarded as the gold standard for the diagnostic classification of ASD across clinical and educational settings. Nevertheless, very little independent research has examined the diagnostic accuracy of the ADOS-2.

Objectives: The aim of this study was to examine the sensitivity and specificity of the ADOS-2 when used as part of the standard clinical evaluation of children referred to a specialty diagnostic clinic to identify or rule out ASD.

Methods: A total of 155 available reports from the Autism Assessment Clinic at the University of Vermont Medical Center were reviewed representing modules 1 through 4 of the ADOS-2. All ADOS-2s were administered by a speech-language pathologist specializing in ASD who had extensive training in the ADOS-2 and the diagnosis of ASD. Final clinical diagnosis was made following a multidisciplinary team assessment including a child psychiatrist, child psychologist, and speech-language pathologist. ADOS-2 data were submitted to a series of 2X2 contingency tables to calculate the classification accuracy of the instrument by module.

Results: Overall accuracy across modules was 70.4% (sensitivity = 90.9%; specificity = 66.0%) with a high rate of false positives (27.9%). Overall accuracy tended to decrease as module number increased (module 1 = 90.9%; module 2 = 93.9%; module 3 = 62.5%; module 4 = 58.8%). The most common non-spectrum diagnosis for children classified as ASD by the ADOS-2 for modules 2 – 4 (approximately 88%) was ADHD and anxiety.

Conclusions: The ADOS-2 can provide valuable information to a diagnostic team for the clinical evaluation of a child with ASD, however, for the higher modules and in settings where children with numerous developmental disorders are evaluated, the specificity of the instrument is low and the risk is an unacceptable rate of over-identification.

104 **111.104** Diagnostic Assessment of Autism Spectrum Disorder: A Cross-Disciplinary Analysis

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Background: Currently, there are no known biological markers that can accurately diagnose Autism Spectrum Disorder (ASD) (Huerta & Lord, 2012). As such, diagnosis generally relies on behavioural observations and assessment. While best practice guidelines exist (Anagnostou et al., 2015; Volkmar et al., 2014), very little is known regarding the actual assessment and diagnostic practices of clinicians who diagnose ASD. The limited research that does exist, indicates that assessment practices are variable, dependent on the clinician's profession (i.e., medicine or psychology), and may not adhere to best practices such as multidisciplinary team assessment or the use of standardized assessment measures (Skellern, McDowell, & Schluter, 2005; Taylor et al., 2016; Ward, Sullivan ,& Gilmore, 2016). This paucity in research is troubling, given that an ASD diagnosis has major implications for individuals being diagnosed, as well as for their families, providing access to a variety of supports and services.
Objectives: The purpose of this study was to examine the assessment procedures of Canadian psychologists and physicians who diagnose ASD in childhood. In addition, the study aimed to ascertain whether these assessment procedures changed depending on the perceived or actual cognitive functioning of the child they were assessing.

Methods: Participants from two professions: psychology and medicine were recruited using snowball sampling. To recruit Canadian psychologists and physicians, professional associations throughout Ontario were contacted and asked to disseminate the study to their members. Participants were asked to complete an online questionnaire regarding their assessment and diagnostic practices including their professional experience, multidisciplinary team use, their broad assessment procedures, as well as their use of specific ASD assessment tools. Sixty-two participants (41 psychologists and 23 physicians) completed the survey.

Results: Assessment and diagnostic practices of the participants varied depending on their profession. Psychologists indicated a greater reliance on standardized measures of intelligence, adaptive functioning, and ASD symptomatology. Physicians reported a greater reliance on unstructured observation, as well as on medical testing (i.e., genetic and audiological assessment). Both groups reported relatively low levels of multidisciplinary team involvement, and those who did indicated that a second member of their own profession was most often part of their assessment team. Both groups reported a greater reliance on unstructured observation as well as use of the Childhood Autism Rating Scale (CARS) when assessing children with lower perceived cognitive abilities, and a greater reliance on the Autism Diagnostic Interview- Revised (ADI-R) when assessing children with average or above perceived cognitive abilities.

Conclusions: The current study highlights the need for further investigation into the assessment and diagnostic practices of clinicians who diagnose ASD. Inconsistent assessment methodologies between diagnosticians could result in decreased diagnostic reliability, impacting both clinical and research initiatives. For instance, failure to rely on best practice could result in a child not receiving needed intervention services. Further, given the variation in assessment procedures based on the cognitive abilities that was reported, the study highlights the need for research into the utility of assessment battery variations based on a child's cognitive ability.

Poster Session
112 - Early Development (< 48 months)
11:30 AM - 1:30 PM - Room: 710

105 **112.105** The Effects of Multimodal Behaviors from Parents on Children's Sustained Attention: A Dual Eye-Tracking Study in Naturalistic Child-Parent Social Interaction

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Background: Sustained attention has traditionally been studied as an endogenous ability of a child (Mundy & Newell, 2007), but recent work suggests that it is socially modulated. Utilizing wearable eye trackers to study the dynamics of parent-child play, Yu & Smith (2016) found that typically-developing (TD) infants sustained their attention on toys for longer when the parent looked to the toy at the same time as compared to when the infants looked at the toy alone. Particularly, infants sustained their attention most when the parent *looked* at, *touched*, and *talked* about the toy to which they were attending (Suarez-Rivera et al., 2018). This paradigm has yet to be extended to study if and how sustained attention is modulated by parent behavior in children with autism spectrum disorder (ASD).
Objectives: The current study aims to determine whether young children with ASD (24-to-48-months-old) modulate their attention as a function of their parent's attention compared to age-matched TD children while engaging in toy play. We will investigate (1) if coordinated parental attention extends sustained attention in both groups and (2) if different combinations of parent behaviors – looking, touching, and talking – relate to differential increases in sustained attention.

Methods: Child-caregiver dyads played with 24 toys in a toy room space while wearing head-mounted eye-trackers (Figure 1). Each dyad was given the toys to freely play with, and encouraged to play as they would at home. Sustained attention moments were defined as child looks to toys that were 3 seconds or greater. Sustained attention moments were "coordinated" if the parent joined the child in looking at the toy and were "solo" if the child looked alone. Coordinated sustained attention moments were further divided based on their co-occurrence with parent touch and talk.

Results: Data was acquired from 19 dyads in the ASD group and 17 dyads in the TD group. The groups did not differ in the amount of the play session spent in sustained attention (Figure 2a) or in the amount of sustained attention spent in coordination with a parent (Figure 2b) (all *p*s>0.47). Both groups showed an extension of sustained attention with coordinated attention from a parent compared to when attending alone (Figure 2c) (all *p*s>0.04), and there were no differences between groups in this extension (p=0.15). A linear mixed effects model revealed a significant main effect of parent behavior type (p<0.01). However, there was no effect of group and no interaction effect of group by parent

behavior in the extension of sustained attention (all *ps*>0.15).

Conclusions: In the current study, we leveraged dual head-mounted eye-tracking to demonstrate the feasibility of studying naturalistic parent-child interaction with young children with ASD. Our preliminary results show present social modulation of sustained attention in children with ASD. Further, sustained attention is extended similarly by different parent behavioral cue combinations in the ASD group compared to the TD group. Future studies will examine how variability in social modulation during naturalistic play may relate to language abilities and symptom profile to inform individualized targets for intervention.

106 **112.106** Associations between the Home Language Environment, Maternal Education, and Naturalistic Response to Joint Attention in Infants at High and Low Familial Risk for ASD

I. Stallworthy[1], *M. Swanson*[2], *S. R. Dager*[3], *A. Estes*[3], *H. C. Hazlett*[2], *R. T. Schultz*[4], *J. Piven*[5], *J. T. Elison*[6] *and K. Botteron*[7], *(1)Institute of Child Development, University of Minnesota, Minneapolis, MN, (2)University of North Carolina, Chapel Hill, NC, (3)University of Washington, Seattle, WA, (4)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (5)*Co-Senior Authors, IBIS Network, University of North Carolina, Chapel Hill, NC, (6)University of Minnesota, Minneapolis, MN, (7)Washington University School of Medicine, St. Louis, MO*

Background:

Responding to joint attention (*RJA*), or the ability to respond to cues from another to share attention to an object, is a pivotal socio-cognitive milestone in infancy. RJA abilities are associated with social and language outcomes later in childhood (e.g., Morales et al., 2000). Moreover, early deficits in RJA are a hallmark of autism spectrum disorder (ASD; Mundy et al., 1986).

Some studies have found that specific caregiver behaviors such as attention-directing styles (Tomasello & Farrar, 1986), persisting tendencies (Saxon & Reilly, 1999), and sensitivity (Hobson et al., 2004) are associated with RJA. However, little is known about the impact of more global aspects of the home environment, like the amount of caregiver speech. Furthermore, despite associations between RJA and language outcomes, it is unclear whether the home environment contributes to both abilities early in development.

Objectives:

To begin to fill these gaps, the current study investigated associations between two aspects of the home environment, language exposure and conversational turns, and RJA in infants at high (HR) and low (LR) risk for ASD. We hypothesized that both language exposure and conversational turns would positively predict RJA for all infants.

Methods:

We measured RJA using the Dimensional Joint Attention Assessment (*DJAA;* Elison et al., 2013). This measure characterizes individual differences in infants' RJA abilities using 4 series of hierarchically ordered joint attention bids varying in cue redundancy. Higher DJAA scores (range 0-4) reflect the ability to respond to subtler, less redundant bids (i.e., gaze shift and head turn cues, vs. gaze shift, head turn, and verbal cue) for joint attention. The DJAA was administered during naturalistic play at 58 assessments of 12- to 15-month-old infants (N=52; 29 HR, 23 LR).

The home language environment was measured at age 15 months using small language recorders worn by the infants in their homes. Adult word counts (AWC) and conversational turn counts (CTC) were quantified using automatic voice detection software and natural log transformed for analyses.

Results: Table 1 contains descriptive statistics. Regression analyses indicated a positive relationship between AWC and mean DJAA scores ($t(42)=2.86$, $p=0.006$). Additionally, infants of college-educated mothers received higher DJAA scores than infants whose mothers were not college educated ($t(42)=2.01$, $p=0.051$). Lastly, a significant interaction suggested that the relationship between AWC and DJAA scores was strongest for infants of non-college-educated mothers ($t(42)=-2.01$, $p=0.050$; Figure 1). Average CTC did not predict mean DJAA scores, and none of these measures differed by ASD risk.

Conclusions: Preliminary results suggest that characteristics of the home environment may relate to RJA. While the number of infant-caregiver conversational turns had no influence, more adult words heard in the home was associated with greater RJA sophistication, particularly for infants whose mothers did not have a college degree. These findings suggest that the influence of more global environmental features may vary by family socio-economic status, acknowledging that shared genetic factors may shape aspects of the home environment. Future work seeks to replicate these findings and examine some of the more proximal factors driving our results.

107 **112.107** Parent Reported Regression in Autism Spectrum Disorder: Characteristics, Early Development and Later Outcomes.

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Background: Previous retrospective research on regression in ASD has produced conflicting results caused by divergent definitions and methodologies. Although development prior to regression is assumed to be typical, evidence has been found for early delays. Besides, mixed results have been reported concerning whether children with regression experience better or worse long-term outcomes. These inconsistencies explain the shift towards prospective studies of infants at risk which provide evidence for declining trajectories for the majority of children with ASD. However, as there are no practical alternative approaches to retrospective parent report, it remains the most commonly used method to study early development. Different strategies to improve this method need to be developed since examining regression in ASD could be of significant diagnostic and therapeutic value.

Objectives: Our first objective is to explore the characteristics of onset patterns reported by parents. In the present retrospective study, different strategies (e.g., use of developmental records) have been applied to deal with parent report reliability. Second, our goal is to confirm whether early delays are already present prior to regression. Third, we investigate outcomes in terms of severity of ASD-symptoms, language and motor skills.

Methods: Parents have reported on the early development of 100 children with ASD (M age=7.57y,SD=1.95,range=3-11y,71% boys) through a questionnaire (EDQ) and interviews (ADI-R+RSQ). Current outcomes have been examined using parent (SCQ,SRS-2,N-CDI) and teacher (SRS-2) reports as well as standardized (WNV,CELF,ABC-M-2) and observational (ADOS-2) measurements. Group differences between children who have ever experienced a regression (ASD-R;n=36), or a regression before 36 months (ASD-R≤36M;n=24), or no regression (ASD-NR;n=64) have been

mutually investigated.

Results: Regression concerning language and social skills before 36 months has been reported for 24% of the children and 12% of the children lost skills after 36 months. Four percent showed plateau only, mainly in language skills, starting at a mean age of 30 months.
During early development, ASD-R and ASD-R≤36M have shown a similar amount of social atypicalities and repetitive and stereotyped behaviours as compared to ASD-NR. However, ASD-R have shown significantly less early communication skills compared to ASD-NR (t(98)=2.593,p=<.013,d=.53). Kaplan-Meier survival analyses have revealed no significant differences between the three age groups for their first steps and words, but a significant difference has been detected for first sentences between ASD-NR and ASD-R≤36M (24 vs. 33 months;$\chi^2(1)=6.640,p=<.05$).
With regard to later ASD characteristics, ASD-R≤36M and ASD-R have shown significantly more restricted and repetitive behaviours as compared to ASD-NR (U(88)=1,226.50,p=<.002,d=1.03 and U(100)=1,629.00,p=<.002,d=.73, respectively). Lastly, no significant differences have been found between ASD-NR, ASD-R≤36M and ASD-R concerning later cognitive, language and motor skills.

Conclusions: Generally, children with and without regression seem to develop in a similar way prior to regression. However, children with regression show less communication skills: a finding that may be a valuable predictor. Further, children that regress, turn out to experience a more deleterious outcome later in life, characterized by early language delays and more repetitive and stereotyped behaviour. The findings of the present retrospective study merit further investigation through prospective longitudinal studies with high-risk siblings of children with ASD.

108 **112.108** To Lose or Not to Lose: Developmental Pathways to Regression in Rett Syndrome

ABSTRACT WITHDRAWN

Background: Rett syndrome (RTT) is an X-linked genetic disorder that occurs predominantly in females, with a period of regression characterized by loss of purposeful hand use and the decline of verbal and other socio-communicative abilities.
Objectives: The objectives of this exploratory study are: (i) to depict atypical neurofunctions in the first two years of life and define potential early behavioural biomarkers pinpointing RTT before the onset of regression; (ii) to reveal developmental trajectories including the acquisition and loss of functions in the following developmental domains: motor development, speech-language and socio-communicative development; and (iii) to develop a vocalisation-based automated detection approach.
Methods: Utilizing a novel pattern recognition approach, we applied a signal-analytical paradigm to assess video footage of the prodromal development of individuals later diagnosed with RTT (intelligent audio analysis on retrospective data; Marschik et al., 2017). Moreover, early motor development was analysed with the standardised General Movement Assessment (GMA; e.g., Einspieler et al., 2017; Novak et al., 2017). Verbal utterances were linguistically captured following established schemes of vocalisation categorisation (e.g., Nathani et al., 2006) and socio-communicative functions are evaluated referring to classifications of the Inventory of Potential Communicative Acts (IPCA; Sigafoos et al., 2006). Data are extracted from our large-scale database GUARDIAN (Pokorny et al., 2016), comprising – besides prospectively collected data – home-video material of children with various neurodevelopmental and genetic disorders (N=118; n=40 with RTT or the preserved speech variant of RTT: PSV; n=52 with autism spectrum disorder: ASD) and typically developing children (TD; total n=33).
Results: Adding to recent findings, we observed atypical neurofunctions in the above-mentioned domains in the pre-regression development of individuals with RTT or PSV: abnormal general movement patterns, a marker for the integrity of the developing nervous system, were observed in all individuals. Atypical pre-linguistic vocalisations were present in 100% of the analysed sample already during the first year of life. As a predecessor of breathing irregularities, atypical inspiratory vocalisations while cooing or babbling were found in 70% of the individuals. A limited repertoire of communicative forms and functions as well as a reduced volubility and complexity of pre-linguistic vocalisations were present in all participants. Intelligent audio analyses automatically differentiating individuals with RTT or ASD versus TD individuals revealed recognition accuracies of 87.9% for RTT and 75% for ASD. Spectral vocalisation parameters, such as Mel-frequency cepstral coefficients, spectral flux, or the Hammarberg index, yielded the highest differentiation effects. Decline of communicative forms and functions and loss of purposeful hand use coincided with an increase of prototypical hand stereotypies. The spontaneous motor repertoire and the productive and receptive verbal abilities in concert point to different developmental disease pathways: (i) developmental milestones are achieved and functions deteriorate or are lost (regression); and (ii) an increase in atypical behaviours and the lack of achievement of expected functions mimic developmental 'regression' (pseudo-regression).
Conclusions: Our results are promising towards defining reliable neurofunctional markers for an early (automated) detection of RTT, unravelling within-syndrome traits, and distinguishing developmental trajectories. Our exploratory findings question the prevailing understanding of regression in RTT.

109 **112.109** Loss of Skills in Genetic Conditions Associated with ASD: Findings from the Developmental Synaptopathies Consortium.

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Background: While literature on regression, or loss of skills, in ASD is mostly informed by studies of samples considered "idiopathic," studies are starting to explore if and how specific genetic conditions present with distinct patterns of symptom onset or loss. While we know that regression is pathognomonic for some neurodevelopmental conditions such Rett Syndrome (Neul et al., 2014), large data sets and data from specific genetic conditions with risk factors that may elicit loss of skills (e.g., seizures) require exploration using existing definitions of patterns of onset. Such studies will inform if and how patterns of onset of delays and ASD symptoms in specific conditions compare with those seen in idiopathic ASD. Individuals with the conditions studied in the Developmental Synaptopathies Consortium display risk factors for loss of skills, including high rates of early onset epilepsy in Tuberous Sclerosis Complex and Phelan-McDermid Syndrome.
Objectives: The purpose of this study was to investigate milestone attainment and loss of skills in youth with Phelan-McDermid Syndrome (PMS), Tuberous Sclerosis Complex (TSC) and PTEN hamartoma tumor syndrome (PHTS).

Methods: Inclusion criteria for this analysis were that the child was able to walk independently, and that the child received an Autism Diagnostic Interview-Revised (ADI-R). Out of 98 participants with PMS, 82 were included (mean age 9±5 years, 54% male; 63% with a clinical ASD diagnosis). The TSC sample included 72 of 98 (mean age 8±5 years, 60% male; 54% with a clinical ASD diagnosis), and the PHTS included 28 of 40 (mean age 9±4 years, 79% male; 84% with a clinical ASD diagnosis). The ADI-R was used to determine rates and patterns of skill attainment and loss. In addition to questions pertaining to timing of first concerns, age of walking and age of first words, questions pertaining to language loss (Q11), general loss of other skills (Q20) and loss of social responsiveness (Q25) are reported.

Results: In all groups, the majority of parents reported that with hindsight, their child had exhibited behavioral or developmental problems in the first year of life (PMS, 66%; TSC, 74%; PHTS, 85%). Attainment of milestones and rates of skill loss are shown in Table 1 and indicate that loss was reported in 48% of the PMS group, 35% of the TSC group and 43% of the PHTS group. A fuller description of risk factors relating to these onset patterns, areas of loss, and current functioning in these cohorts will be provided.

Conclusions: A significant percentage of children in all three genetic condition groups were reported to have significant early delays in both language and motor domains, but also have parent report of lost skills, at rates that appear as high, if not higher than found in idiopathic ASD, using similar definitions as previous ASD studies. These findings raise further questions about the relationship of loss of skills to the existence of prior delays, and to the relationship of regression to specific genetic etiologies.

110 **112.110** 2-Year-Olds with Autism Spectrum Disorder Direct a Smaller Proportion of Vocalizations Toward Others

L. D. Yankowitz[1], *S. Plate*[1], *J. Parish-Morris*[1], *S. Gregory*[1], *N. Park*[1], *A. Song*[1], *L. A. Wang*[1], *N. Marrus*[2], *M. Swanson*[3], *S. S. Meera*[4], *J. Pandey*[1], *J. C. Chappell*[3], *L. Flake*[2], *T. St. John*[5], *H. C. Hazlett*[3], *K. Botteron*[2], *J. N. Constantino*[2], *S. R. Dager*[5], *L. Zwaigenbaum*[6], *J. Piven*[7] *and R. T. Schultz*[1], *(1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Washington University School of Medicine, St. Louis, MO, (3)University of North Carolina, Chapel Hill, NC, (4)Carolina Institute of Developmental Disabilities, University of North Carolina at Chapel Hill, Carrboro, NC, (5)University of Washington, Seattle, WA, (6)University of Alberta, Edmonton, AB, Canada, (7)*Co-Senior Authors, IBIS Network, University of North Carolina, Chapel Hill, NC*

Background: Socially-directed vocalizations such as cries, laughter, and babbling are early infant communicative signals that, when atypical or diminished, could indicate risk for autism spectrum disorder (ASD). Importantly, vocalizations can be socially directed before words are acquired, and may carry information about social development across a variety of populations, from typically developing to language-delayed. Despite the clinical relevance of socially directed vocalization in young children with ASD, only a small number of studies have quantitated rates of socially directed vocalizations in infants at high familial risk (HR) for ASD. Additionally, relationships between quality of early vocalizations and social directedness of early vocalizations have not been systematically studied. This relationship is important to understand in HR populations given evidence that toddlers with ASD produce atypical rates of speech-like versus non-speech vocalizations, relative to non-ASD peers.
Objectives: To test whether the proportion of socially directed vocalizations differs in HR toddlers with ASD vs. without ASD, and measure whether rates of social directedness differ between groups separately by vocalization type (speech-like and non-speech).

Methods: Participants were 10 LR and 20 HR (10 HR-ASD; 10 HR- [non-ASD]) 2-year olds from the Infant Brain Imaging Study (IBIS). Groups were matched on Mullen Visual Reception score, maternal education, and sex ratio. Audio-visual recordings of the Communication and Symbolic Behavior Scales (CSBS) administration were available for all participants. Using ELAN, two trained raters segmented child vocalizations as (1) speech-like, (2) non-speech, and (3) vegetative (excluded from analysis). Discrepancies in segmentation and annotation were resolved through consensus. Child vocalizations were further classified as socially directed or non-directed on the basis of orienting, use of gesture, making a request, or responding to a question, by two raters with discrepancies resolved by a third rater. Inter-rater reliability was acceptable for ratings of speech-like, non-speech, and vegetative vocalizations (Cohen's κ=0.74) and directed versus non-directed vocalizations (κ=0.65). Proportions of directed vocalizations out of the total number of vocalizations were treated as dependent variables in linear regressions with diagnosis as a dummy-coded factor, with ASD as the reference group.

Results: There were no significant differences between ASD, LR and HR- for recording duration, vocalization rate, or proportion of speech-like to non-speech vocalization. The ASD group produced a significantly smaller proportion of socially directed vocalizations (M=0.40, SD=0.14) than the LR group (M=0.53, SD=0.12, p=0.04, Cohen's d=1.0), and a marginally smaller proportion than the HR- group (M=0.52, SD=0.15, p=0.05, d=0.83). The ASD group also directed a significantly lower proportion of non-speech vocalizations (M=0.28, SD=0.09) than LR (M=0.49, SD =0.20, p=0.007, d=1.35), but not HR- (M=0.36, SD=1.7, p=0.25). The ASD group trended toward a smaller proportion of directed speech-like vocalizations (M=0.42, SD=0.15) compared to LR (M=0.54, SD=0.10, p=0.07, d=0.94) and HR- (M=0.54, SD=0.15, p=0.07, d=0.8).

Conclusions: This study provides preliminary evidence that when 2-year-olds with ASD vocalize, they direct fewer of their vocalizations toward others than typical peers. With additional video annotation (ongoing), we aim to increase our sample size and test interactions between diagnostic group, vocalization type, and manner of social directedness.

111 **112.111** A Behavioral-Physiological Approach to Characterizing Emotion in Infants at Risk for Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is associated with impaired emotion regulation. Emotion regulation is defined as the ability to maintain homeostasis in response to positive and negative events. Prospective research on the early development of ASD has shown that infants at risk for ASD have difficulty regulating their emotional states by 12 months of age. The early control of emotion may be critical to the development of later social-communicative abilities and, consequently, may affect the onset and progression of ASD symptomatology. Given that emotion regulation is a multicomponent process, a behavioral-physiological approach is warranted to study the role of emotion regulation in the emergence of ASD.
Objectives: The objectives of this study were to determine (1) the relation between behavioral affect and heart-rate during an emotion regulation

task, and (2) whether behavioral affect and/or heart-rate predict ASD symptom expression in a high-risk (HR) infant sibling cohort.

Methods: *Participants:* Participants, drawn from an ongoing longitudinal study of early development of ASD, were 35 HR infants with an older sibling with ASD. Infants were assessed at 12 months of age. *Emotion Regulation*: The emotion regulation task, adapted from the Laboratory Temperament Assessment Battery, is comprised of activities designed to elicit positive (bubbles, toy play) and negative (toy removal, masks, grooming) emotions (Goldsmith et al., 1996). Infant behavioral affect was coded using Noldus Observer software. Affect was coded for valence (positive, negative, or neutral) and intensity (to differentiate mild/moderate displays from intense displays of affect). Raw heart-rate was recorded and extracted from an electrocardiogram signal using Thought Technologies Procom5 Infiniti. The data were processed and transformed into a metric of average change in heart-rate from baseline. *ASD Symptom Expression*: The Autism Observation Scale for Infants (AOSI; Bryson et al., 2007), a clinician-led observational assessment, was used to measure early signs of ASD. *Analytical Approach:* Average values were calculated for behavioral affect and heart-rate across 5-second time bins. Data were analyzed using a series of Spearman rank-order correlations to determine the (1) relation/congruence between behavioral affect and heart-rate, and (2) relation between affect intensity and heart-rate with AOSI total score.

Results: A significant correlation between behavioral affect and heart-rate was found for the grooming activity (r_s=-0.458, p=0.003), but not other emotion-eliciting activities (p's>0.05; Table 1). Behavioral affect was significantly correlated with AOSI total score for bubbles (r_s=-0.692, p<0.001), toy play (r_s=-0.337, p=0.026), and grooming activities (r_s=-0.337, p<0.026). No significant correlations were observed between heart-rate and AOSI total score on any emotion-eliciting activities (Table 2).

Conclusions: The results suggest modest congruence between behavioral affect and heart-rate indices of emotion regulation in 12-month-old HR infants. Behavioral affect during the positive and negative emotion-eliciting activities was correlated with concurrent ASD symptom expression in HR infants, whereas heart-rate was not. Further work is warranted on modeling physiological responses to tasks eliciting various emotions in HR infants. Using this approach, we may be able to discern behavioral and physiological differences between infants who are diagnosed with ASD from those who are not.

112 **112.112** A Novel Measure for Quantifying Infant Engagement during Social Interactions with Their Caregivers

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Background: Infant-caregiver interactions provide the ideal framework for social learning: as infants engage with their caregivers, caregivers, in turn, modify their behavior to the needs of their infant, creating cycles of contingency that scaffold infants' emerging abilities. These reciprocal social exchanges are highly engaging to typically-developing (TD) infants: they display positive affect, and often become distressed when the contingency is removed (Tronick et al., 1975). By contrast, reduced engagement with the social world is not only a defining feature of Autism Spectrum Disorder, but may also be a significant contributor to emerging social disability, as active engagement during reciprocal exchanges is a necessary condition for social learning to occur (Rose et al. 2011). Unfortunately, few quantifiable, objective measures of infant engagement exist, limiting inquiry into this important area.

The present study capitalizes on previous reports of TD infant engagement during contingent social interaction to test whether patterns of eye-blinking can be used as a measure of infant engagement. This method is based on the fact that eyeblinks interrupt the flow of visual information; as a result, viewers unconsciously adjust the timing of their own eye-blinks to minimize the likelihood of missing important information. Consequantly, the more engaged the viewer is, the more likely they will be to inhibit blinking (Shultz, Klin, & Jones, 2011, *PNAS*). This measure could provide new inroads for quantifying the subjective experiences of infants as they interact with their caregivers, enabling future research into disruptions to foundational mechanisms of social learning in ASD.

Objectives: To determine if patterns of eye-blinking can be used to measure engagement during contingent and non-contingent social interactions in 3- to 5-month-old TD infants.

Methods: Eye-tracking data were collected from 3- to 5-month-old TD infants (N=14) while viewing 3 conditions: 1) a prerecorded non-contigent video of a stranger; 2) a live video feed of the infant's caregiver (see Figure 1); and 3) prerecorded non-contingent videos of the infant's caregiver. Mean blinks per minute (bpm) were calculated and compared across conditions.

Results: Paired samples t-tests revealed that infants demonstrated *lower* rates of eye-blinking during the contingent condition (mean bpm=4.82, SD=4.89) compared with the non-contingent stranger condition (mean=9.04, SD=8.40; p<.05). A trend towards lower rates of eye-blinking during the contingent condition compared to the non-contingent caregiver condition (mean bpm=10.01, SD=11.08) was also observed (p=0.10) (see Figure 2). Immediate next steps include coding of eye-blink data in an additional N=24 TD infants and N=7 infants who received a diagnosis of ASD at 24 and 36 months.

Conclusions: Preliminary findings suggest that eye-blink rates can provide a useful index of infant engagement, with TD infants blinking *less* during contingent, compared with non-contingent, social interactions. This study advances a useful framework and novel measure for future work investigating the influence of engagement on learning within the context of reciprocal social interactions in typical development and in ASD.

113 **112.113** Adaptive Functioning in ASD and Ws: Shared Profiles with Unique Correlates

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Background: Children with neurodevelopmental disorders, such as autism spectrum disorder (ASD) and Williams Syndrome (WS), often exhibit adaptive functioning falling behind peers with typical development (TD) and experience language delays (Hahn et al., 2014; Yang et al., 2016). However, research on the profile of relative strengths and weaknesses in the adaptive domains, both within and between groups, remains limited and inconclusive. Identifying early emerging adaptive profiles in these conditions within the first years of life is critical to inform early intervention targets, with the potential to mitigate the escalating gap in adaptive domains (Kanne et al., 2011). In particular, understanding the role of correlates, such as language, in adaptive functioning may help to elucidate shared and unique adaptive challenges across disorders.
Objectives: To examine adaptive profiles of WS, ASD, and TD to delineate syndrome-specific adaptive profiles, identify shared versus distinctive areas of strengths and needs across conditions, and examine correlates of adaptive behavior in each group, including the contribution of

language.

Methods: Participants included 96 children: 52 ASD (*M*age = 40.13 months), 24 WS (*M*age = 52.13 months), and 20 TD (*M*age = 45.25 months). Adaptive functioning was assessed using the Vineland Adaptive Behavior Scales (VABS). Developmental functioning was assessed using the Mullen Scales of Early Learning (MSEL). Developmental quotients (DQ; [mental age/chronological age]*100) were averaged for the language scales of the MSEL to create an overall verbal-DQ. Each group was divided into high versus low language groups based on mean verbal-DQ for each group.

Results: A significant group-by-domain interaction emerged (F[3,210]=10.51, p<.001) revealing differences between clinical groups. The WS group had significantly higher scores in Socialization (p= .02) but significantly lower Motor scores (p = .006) than the ASD group. Communication and Daily Living Skills (DLS) did not differ between groups. Pairwise comparisons revealed syndrome specific strengths and weaknesses: ASD Motor skills significantly higher than all domains (Communication p= .002, DLS p= .04, and Socialization p= .001); WS Socialization significantly higher than all domains (p's< .001); no differentiated profile for TD. When variation in skills as a function of language was explored, a significant group-by-domain interaction emerged for ASD (F[3,106]=7.57, p<.001), with those in the high language group scoring significantly higher than those in the low language group (p's< .001). For WS, a main effect of VABS domain emerged (p<.001), but there was no interaction with language. Adaptive functioning did not differ across language group or scale for TD.

Conclusions: Results of this preliminary study suggests young children with ASD and WS present with syndrome-specific adaptive profiles despite overall similar (and delayed) levels of adaptive functioning. Those with ASD outperformed those with WS on Motor functioning, were more impaired on Socialization, and did not differ on DLS or Communication. Whereas high language level within ASD predicts higher scores on all measures of adaptive functioning, differences in language do not appear to relate to adaptive functioning in children with WS or TD. Consideration of syndrome-specific and shared adaptive profiles and correlates provides relevant insight on early intervention targets and strategies.

114 **112.114** Age of First Concerns, Early Milestones and Eventual ASD Diagnosis: Are There Sex Differences?

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Background: Despite advances in early detection, the average age of ASD diagnosis often exceeds 4 years, with a significant lag following first concerns (Daniels & Mandell, 2014). Previous research suggests that due to the sex imbalance and resultant male conceptualization of ASD, girls are particularly likely to experience diagnostic delays (Salomone et al., 2015).
In typical development, child sex predicts inter-individual variation across multiple developmental milestones, with females often exhibiting earlier progress. Parental perceptions of what is *normative* for males and females may engender differential expectations and influence timing of initial concerns in ASD. Early developmental milestones are predictive of later diagnosis and clinical outcomes in ASD (Bedford et al., 2016; Kower et al., 2016); however, the role of sex on early milestones has not been studied in-depth.

Objectives: Explore sex differences in (1) developmental milestones and (2) their contribution to timing of initial concerns and diagnosis.

Methods: 195 participants (105 males) aged 8-17 years with ADOS-2 and ADI-R confirmed ASD diagnosis were recruited across four sites. Early developmental milestones, age of first concerns and age of ASD diagnosis were obtained from the ACE Medical History Form. Univariate ANOVAs tested for sex differences in timing of early milestones, first concerns, ASD diagnosis, and diagnostic lag (time between initial concerns and eventual ASD diagnosis), after controlling for demographic variables (child IQ, maternal education, race, ethnicity, and site). Stepwise linear regressions were used to investigate the relative contributions of demographic variables, sex, IQ, and early developmental milestones to age of first concerns, diagnosis and diagnosis lag.

Results:

Between-sex differences: There were trends toward earlier first concerns and diagnosis in males (p=.08). There were no sex differences in diagnostic lag, nor age of first walking. Parents reported earlier first words and phrases in females (p = .04 and .06).

Factors predicting age of first concerns, diagnosis, and lag (Table 1): Demographic variables alone did not significantly predict age of first concerns (R^2=.04), age of diagnosis (R^2=.03), nor diagnostic lag (R^2=.01). All three models reached significance with inclusion of current IQ: first concerns (R^2=.08), diagnosis (R^2=.11), lag (R^2=.05).The inclusion of sex in the model predicting age of first concerns was marginally significant (R^2=.98, p=.07), but was non-significant for age of diagnosis, nor lag. There were no sex by interactions. The amount of variance accounted for by inclusion of early milestones was not significant for any models: first concerns (R^2=.12), diagnosis (R^2=.14) lag (R^2=.07). Across models, IQ remained the strongest individual predictor.

Conclusions: Results show sex differences in early developmental milestones related to language in an ASD sample, reflecting what is observed in typical development and potentially suggestive of a *female bias* in parent's perceptions of development. Early milestones did not predict the age of initial concerns, diagnosis nor lag. IQ was the most significant predictor, suggesting children with lower IQ, regardless of sex, are identified and diagnosed earlier. Overall, our variables did not account for a large proportion of variance, suggesting other factors are more influential in predicting timing of initial concerns and diagnosis.

115 **112.115** Associations between Fear and Later Anxiety and Internalizing Symptoms in Very Young Children with ASD

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Background: Seventy percent of school-age children with ASD have at least one comorbid disorder, anxiety among the most common (Simonoff et al., 2008). Anxiety disorders in the general population are often preceded by the presence of behavioral inhibition, a characteristic that includes fear and reticence (Biederman et al., 2001; Rosenbaum et al., 1993). Although a previous study reported lower levels of fear in toddlers with ASD compared to TD and DD peers (Macari et al., 2018) and another investigated concurrent relationships between fear and anxiety in preschoolers

with ASD (Scherr et al., 2017), links between fear and later comorbid anxiety in young children with ASD have not yet been examined.
Objectives: To examine the associations between fearful emotional expression and temperament in the second year and comorbid anxiety and internalizing symptoms at age 3.

Methods: Participants included 95 children (Time1: M_{age}=22mo, range: 13-30mo; Time2: M_{age}=39mo, range: 33-47mo): 53 with ASD and 42 typically-developing (TD). At Time1, fear was assessed both via parent report (ECBQ-Fear) and direct assessment (Laboratory Temperament Assessment Battery (Lab-TAB); Goldsmith & Rothbart, 1999). Intensity of emotional expression of fear (iEE-Fear) across facial and vocal channels was coded during three Lab-TAB episodes designed to elicit fear. At Time2, parents completed the Preschool Anxiety Scale (PAS-R; Total Anxiety Symptom score) and the Early Childhood Inventory-4 (ECI-4; Internalizing composite).

Results: In the children with ASD, iEE-Fear expressed during the Lab-TAB at Time1 was associated with Time2 ECI-4-Internalizing symptoms ($r(29)=.50$, $p<.01$), but not with PAS-R Anxiety symptoms. Conversely, iEE-Fear in the TD group marginally predicted later PAS-R Anxiety symptoms ($r(27)=.34$, $p=.08$), but not ECI-4-Internalizing symptoms. In the ASD group, parent-reported ECBQ-Fear at Time1 was associated with both PAS-R Anxiety symptoms ($r(53)=.41$, $p<.01$) and ECI-4-Internalizing symptoms ($r(48)=.29$, $p<.05$) at Time2. In the TD group, ECBQ-Fear at Time1 was associated with later PAS-R Anxiety symptoms ($r(42)=.29$, $p=.05$) only.

Conclusions: This study suggests a significant role for fear in the development of anxiety and internalizing symptoms for young children with ASD as well as TD children. Our study also indicates that at age 2, direct and parent-reported measures of fearful emotional expression provide somewhat complementary accounts of behavior relevant to later emotional difficulties. In toddlers with ASD, both directly-assessed fear and parent-reported fear predicted a broad set of internalizing symptoms including anxiety at age 3. This differed from TD children, for whom both indices of fear predicted later anxiety symptoms only, consistent with previous studies. Divergent longitudinal patterns of association indicate that pathways to comorbid anxiety and other internalizing symptoms may be different in each group. The data also underscores the importance of a multi-method approach in understanding the development of anxiety and other internalizing symptoms in ASD, and thus, potential treatment targets.

116 **112.116** Associations between Socioeconomic Status, Language Ability, and ASD Symptoms in Toddlers with Autism

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Background: Autism Spectrum Disorders (ASDs) present major personal, community, and public health challenges due to their associated functional impairments and high cost of care. In addition, socioeconomic status (SES) is a critical, broad-reaching developmental factor that directly impacts language and social development in early childhood (e.g., Hart & Risley, 1995; Johnson et al., 2016). While the field of developmental research focused on ASDs has made strides in characterizing the unfolding of the disorder beginning in early childhood, less is known about the deleterious effects of low-SES on early development in ASDs. It remains unknown to what extent low-SES confers additional developmental risks, above and beyond the vulnerabilities associated with ASDs, in young children during critical periods for language development. Knowledge thereof will have the potential to inform targeted interventions for low-SES children with ASDs.
Objectives: Examine associations between socioeconomic status, language skills, and autism symptoms in toddlers with autism.

Methods: 45 toddlers with autism (13 females), ages 17- to 34-months (mean age = 24.7, standard deviation = 4.4 months), completed developmental and diagnostic assessments as part of their participation in an ongoing study of early brain development in autism. Participants completed the Mullen Scales of Early Learning, the ADOS-2, the Vineland Adaptive Behavior Scales, and the Child Behavior Checklist. Additionally, caregivers provided demographic information, including income, education, and racial/ethnic identity. Participants' postal codes were used to extract median income by postal code, an area-based measure of SES. Spearman's correlation analyses were conducted to test for associations between socioeconomic indices and outcome variables of interest (language, autism symptoms). Minimally verbal children with ASDs (lower quartile of sample on Mullen expressive language scores) were also compared to their peers with relatively more intact language capabilities (upper quartile) with regard to SES, using independent samples t-tests.

Results: Toddlers with autism showed negative associations between neighborhood SES (postal-code-based) and autism symptoms (ADOS-2; r = -.31, p = .08), and household income and parent-rated autism symptoms (CBCL ASD r = -.39, p = .08), though not significantly. Toddlers with ASDs showed positive associations between neighborhood SES, and expressive (r = .36, p = 0.04) and receptive (r = .34, p = 0.06) language, and overall development (Mullen Early Learning Composite; r = .32, p =.07). In comparison to their peers with relatively higher language skills, children with minimal language abilities were from lower income neighborhoods ($t_{(1,17)}$ = -2.2, p = .04).

Conclusions: Young children with ASDs showed negative associations between SES and autism symptoms, and positive associations between SES and language abilities. Participants with lower language abilities (lowest quartile of sample; T-score ≤ 20) also came from lower-income neighborhoods, compared to their peers with relatively higher language skills (highest quartile of sample, T ≥ 40). Future analyses will include a larger sample size, with increased power to detect associations between SES and relevant outcome measures, stratifications by ethnicity and bilingual status, relations between SES and measures of functional brain connectivity, and associations between SES and language measures in our control sample of TD young children.

117 **112.117** Attention to Speaker's Mouth Region in Toddlers Predict Language and Autism Severity Levels in Preschool Aged Children

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Background: Although well documented that toddlers with ASD look less at faces (Guillon, 2014), atypicalities in attention to the eye and mouth regions is context dependent (Chawarska, 2012). While limited attention to the mouth in the second year of life may be detrimental to language acquisition (Tenenbaum, 2015), poor attention to the eye region may negatively impact social communication skills (Elsabbagh, 2013).
Objectives: To examine associations between proportion of time spent on eye (%Eye) and mouth (%Mouth) regions of interest (ROIs) of videotaped interactive partners in the 2nd year (Time-1) and, verbal skills and autism severity 1-2 years later (Time-2) in toddlers with ASD and

typically developing (TD) controls. Based on prior work (Tenenbaum, 2015), we hypothesize that toddlers with higher Time-1 %Mouth will have higher verbal ability at Time-2 and toddlers with lower Time-1 %Eyes will show greater Time-2 autism severity.

Methods: Participants include 39 toddlers with ASD (Mean age=23.2 months, SD=3.2) and 36 with TD (Mean age= 21.5 months, SD=3.1). At Time-1, they were administered the Selective Social Attention 2.0 eye-tracking task (Figure 1) that included four conditions: (1) Direct Gaze Only (DG+SP-): actress looking at camera, silently (2) Speech Only (DG-SP+): actress looking down, speaking, (3) Dyadic Bid (DG+SP+): actress looking at camera, speaking, and (4) No Bid (DG-SP-): actress not speaking, looking down. For each condition, %Eyes %Mouth standardized total looking time was computed. Diagnostic assessment took place at 40.2 months (SD=3.56) (Time-2). Verbal skills were evaluated with the Mullen Scales of Early Learning (VDQ) and the Autism Diagnostic Observation Schedule-2 (ADOS-2) was used to quantify autism severity. Pearsons' r correlation analyses evaluated relationships between variables of interest at both time points.

Results: Without speech (DG-SP-, DG+SP-), neither %Mouth nor %Eyes were associated with later outcomes (Figure 2). When speech was present (DG-SP+, DG+SP+), significant correlation was observed between Time-1 %Mouth and Time-2 VDQ (DG-SP+ $r(72)=.35$, $p=.002$) (DG+SP+ $r(68)=.38$, $p=.001$) (Figure 2a). %Mouth at Time-1 was also associated with lower autism severity at Time-2 (DG-SP+ $r(50)=-.34$, $p=.013$)(DG+SP+ $r(47)=-.40$, $p=.004$) (Figure 2b). However, Time-1 %Eyes was not associated with Time-2 outcomes in either condition (Figure 2b).

Conclusions: How toddlers monitor speaker's faces predicts social and verbal functioning in preschool. Greater attention to the mouth was associated with better language outcomes and lower autism severity. These results are consistent with work in TD infants showing positive links between early mouth looking and later language skills (Tenenbaum, 2015). Both toddlers and older children with ASD show limited attention to the speaker's mouth region (Shic, under-review), which in older children is linked with poor audiovisual speech integration and speech perception deficits (Irwin, 2017). These findings suggest diminished attention to salient audio-visual cues early in development has negative impact on audio-visual perception. Thus, in the second year of life, in contexts in which an interactive partner is speaking, looking at the eyes does not appear to have a similar adaptive advantage as it may have when monitoring gaze and facial communicative gestures when speech is absent (e.g., joint attention).

118 **112.118** Attenuated Attentional and Behavioral Vigilance Towards Nonsocial Threats in Preschoolers with Autism Spectrum Disorder

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Background: Approximately forty percent of children with ASD experience anxiety (vanSteensel et al., 2011). While children diagnosed with generalized anxiety disorder show an attentional bias to threatening stimuli (Waters, Bradley, & Mogg, 2013), it is not clear if children with ASD also exhibit attentional biases for threat and physical avoidance patterns observed in non-ASD individuals. Prior work has revealed attenuated facial and vocal expressions of fear (Macari et al., 2018) as well as attenuated physiological arousal (Vernetti et al., 2018) in response to nonsocial real-world threatening situations in toddlers with ASD. Based on these findings showing attenuated fear response towards nonsocial threats in toddlers with ASD, we hypothesize that preschoolers with ASD will show less attentional vigilance and more physical approach when facing real-life nonsocial threatening situations.

Objectives: To examine attentional vigilance and approach-avoidant behaviors towards several nonsocial threats in preschoolers with ASD compared to non-ASD preschoolers.

Methods: 110 preschoolers (44 preschoolers with ASD: M=40.3mo, SD=3.5, 91%males, 17 age-matched preschoolers with developmental delay (DD): M=40.1mo, SD=3.1, 47%males, and 49 typically-developing preschoolers (TD): M=38.6mo, SD=2.5, 53%males)) were administered three fear-eliciting tasks (crawling spider, scary mask, animated Halloween monster hand) based on the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart,1999). Indices of attentional vigilance to threat (proportion of looking time to the threat) and physical-approach behaviors (proportion of body movements towards the threat) were rated offline by blinded coders and averaged across the three episodes.

Results: A multivariate GLM revealed a marginal effect of diagnosis for *attention to threat* ($F(2,107)=2.45$, $p=.092$,$\eta p2=.04$) and significant effect of diagnosis for *physical approach towards the threat* ($F(2,107)=6.73$, $p=.002$, $\eta p2=.11$) . Planned comparisons confirmed that preschoolers with ASD spend less time *looking at the threat* than their TD (p=.030) peers. Additionally, compared to their peers, preschoolers with ASD spent more time *approaching the threat* (vs.TD (p=.001) and vs.DD (p=.031)). TD and DD groups did not differ from each other in *attention to threat* or *approach behaviors* (all ps>.568) (see Figure1).

Conclusions: Results indicated that attentional vigilance and approach-avoidant behaviors in preschoolers with ASD are atypical. Indeed, preschoolers with ASD looked less at nonsocial threats compared to their typically developing peers and spent more time approaching nonsocial threats compared to peers with typical development and developmental delay. This attenuated vigilant response towards threat in preschoolers with ASD corroborate previous findings of attenuated emotional and physiological responses to threatening stimuli. Given that *heightened* fear and vigilance are usually linked with the development of anxiety in the general population, our findings highlight the need to further investigate the prospective relationships between early fear and later anxiety symptoms in children with ASD.

119 **112.119** Atypical Physiological Responses to Emotion-Eliciting Challenges in Preschoolers with ASD

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Background: Emotional difficulties constitute a frequently co-occurring feature of Autism Spectrum Disorder (ASD) in young children and adults (Garon et al.,2016) and have been linked to the emergence of psychological problems such as depression, aggressive behavior problems and anxiety (Garber et al.,1995, Cole et al.,2003, Rubin et al.,1995, Morris et al.,2010). Physiological data quantified by the measure of changes in skin conductance levels (Vernetti et al.,2018), and behavioral data measured with the intensity of facial and vocal expressions (Macari et al.,2018) have

shown under-reactivity to threatening, and over-reactivity to frustrating, real-world probes in 24-month-olds with ASD. However, it is not clear if this physiological phenomenon is only characteristic of toddlerhood or whether it is stable into preschool age.

Objectives: (1) To test whether preschoolers with ASD differ from typically developing (TD) controls in the magnitude of changes in SCL (ΔSCL) to real-world probes eliciting fear, anger, and joy (2) To test if ΔSCL is associated with autism severity at preschool age. Based on findings at 24months, we hypothesized that preschoolers with ASD will show greater ΔSCL in response to Anger and lower ΔSCL in response to Fear probes but not Joy probes in the ASD group.

Methods: Participants included 29 preschoolers with ASD and 41 age-matched TD controls (age: M=39.3mo, SD=3.1). ΔSCL was measured in response to multi-trial conditions eliciting Fear, Anger or Joy based on the Laboratory-Temperament Assessment Battery (Goldsmith & Rothbart,1999), using the Affectiva Q-Sensor placed on the participants' ankle. ΔSCL was calculated between the start and end of each trial and averaged within each condition. Autism severity was assessed using the Autism Diagnostic Observation Schedule, 2nd edition (ADOS-2, Lord et al.,2012).

Results: A LMM analysis of ΔSCL indicated a significant diagnosis x condition interaction ($F(2,199)=7.99, p<.001$). ΔSCL in the ASD group was higher compared to the TD group in the Anger ($p=.006$) and Joy ($p=.008$) conditions and lower in the Fear condition ($p=.030$). ΔSCL at 36mo was not correlated with autism severity in the overall sample (N=50), or in the ASD sample only (N=26) in any of the conditions (all $rs<.24$, all $ps>.095$).

Conclusions: As predicted, group differences in Fear- and Anger-related physiological arousal changes at 36months mirrored those previously reported at 24months, with ASD preschoolers showing an attenuated physiological response during fear-eliciting challenges and an accentuated response to anger-eliciting challenges compared to TD preschoolers. The ASD group also showed higher physiological responses than the TD group in the Joy condition. These atypical physiological responses observed in the ASD group were not associated with severity of autism symptoms. These findings suggest consistent atypical patterns of physiological responses to environmental challenges in children with ASD between 2 (Vernetti et al.,2018) and 3 years of age and underscores the need to examine links between physiological responses to emotion-eliciting challenges and later emotional difficulties in ASD. Data collection of physiological responses to emotion-eliciting challenges in preschoolers with ASD is still ongoing and will allow for the direct assessment of homo- and heterotypic continuity of physiological reactivity between 24 and 36months of age.

120 **112.120** Autism Adversely Affects Toddlers' Joint Engagement with Sounds, Especially Speech

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Background: Research on joint attention in autism spectrum disorder (ASD) has focused almost exclusively on the sharing of tangible objects, leaving unclear whether ASD affects auditory joint engagement (AJE). Typically-developing (TD) toddlers often delight in sharing sounds with parents, creating opportunities for language learning. But toddlers with ASD may display atypical reactions to sound (e.g. ignoring their name) that might adversely affect communicating about and sharing sounds.

Objectives: Our aims were to discern whether AJE occurs less often for toddlers with ASD than for TD toddlers or toddlers with non-ASD developmental disorders (DD), and whether AJE to speech is more impacted than AJE to environmental sounds.

Methods: 141 toddlers (mean age=23 months)—46 ASD, 46 DD, and 49 TD—and their parents participated. AJE was observed during four auditory scenes, one for each of four types of sounds: music, animal, mechanical, and speech including child's name. In each scene, the sound occurred twice while the child and parent played, first in a 30-sec *ignore-sound phase*, during which the parent ignored the sound, and then in a 60-sec *share-sound phase*, during which the parent tried to share the sound. Three concurrent video records (one from a headcam on the parent's forehead) were reliably coded for the child's initial reaction to sound (alerts, orients, sustained interest in phase 1), communication about sound (bids to share in phase 1; speaks, points in both phases); and AJE (total, coordinated, supported in phase 2).

Results: Parents almost always followed instructions, initially ignoring (94%) and then attempting to share the sound (91%). When parents followed instructions during the *ignore-phase*, most children alerted, oriented, and sustained interest (see Figure 1)—although in the speech scene children in the ASD group did so significantly less than others. In contrast, few children with ASD communicated about the sound (speaks, points, shares), differing strongly from the TD group for all sound types (odds ratios > 3.0). When parents followed instructions during the *share-sound phase*, again few children with ASD communicated about the sound, differing significantly from the TD group for all sound types. Total AJE and coordinated AJE were also less likely for children with ASD than TD children for all sound types, whereas supported AJE was less likely only for music scenes. ASD and TD groups differed pervasively, for 32 of 44 tests; DD differed from ASD for just 12 of those 32, 6 involving the speech scene.

Conclusions: This study provides an unprecedented view of how toddlers with ASD react to and share speech and environmental sounds during parent-child interactions. Like their peers with TD and DD, they often alerted and oriented to environmental sounds, but were less likely to react to speech or to communicate about, share interest in, or be jointly engaged with any of the sound types. Intriguingly, only supported AJE, when the child shares sound but does not explicitly attend to the parent, appeared spared. Implications for communication and language development and for early interventions seeking to enhance joint engagement are discussed.

121 **112.121** Autism Symptom Development from 6 to 18 Months of Age in a Prospective High-Risk Cohort: Findings from the Autism Observation Scale for Infants

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Background: Early identification of autism spectrum disorder (ASD) helps ensure access to specialized services, which can improve outcomes. The Autism Observation Scale for Infants (AOSI; Bryson et al., 2008) is a 19-item interactive measure developed for the purpose of assessing early symptoms in infants aged 6 to 18 months, in longitudinal research.

Objectives: To examine the predictive validity and classification properties of the AOSI in the original cohort of high-risk (HR; infants with an older

sibling with confirmed ASD diagnosis) and low-risk (LR; infants with no first- or second-degree relatives with ASD) for which the measure was developed.

Methods: *Participants*: 501 HR infants, including 136 diagnosed with ASD at age 3 (HR-ASD; 27.1%) and 365 not diagnosed (HR-N), as well as 180 LR infants (one diagnosed with ASD; not included in these analyses). *Assessments*: The AOSI (Bryson et al., 2008) was administered at 6, 9, 12, 15 and 18 months (9- and 15-month assessments were introduced later in the study). 3-year ASD diagnoses were based on clinical best estimate using the ADOS and ADI-R at 36 months, blind to prior study data. Participants were also assessed at 3 years using the Mullen Scales of Early Learning (MSEL) and Vineland Adaptive Behavior Scales (VABS). *Analytic Approach*: Groups defined by risk status and ASD outcome (HR-ASD, HR-N, LR) were compared on AOSI total scores at each timepoint using linear mixed modeling, with post-hoc pair-wise group comparisons at each age using Tukey HSD. Next, we used receiver operating characteristics (ROC) curves and Youden's index to determine the optimal cut-point for AOSI total score at each age (limited to the HR cohort), and estimated sensitivity, specificity, positive predictive value and negative predictive value. Finally, we compared clinical features (ADOS severity, MSEL and VABS scores) at age 3 in children with ASD correctly vs. incorrectly classified by the AOSI, based on these identified cut-points.

Results: Findings are summarized in Tables 1 and 2. There were ASD-specific group differences in AOSI total scores starting at 12 months, with higher scores in HR-ASD compared to HR-N and LR groups. AOSI total scores were predictive of ASD within the HR group with a sensitivity and specificity of 52% (95% CI: 48-56%) and 74% (95% CI: 70-78%) at 12 months, and 72% (95% CI: 68-76%) and 65% (95% CI: 61-69%) at 18 months, respectively, based on cut-points identified by ROC analyses. Children with ASD that could be identified based on elevated AOSI score at 12 months, compared to those with lower AOSI scores, had more severely delayed language (MSEL – Expressive Language subscale; p=.03), adaptive functioning (VABS-2 – Social and Communication subscales; p=.04 and .02, respectively), and higher levels of parent-reported ASD symptoms (ADI-R) (p<.001) at age 3.

Conclusions: AOSI total scores discriminate children with ASD ascertained from a HR cohort from non-diagnosed HR and LR peers starting at 12 months, which may assist with making earlier referrals to diagnostic and intervention services. Elevated scores are associated with more severe language and adaptive delays and ASD symptoms at diagnosis.

122 **112.122** Autism and Prematurity: Sharp Increase in Risk Correlates with Shorter Preganancy

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Background:
Prematurity was identified as one of the risk factors of Autism Spectrum Disorder (ASD).

Objectives: to identify the correlation between prematurity level and ASD, in a cohort of children born prematurely in Israel and followed prospectively at one tertiary center.

Methods:

Retrospective analysis of the database recorded all of children born between 2011-2017 and followed at one tertiary prematurity clinic. The database was filtered for level of prematurity and subsequent diagnoses. Of interest was a diagnosis of ASD, however additional diagnoses were encountered.

Results:

Of the 416 children identified as born premature, 43 (10.3%) received a diagnosis or autism spectrum disorder. Birth week and subsequent diagnosis of ASD were compared. There was a linear correlation between the degree of prematurity and the risk of ASD with higher incidence in more extreme prematurity. Additionally, there was a significant difference between birth week of multiple pregnancies versus singletons.

When divided by gender, 246 (59.1%) were male, and 170 (40.9%) were female. Of 43 children bearing a diagnosis of ASD, 27 were males (11% of males) and 16 were females (9.4%) , which results in an almost 1:1 ratio of ASD in boys and girls, a different male to female ratio as recognized in "idiopathic" ASD. Additionally, 177 (42.5%) of the premature children were twins, and 7 (1.7%) were triplets. With an age range from 2-14.2 years old, the average age was 4.2 years with a standard deviation of 2 years. Birth week ranged from week 24 to 36+ 6days, with an average of 30.8 and standard deviation 3.3 weeks. Birth weight ranged from 368-3550 grams, with an average of 1427 g and standard deviation of 557 grams. In terms of additional diagnosis, of the 416 children, , 62 (14.9%) received a diagnosis of cerebral palsy, and 68 (16.3%) received a diagnosis of global developmental delay.

Conclusions:

In this study examining the correlation between autism and prematurity in Israel, we found a much higher prevalence—10.3%—of ASD in the premature population, compared to the known general incidence of 1.2%. The study also looked at birth week and birth weight, as well as a number of other factors. Of significance is that the earlier the babies were born (i.e. if they were born in week 27 of a pregnancy versus week 32), there was a statistically significant increase in autism rates. Additional findings of comparable rates in males and females support the theory that ASD in prematurity is linked to insult due to immaturity than to a genetic predisposition, which renders a much higher ASD rate in males (4:1). Since the diagnosis of ASD is commonly decided around the age of two years, it is possible that the actual incidence is even higher. Since early intervention has been shown to have significant impact on the prognosis and functioning of children with autism, it is important to be aware of prematurity as a significant risk factor, and to include ASD screening in each follow up of infants born before term.

123 **112.123** Caregiver-Infant Tactile Communication in Infants at-Risk for Autism Spectrum Disorder

G. Kadlaskar[1], *B. Keehn*[1], *A. Seidl*[1], *H. Tager-Flusberg*[2] *and C. A. Nelson*[3], *(1)Speech, Language, and Hearing Sciences, Purdue University, West Lafayette, IN, (2)Psychological and Brain Sciences, Boston University, Boston, MA, (3)Boston Children's Hospital, Boston, MA*

Background: Caregivers of children diagnosed with and at-risk for autism spectrum disorder (ASD) may modify their interactive style to adapt to their child's needs. We investigated the frequency of the tactile input presented to infants at high- and low-risk for ASD along with the percentage of the tactile input aligned with speech (touch+speech). Touch is of particular interest, as it forms the basis of early caregiver-infant interactions.

For instance, greater amounts of maternal affectionate touch in early development is associated with an increase in infant smiles and vocalizations and predicts later cognitive and neurobehavioral development. Yet, prior findings indicate that, maternal touch frequency decreases after 6 months of age, mainly because, as infants become more socially competent *and* physically independent, mothers start using other forms of communication, primarily speech, to interact with infants. However, it remains unclear whether caregivers with infants at-risk for ASD use touch and associated speech in a different manner compared to controls. Furthermore, whether mothers' use of touch or touch+speech input is sensitive to infants' responsiveness, given prior research showing that high-risk infants who later received a diagnosis of ASD were less responsive to maternal touch.
Objectives: (1)To examine the frequency of touch and the percentage of touch aligned with speech provided to 12-month-olds at-risk for autism (HRA) compared to low-risk comparison (LRC) infants. (2)To examine infant responsiveness to touch and touch+speech alignment.

Methods: Data for 58 (HRA=31,LRC=27) mother-infant dyads were selected from a larger sample that was obtained as a part of a longitudinal study. Dyads participated in 10-minute play sessions using identical sets of toys and were instructed to play as they would at home. Trained coders, blind to group membership, evaluated the frequency of caregiver-initiated touches to infants during play interactions along with maternal speech and infants' looking behaviors before, during, and after each touch.

Results: Independent samples t-tests revealed no differences in the frequency of touch delivered to infants in the HRA (M=19.87,SD=9.30) and LRC (M=16.18,SD=6.36) groups, $t(56)=-1.78$, $p=0.09$. However, the percentage of touch+speech alignment was significantly higher in the HRA (42.4%) compared to the LRC (34.7%, $p=0.03$) group. Lastly, infants in both the groups responded equally to touch, $t(56)=0.19$, $p=0.8$ and touch+speech input, $t(56)=-0.20$, $p=0.8$.

Conclusions: Mothers in the HRA and LRC groups deliver equal amounts of touch to their 12-month-olds. However, percentage of touch+speech alignment is higher in the HRA group. This difference is not attributable to infants' responsiveness to either touch or touch+speech input. One possible explanation for the greater alignment of touch+speech input in the HRA group could be attributed to strategies that mothers draw from their experiences of interacting with their older child with ASD, rather than HRA infants' responsivity to specific types of input at 12 months. In other words, differences in touch+speech alignment could be more related to mothers' interactive styles with infants at-risk for ASD rather than being related to infant behaviors. These findings have broader implications for caregiver-infant interactions in ASD, since providing a richer multimodal input have been suggested to promote learning in typical development.

124 **112.124** Characterizing Adaptive Behavior in Young Children with Autism: Exploring the Gap between IQ and Adaptive Behavior

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Background: Children with autism spectrum disorder (ASD) present with impairments in adaptive behavior, particularly, socialization skills (Kanne et al., 2011); however, evidence for a unique "autism profile" of adaptive behavior has yet to be consistently established (Pathak et al., 2017). More fully characterizing the adaptive behavior of young children with ASD has important implications, as this domain is associated with more positive outcome in adulthood (Bishop et al., 2016; Farley et al., 2009).
Objectives: The primary purpose of this study was to characterize adaptive behavior in relation to cognitive functioning in a community-ascertained sample of young children with ASD.

Methods: A total of 150 children who received a best-estimate diagnosis of ASD at three were included in this sample to date. It is anticipated an additional 80 children will be added prior to the conference presentation. All children were recruited as part of the ongoing, prospective FIRST WORDS® Project (Delehanty et al., 2018; Dow et al., 2017; Wetherby et al., 2008), which screens for ASD and communication delays in primary care settings. Children in the sample were primarily male (n = 120) with an average age of 36.02 months (SD = 2.93). The evaluation battery included the Autism Diagnostic Observation Schedule (Lord et al., 1999), the Mullen Scales of Early Learning (MSEL; Mullen, 1995) and the Vineland Adaptive Behavior Scales, 2nd edition (VABS-II; Sparrow et al., 2005).

Results: Preliminary descriptive analysis of this community sample revealed variability in regard to autism symptomology, cognitive functioning (M= 73.67, SD= 23.68), and adaptive behavior (M = 77. 15, SD = 10.40). With regard to adaptive behavior, children demonstrated significant strengths in Communication (M = 82.61, SD = 15.30) and Motor Skills (M = 81.75, SD = 10.77) relative to Daily Living Skills (M = 79.97, SD = 10.42) and Socialization (M = 76.73, SD = 10.27). Consistent with previous research (Kanne et al., 2011; Perry et al., 2009), children with higher cognitive functioning (IQ > 70, n = 70) evidenced an IQ advantage over adaptive behavior across domains and the opposite pattern was observed for children with lower cognitive functioning. Exploratory examinations of the gap between the Adaptive Behavior Composite and IQ indicated approximately 55.3% (n = 83) of the sample presented with standard scores within one standard deviation (±15 points) of each other, 22.0% within 1.5, and 22.7% (n = 33) showed differences of greater than 1.5 standard deviations between scores. Observations indicated the size of discrepancy between composites was more strongly associated with cognitive ability (r =.911) than with adaptive behavior (r = .338).

Conclusions: Results of this study demonstrate a pattern of adaptive behavior with strengths in Communication and Motor Skills in a community sample of children with ASD. With regard to the cognitive functioning and adaptive behavior, findings suggest the size of the gap is likely accounted for by large variability in IQ compared to the relatively narrower range of adaptive functioning ability. Findings will be discussed in view of clinical implications and future research directions.

125 **112.125** Cumulative Risk of the Oxytocin Receptor Gene Interacts with Prenatal Exposure to Oxytocin-Receptor Antagonist to Predict Children's Social Communication Development

ABSTRACT WITHDRAWN

Background: Compelling evidence for the far-reaching role of Oxytocin (OT) in social cognition and affiliative behaviors in humans set the basis for examining the association between genetic variation in the OT receptor (*OXTR*) gene and risk for Autism Spectrum Disorder (ASD).
Objectives: The aim of the study was to examine gene-environment interaction of the *OXTR* gene and prenatal exposure to OT and *OXTR* antagonist (OXTRA) in predicting early social-communication development.

Methods: One hundred and fifty three children (age: M = 4.31, SD = 1.07) were assigned to 4 groups based on prenatal history: children whose mothers prenatally received OXTRA and Nifedipine to delay preterm labor (n = 27); children whose mothers received Nifedipine only to delay

preterm labor (n = 35); children whose mothers received OT for labor augmentation (n = 56) and a no intervention group (n = 35). Participants completed a developmental assessment of IQ, Adaptive Behavior and social communication abilities. DNA was extracted via buccal swab. A genetic risk score was calculated based on 4 *OXTR* SNPs (rs53576, rs237887, rs1042778, rs2254298) previously reported to be associated with ASD symptomatology.

Results: The OXTRA group exhibited more social-communication difficulties compared to all other groups. Furthermore, higher *OXTR* genetic risk and being a male predicted more social-communication difficulties. Pharmacological intervention and *OXTR* risk interaction emerged, indicating that in the OXTRA group more risk alleles were associated with more social-communication difficulties, whereas in the Nifedipine, the OT and the no intervention groups more risk alleles were not related with social-communication difficulties, as seen in Figure 1.

Conclusions: In the current study the gene by environment interaction observed was specific to ASD related impairments, rather than a general functional deficit. Our findings demonstrate how the inclusion of targeted genetic information may help identify previously unmeasured heterogeneity in treatment response, thus highlight the importance of both genetic and environmental pathways of OT in signaling early social development. Furthermore, the current findings raise the need for further research of the association between OXTR and ASD.

126 **112.126** Developmental Surveillance Versus Clinical Referral: A Longitudinal Study of Children with Autism Spectrum Disorder (ASD) Diagnosed at 2-Years Via Different Referral Systems

ABSTRACT WITHDRAWN

Background: Referral pathways to early ASD diagnosis have received little attention despite their potential influence on the baseline characteristics and developmental presentation. For example, children in the general community who do not receive developmental surveillance may only be identified and diagnosed early if they have more severe symptomology and developmental delays – a thesis consistent with Daniels and Mandell's (2014) findings, via systematic review, that children with more severe ASD symptomology and cognitive impairments were likely to receive an earlier ASD diagnosis.

Objectives: The primary objective in this longitudinal study was to compare autism symptom severity and cognitive functioning of children who received an early ASD diagnosis via two different referral systems. This was achieved by comparing the baseline characteristics and developmental outcomes at preschool age of children with ASD who were diagnosed at 2-years of age, following two different referral pathways.

Methods: The participants comprised 53 children identified early through developmental surveillance at well-child visits (community group) and diagnosed with ASD (at M age = 25.96; range 23-33 months) and 24 children diagnosed (at M = 25.79, range 21-31 months) following referral to a specialized early assessment clinic by a primary healthcare professional (clinical group). All children were administered the Autism Diagnostic Observation Schedule and the Mullen Scales of Early Learning at 24- and 48-months of age.

Results: Children in the clinical group had parents that were more highly educated, and were more likely to have a relative and/or an older sibling with an ASD diagnosis than those in the community group. There were no differences between the groups in the intensity or type of early intervention received between 24- to 48-months.

A two-way repeated measures ANOVA revealed no significant differences between the community and clinical groups on ASD symptom severity at the 24-month assessment. However, children in the community group showed an improving trajectory in their symptomology such that they had significantly milder autism symptom severity (both social attention and communication deficits and restricted and repetitive behaviour) at 48-months compared with the clinical group, who showed an overall stable trajectory. A further two-way ANOVA revealed that the groups did not differ at either age in cognition, with both groups showing significant improvements in their overall developmental quotient (DQ), which was driven by the subdomain of verbal DQ, with non-verbal DQ being stable between 24 and 48-months.

Conclusions: The expectation that the clinical group may be more severe at baseline with lower developmental scores was not supported. However, the two groups did vary in their autism severity over time with the community group showing a reduction in autism symptoms at outcome despite no group differences in cognition. It is concluded that clinically-referred samples of children with ASD are not representative of community-based children with ASD, signalling that caution is needed when drawing conclusions from these different populations.

127 **112.127** Developmental Trajectory of Selective Attention to a Talking Face in Infants at-Risk for ASD

***Y. Minagawa**, M. Hata, Y. Hakuno, E. Yamamoto and K. Abe, Keio University, Tokyo, Japan*

Background: Infants' gaze behavior during face-to-face speech communication changes through the first year of life. Specifically, infants' attention to a talking face shifts from the eyes to the mouth between 4 and 8 months of age. Mouth-gazing behavior after 8 months old is reported to predict later language development, possibly because this mouth gazing may reflect the ability of canonical babbling, which is crucial for speech production. However, such gaze behavior toward a talking face has not been thoroughly studied for infants at-risk for autism spectrum disorders (ASD). Their atypical language development may be reflected by atypical gaze patterns, which may be an early marker of ASD.

Objectives: The present study longitudinally examined infants' attention to a talking face among 6- to 18-month-olds to reveal differences in attention patterns between typically developing infants (TD) and infants at-risk for ASD (RA). Furthermore, because selective attention to a talking face may differ depending on the language, the present study also aims to reveal its development in the case of a Japanese-speaking environment.

Methods: Participants (25 RA and 20 TD) were followed up to record their eye gaze at 6, 9, 12, and 18 months of age. However, all the infants were not able to complete or participate in all the sessions number of participants differ depending on age. Each infant's eye movement while viewing a video of a woman who was speaking to the infant (20 seconds x 2), was recorded using the Tobii X120 Eye Tracker system. We created three areas of interest (AOI) on the female face–around the eyes, mouth, and entire face–and calculated the proportion of looking time (total looking time at the eyes or mouth / total looking time at the face) using an arcsine transformation. We also performed developmental testing and administered a language questionnaire at each recording point.

Results: The RA showed a different developmental pattern of eye gaze behavior compared to the TD. Firstly, the Japanese TD showed a similar developmental shift for mouth watching as in American infants; namely, their attention shifted to the mouth from the eyes at 9 months old. However, among the RA, such a developmental shift did not occur until 18 months old. There was a considerable difference at this age between

the TD and RA. While the RA shifted their attention to the mouth from the eyes, the selective attention of the TD was directed toward the eyes at 18 months old. These results were statistically confirmed by a linear mixed-effects model with group, age, and the interaction of these two factors as effects and participants as random effects.

Conclusions: Although the TD and RA showed a similar eye gaze pattern at 6 months old with selective attention to the eyes, their developmental trajectories were different. The RA's delayed attentional shift (at about 9 months old) to the mouth from the eyes while watching a talking face may be chiefly related to their slower language acquisition, particularly delayed speech production as assumed from their language profiles.

128 **112.128** Differences in Temperament between Children with Autism Spectrum Disorder and Typical Development in the Study to Explore Early Development

B. Barger[1], *E. Moody*[2], *S. Rosenberg*[3] *and L. Wiggins*[4], *(1)Georgia State University, Atlanta, GA, (2)University of Colorado, Denver, Aurora, CO, (3)University of Colorado Anschutz Medical Campus, Aurora, CO, (4)Centers for Disease Control and Prevention, Atlanta, GA*

Background: The Behavioral Style Questionnaire (BSQ) is a widely used temperament measure in children with autism spectrum disorder (ASD)[1,2]. Recent evidence suggests that the BSQ's original factor structure does not best describe diverse samples of children with ASD *or* typical development.[3] Instead, children with ASD and typical development may share an alternative 9-factor temperament structure measuring (1) *Maladaptivity* (e.g., "bothered by plan changes"), (2) *Environmental Sensitivity* (e.g., "sensitive to noises"), (3) *Quiet Persistence* ("practices [to mastery]"), (4) *Social Inattention* (e.g., "does not acknowledge [when called]"), (5) *Social Approach* (e.g., "approaches [unknown children]"), (6) *Activity* (e.g., "[frequently] runs"), (7) *Crying*, (8) *Rhythmicity* (e.g., "hungry at dinner"), and (9) *Food Openness* (e.g., "tries new foods"). To date, there are no data published on these alternative temperament factors comparing children with ASD to children in a population-comparison group.

Objectives:

This study compared children with ASD and children in a population-comparison group (POP) on the alternative 9-factor BSQ temperament structure.

Methods: Study data were collected in the Study to Explore Early Development-Phase I (SEED1). SEED1 is a case-control study funded by the Centers for Disease Control and Prevention and conducted at multiple sites throughout the U.S. (California, Colorado, Georgia, Maryland, North Carolina, and Pennsylvania).[4] SEED participants were recruited through developmental disability service organizations (ASD) or a sample of state vital records (POP). Children were aged 2-5 years at the time of study enrollment. Clinicians confirmed ASD status with gold-standard diagnostic instruments administered during an in-person evaluation of the child. BSQ data were obtained via a self-administered questionnaire completed by a caregiver.

Revised BSQ (BSQ–R) scales were created by summing items shared among ASD and POP children in exploratory factor analysis (i.e., both groups shared items with factor loadings ≥ .40): *Maladaptivity* (*k* [items]=4), *Environmental Sensitivity* (*k*=7), *Quiet Persistence* (*k*=5), *Social Inattention* (*k*=5), *Social Approach* (*k*=5), *Activity* (*k*=4), *Crying* (*k*=5), *Rhythmicity* (*k*=2), and *Food Openness* (*k*=2). Higher scores on *Maladaptivity, Social Inattention, Crying,* and *Activity* indicate potential behavioral concerns, while lower scores on *Environmental Sensitivity, Quiet Persistence, Social Approach, Rhythmicity,* and *Food Openness* indicate potential concerns. Consideration of scale residuals suggested that the following BSQ-R scales were non-parametrically distributed: *Maladaptivity, Quiet Persistence, Social Approach, Crying, Rhythmicity* and *Food Openness.* T-tests were used to compare ASD and POP children for parametric data; Mann-Whitney tests were used to compare ASD and POP children for non-parametric data.

Results:

Children with ASD scored higher than POP children on *Maladaptivity*, U=19.18, p<.001; *Social Inattention, U*=13.67, p<.001; and *Crying, U*=5.77, p<.001. Children with ASD scored lower than POP children on *Environmental Sensitivity*, t(1221)=10.45, p<.001*; Quiet Persistence, U*=15.16, p<.001; *Social Approach*, t(1164)=23.71, p<.001*; Rhythmicity, U*=6.53, p<.001*;* and *Food Openness, U*=13.67, p<.001. There were no differences on *Activity*.

Conclusions:

These results show that the BSQ-R scales may distinguish ASD from POP children on eight of the nine subscales. Specifically, children with ASD had more problems than POP children on all temperament domains except *Activity*. The BSQ-R scales may be useful for developing metrics of previously unstudied phenotypic factors in children with ASD.

129 **112.129** Early Behavioral Indicators of Optimality of Developmental Outcome in an ASD Risk-Enriched Sample

R. Landa[1] *and M. Tahseen*[2], *(1)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (2)Kennedy Krieger Institute, Baltimore, MD*

Background:

Chronological transition into the second year is characterized by developmental transitions in communication, social engagement, and play. Early experience across such domains during this developmental transition could entrain a distributed system of social-cognitive and symbolic processing, possibly optimizing development and reducing degree of later manifestation of autism spectrum disorder (ASD) symptomatology.

Objectives:

To define behavioral profiles at 14 months that differentiate ASD symptomatology level at age 2 to 3 years. Hypothesis: Profiles defined by early language, gesture, social, and repetitive/restricted behavior patterns will be associated with later ASD symptomatology level.

Methods:

Children at low and high familial risk (LR N=98, HR N=323) for ASD were enrolled in a prospective, longitudinal study and assessed at mean age 14.51 months (sd=.74), with 419 having outcome assessment (mean age=36.17 months; sd=2.53).

Clustering variables at 14 months: Mullen Scales of Early Learning Expressive Language (EL) T score (Mullen, 1995), Communication and Symbolic Behavior Scales Caregiver Questionnaire (CSBS CQ) Object Use and Social composite standard scores (Wetherby & Prizant, 2002), Autism Diagnostic Observation Schedule (ADOS) Repetitive and Restricted Behavior section total score (RRB; Lord et al., 2002). Post hoc analysis variables:

CSBS CQ Emotion & Eye Gaze, Communication, and Gestures subscale standard scores; ADOS Calibrated Severity Score (CSS); Clinical judgment of ASD+/ASD-; Mullen EL T scores.

Hierarchical agglomerative cluster analysis, with clustering determined by Ward's (1963) method was performed. Squared Euclidean distance served as the similarity measure. Variables were standardized to control for unequal scaling. To determine the optimal number of clusters to retain, we used: visual examination of the dendogram, Mojena's Rule One, and examination of fusion coefficients (Lorr, 1983; Milligan & Cooper, 1985; Mojena, 1977). A MANOVA was conducted to compare the retained clusters on the four clustering variables. Additional post-hoc analyses used ANOVA and chi square.

Results:

A 2-cluster solution was most optimal; Jaccard coefficients indicated high stability for both clusters (>.70). Cluster 1 (n=300) scored significantly lower on all clustering variables at 14 months than Cluster 2 (n=120) (Table 1). A significantly greater percentage of toddlers in Cluster 1 (hereafter, At-Risk) were identified as ASD+ at outcome, X2(1, N=339), 18.68, p<.001, compared to those in Cluster 2. At age 36 months, toddlers in At-Risk Cluster had higher ASD symptomatology (ADOS CSS) and lower EL scores than Cluster 2 (p's<.001). Within the At-Risk Cluster, toddlers with ASD+ outcomes scored significantly lower than non-ASD toddlers at 14 months on CSBS CQ scales of Emotion and Eye Gaze, Gestures, and Communication (p's<.001).

Conclusions:

A combination of more advanced spoken language, play, and social development, along with reduced RRB levels, at age 14 months appear to define an optimality profile associated with low levels of ASD symptom manifestation at age 36 months. Early coherence within and across these domains may facilitate continuous improvement in efficiency and combinations of information processing that support enhanced learning (Hunt, 1999) (and reduced ASD symptomatology) through age 36 months. Thus, exposing infants to early enriching experiences is emphasized, especially for younger siblings of children with ASD.

130 **112.130** Early Developmental Characteristics of Children with ASD in SPARK

L. Green Snyder[1], *P. Feliciano*[1], *E. Brooks*[1], *A. Daniels*[1] *and W. K. Chung*[2], *(1)Simons Foundation, New York, NY, (2)Pediatrics, Columbia University, New York, NY*

Background:

The SPARK cohort offers the opportunity to characterize the natural history of autism in a representative cross-sectional sample of unprecedented size.

Objectives:

To describe early development and regression in SPARK participants.

Methods:

Developmental data including regression and symptom onset were collected through online parent surveys. Variables were harmonized with ASD-UK for future meta-analysis. Participants were 21,254 children aged 15 months to 17 years with a reported professional ASD diagnosis.

Results:

The average ages of major motor milestones were 6.7 months for sitting unsupported and 14 months for walking independently. Only 3-6% exhibited severe delays, defined as sitting after 12 months or walking after 2 years. The average age of speaking single words was 20.7 months. Among children over 2 years (n=20,161), the average age of speaking simple phrases was 32.8 months, with 60% achieving phrase speech between two and three years of age.

The average age of parental first concern was 22 months, with language (28%) and social concerns (19%) the most common first signs. Only 9.7% reported that regression signaled onset of ASD symptoms. However, one-third of parents reported a complete loss of speech typically in the second year, at an average age of 22.4 months. Regression usually lasted one to two years, but one-third of cases reported that regression had not yet resolved. 27% experienced a regression in social/play or other skills, but significantly later at an average age of 34.7 months. 56% of parents reported their child's nonverbal cognitive ability as mildly to significantly delayed. Nonverbal cognitive delay was higher in those who had regression in language (66%) than in those who did not experience regression (50%).

Conclusions:

Online parent survey data in SPARK closely mirror findings from developmental studies of confirmed ASD diagnoses. Early gross motor skills are within normal limits. SPARK participants report less severe language delay than previous studies, which may reflect improving sensitivity in detection and diagnosis. ASD symptom onset usually occurs in the first two years, often before regression, and is rarely heralded by repetitive behavior but rather by language concerns. Children with language regression have a greater likelihood of persistent delay in non-verbal cognitive ability, which supports a clinical subtype of ASD. SPARK offers potentially the largest data source of its kind to examine predictors and etiologies in autism, including those specific to autism in the absence of other disability.

Poster Session
113 - Education
11:30 AM - 1:30 PM - Room: 710

131 **113.131** A Scoping Review of Autism Spectrum Disorder and the Criminal Justice System

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Background: Given that the current prevalence rate of autism spectrum disorder (ASD) is now estimated to be 1 in 59 (Baio et al., 2018), the likelihood that individuals with ASD may come into contact with the criminal justice system (CJS) is increasing, especially as these children grow

into adulthood. Many behaviors displayed by individuals with ASD can be misinterpreted by law enforcement officers as challenging or disrespectful (Debbuadt & Rothman, 2001). Misinterpretations may contribute to the rising number of incidents involving individuals with ASD and the CJS (Rava et al., 2017). Despite the fact that the prevalence of ASD involvement in the CJS is currently unknown (King & Murphy, 2014), research suggests that individuals with ASD are involved in interactions with law enforcement officers (LEOs) as both victims (Mayes, 2003) and suspects (Woodbury-Smith & Dein, 2014). However, little is known about the research surrounding ASD and the CJS.
Objectives: In order to understand findings relevant to various aspects of interface between individuals with ASD and the CJS, a scoping review of the literature was conducted. The scoping review aimed to summarize empirical studies including individuals with ASD and the CJS.

Methods: Adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Protocols 2015 (PRISMA), we conducted a search of 13 professional databases using search terms related to both ASD (e.g., autism) and the CJS (e.g., police). Four members of the research team compared decisions for study inclusion at two points: initial screening and final inclusion.

Results: From 606 articles, a total of 55 articles were selected for inclusion; kappa for screening decisions = 0.98 and kappa for final inclusion = 0.94. Articles were organized into five categories: (a) prevalence of ASD in CJS settings (*n* = 15), (b) characteristics of individuals with ASD in CJS settings (*n* = 8), (c) ASD experiences and perceptions of the CJS (*n* = 10), (d) interviewing individuals with ASD in CJS settings (*n* = 10), and (e) knowledge, perceptions, awareness, and training by CJS professionals (*n* = 12). Within CJS settings, prevalence rates ranged from 0.3% to 27% for individuals with ASD who demonstrated a wide range of functional levels and criminal actions (e.g., arson, assault, theft). The most common calls to LEOs involved elopement, aggression, and medical emergency. Perceptions of the CJS by the ASD community were marked by reports of lack of LEO knowledge, stigmatizing attitudes, and calls for more training. LEOs' knowledge of ASD is limited and LEOs frequently cite the desire and need for more training around characteristics of ASD and how to respond to calls involving individuals the ASD. The review yielded two experimental studies examining the impact of LEO training; results supported increases in LEO knowledge and attitudes.

Conclusions: Interactions between the CJS and individuals with ASD are not uncommon and may involve individuals with ASD as either victims or perpetrators of crimes. The scoping review identified critical training needs for LEOs, which were identified by the ASD community and LEOs themselves.

132 **113.132** An Exploration of Law Enforcement Officers' Training Needs and Interactions with Individuals with Autism Spectrum Disorder

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Background: In a recent study, one in five individuals with autism spectrum disorder (ASD) reported either being stopped or questioned by police at least once by the time they were in their mid-twenties (Rava et al., 2017). Despite the increased interactions between LEOs and persons with ASD, results from a few studies reveal that LEOs are often not knowledgeable about ASD and report concerns about appropriately handling situations involving persons with ASD. One recent study found that only 42% of LEOs reported satisfaction in their dealings with the ASD community (Crane et al., 2016). However, only 13% of caregivers of individuals with ASD reported "satisfactory" interactions between LEOs and their children with ASD, and a mere 15% of adults with ASD reported a "satisfactory" experience when describing previous interactions with LEOs (Crane et al., 2016). The lack of appropriate support to individuals with ASD could potentially lead to emotional stress, breakdowns in communication abilities, and behavioral regulation difficulties. However, misinterpretation of behaviors during high-stress or tense situations can be improved with proper training, education, and through increasing interactions with persons with ASD in the community.
Objectives: Semi-structured individual interviews were employed to (a) characterize LEOs' knowledge of ASD, (b) understand previous interactions between LEOs and individuals with ASD, and (c) identify training needs to prepare LEOs for interactions with the ASD community.

Methods: Researchers utilized a grounded theory approach to analyze data from 17 participants: (a) six LEOs, (b) six adults with ASD, and (c) five caregivers. Parallel semi-structured interview schedules were developed for each participant sub-group to better understand perceptions regarding potential or actual interactions between LEOs and the ASD community as well as LEO training recommendations and needs. All interviews were audio recorded, transcribed, thematically coded, and summarized by researchers using the constant comparative method (Charmaz, 2014).

Results: Participant demographic information is presented in Table 1. Thematic categories and focused codes for LEOs, caregivers, and adults with ASD were summarized and comparisons between groups were made. All participant groups emphasized the importance of mandatory ASD-specific training for LEOs, and all individuals provided recommendations regarding training content and format. Although many caregivers and adults with ASD highlighted fears over LEOs' potential misinterpretations and/or misperceptions of behaviors, LEOs' transcripts did not reflect these same concerns. Analysis revealed several commonalities across participant groups. Examples of common themes include the (a) need for LEOs to possess knowledge of ASD, (b) importance of LEOs' empathic and supportive responses during interactions, and (c) helpfulness of LEOs' engagement and collaboration with the ASD community.

Conclusions: Findings provide insight into specific strategies that may help increase positive interactions and foster trust between LEOs and individuals with ASD. In addition, these findings have the potential to influence criminal justice policy by identifying current levels of training and specifying training recommendations from the perspectives of LEOs and members of the ASD community. Future research directions and implications are also discussed.

133 **113.133** Developing an Autism Training for Police Officers in Australia Using a Collaborative Approach

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Developing an autism training for police officers in Australia using a collaborative approach
Background: Evaluations of autism training for police (e.g., Hepworth, 2017; Kelly & Hassett-Walker, 2016; Teagardin et al., 2012) have been small scale and, to date, the empirical conclusions that can be drawn are moderate at best. People with autism and their families report low levels of satisfaction with police interactions, with police officers commonly reporting they require additional training in disability and autism (Crane et al., 2016).
Objectives:

This project utilized a collaborative approach to develop autism training for Australian Capital Territory (ACT) Police, informed by the literature and the perspectives of people with autism and their families, and members of ACT Police. Our research approach increased the opportunity for insider knowledge and expert advice when developing research questions, methods and intervention plans (Walmsley, 2010). This presentation reports on the circumstances in which people with autism are interacting with police in Australia; how interactions are perceived by autistic people and their family members; and to what extent autistic characteristics impacted on these interactions. It will also describe a collaborative approach to the development of police training and the particular insights gained by incorporating the views of people on the spectrum and their families.

Methods:

A literature review was conducted to evaluate the extant academic and grey literature regarding interactions between people with autism and police and the effectiveness of police training. People on the spectrum (n=50) and their family members/carers (n=64) completed an online questionnaire about their or their family member's experience during an interaction with police in Australia in the preceding five years. A sample of adult respondents (n=12) and family members (n=18) participated in semi-structured interviews. Questions included demographic information, disclosure, nature of the interaction, levels of satisfaction, impact of autistic characteristics and suggestions about how the interaction could have been improved and what information police could provide to improve future interactions.

A working party comprised of representatives of all relevant stakeholders (ACT Police, adults with autism, parents of people with autism, an autism specific service organisation) was formed. Draft content was developed, informed by common strategies for first responders outlined in the literature, and the analysis of the survey and interview data.

A focus group of autistic people assessed their views regarding the accuracy and respectfulness of the proposed training material.

Results:

Levels of satisfaction and willingness to disclose diagnosis during interactions with police were related to autism severity and type of involvement. Level of satisfaction was associated with type of involvement with police, presence of additional co-existing conditions, and perceptions of procedural justice. Parents and carers reported higher levels of satisfaction than autistic adults. Qualitative analysis indicated need for autism training for police, with a particular focus on strategies to enhance communication and de-escalation.

Conclusions:

People on the spectrum report unsatisfactory experiences with police, especially when the police are unaware of the person's diagnosis. Training programs that would increase awareness and teach specific strategies are strongly endorsed by autistic people and their families.

134 **113.134** Educating for Success. Models of Practice for Teachers of Students on the Autism Spectrum

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Background: EDUCATING FOR SUCCESS. Models of Practice for Teachers of Students on the Autism Spectrum

Teacher knowledge affects, positively or negatively, the inclusion and learning of students on the autism spectrum. There is an established need for practicing teachers to engage in professional learning and development activities for meeting the social-emotional, behavioural, communication, sensory and learning needs of students on the spectrum.

Objectives: The objective of this research was to design, validate, and trial two Models of Practice (MoP) for Australian mainstream early and middle educators, respectively. Each MoP supports teacher decision-making and fosters the effective inclusion of students on the spectrum. The MoP is an Australian Cooperative Research Centre for Living with Autism (Autism CRC) education project.

Methods: A Design Based Research approach was used to develop and validate the development of the Early Years Model of Practice (EY-MoP) and the Middle Years Model of Practice (MY-MoP). Multiple, iterative cycles of design/construction and evaluation/reflection were enacted (McKenney & Reeves, 2012). Successive prototypes were formatively evaluated to establish both content and social validity of both MoPs. Twenty-nine validated practices (EY-MoP) were trialled by Prep/Kindergarten teachers (n = 43) in 23 schools across Queensland, New South Wales, and Victoria. Thirty six validated practices in the MY-MoP were trialled by Year 7 and 8 secondary teachers (n = 32) in 10 schools across Queensland, New South Wales, and Victoria. Schools were assigned to one of three conditions (face-to-face coaching, on-line coaching and information only) with access to the MoPs via the project website. Teachers implemented the MoPs in their classroom for 8 weeks, with data being collected at two time points across this period using online surveys and phone interviews.

Results: This field-testing of both the EY and MY MoPs has demonstrated their usefulness to teachers. The MoP trial surveys and interview results indicated that teachers perceived each practice model as a user-friendly tool that supported their decision making and classroom practice. Further, survey results indicated that use of the MoPs led to increases in teacher knowledge, confidence, and sense of self-efficacy.

Conclusions: The trial of two Models of Practice (MoP) for Australian mainstream early and middle educators, points to the viability of these practice tools in classrooms which include students on the autism spectrum and their associated impact of increasing teacher knowledge, confidence, and sense of self-efficacy.

135 **113.135** Reading Comprehension Intervention for School-Aged Students with ASD

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Background: Children with ASD are increasingly accessing general education curricula; these students frequently exhibit language and reading difficulties (Nation et al., 2006; Whalon et al., 2009), creating an educational imperative for effective instructional practices for learners with ASD. Current research suggests that the reading comprehension disturbances often seen in students in this population may be related to the social cognitive deficits associated with ASD; instructional practices aimed at improving both reading comprehension and social skills simultaneously may be particularly effective for these students.

Objectives: This presentation will discuss a series of initial intervention trials aimed at targeting both reading comprehension and social cognitive

skills for elementary students with ASD.

Methods: Three cohorts are included in these analyses. The first cohort (n = 15) received the intervention for in a clinical-based setting for a total of 8 weeks. The second (n = 12) and third (n = 44, in progress) cohorts included 20 weeks of instruction and introduced a treatment-control design. Student outcome data included pre- and posttest measures of expressive vocabulary (EVT-2; Williams, 2007), reading comprehension (GORT-5,;Wiederholt & Bryant, 2001), listening comprehension (CELF-4; Semel, Wiig, & Secord, 2003), and social cognition (NEPSY-II; Korkman, Kirk, & Kemp, 2007). Children were also asked to generate narratives, which were analyzed for social and evaluative traits. Videotapes of intervention sessions provided information on fidelity of implementation and student-instructor interactions

Results: Study participants in the first cohort demonstrated significant growth from pretest to posttest in ability to identify and label the cognitive and affective states of characters in their stories (Z = 2.986, p = .003, r = .54). Furthermore, there was a significant increase in the number of intensifiers and attention getting strategies used during narrative generation (Z = 2.414, p = .016, r = .44), suggesting that the participants grew in their understanding of storytelling as a social experience (Henry et al., under review). In the second cohort, treatment and control groups differed significantly in the change in the total proportion of narrative evaluation in their stories, with treatment students demonstrating a significant gain (U= 4.00, z= -2.24, p= .02, r= -.46).

There were no gains in standardized measures of reading and language for students who participated in the intervention. However, the results from the third, larger cohort will likely give more insight into the individual differences in student performance, and it may possible to identify moderators (e.g., autism symptomatology, expressive language) of reading ability in these students.

Conclusions: The results of these unique pilot studies suggest that consistent, explicit instruction in comprehension strategies and vocabulary may have a positive impact on students with ASD. These data will allow us to have a better understand of evidence-based intervention methods to support the social and reading development of these students.

136 **113.136** Testing the Mathematics Advantage Hypothesis in Students with ASD

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Background: Students with ASD may display an advantage with spatial ability and mathematics (Baron Cohen, 2002). Consequently promoting ASD student involvement in STEM curriculums may be useful in schools (Wei et al. 2013, 2014). However, research is inconsistent with significant heterogeneity in mathematics development observed across students with ASD (Chiang & Lin, 2007) and a pattern of strength in calculation, but significant difficulty with verbal problem solving has been observed for affected students (Wei et al. 2015).
Objectives: To examine the mathematics advantage hypothesis of ASD this study compare students with ASD, typical development and ADHD on math achievement. The study also examined the relations between math development and spatial ability, reading, social-cognition and working memory.

Methods: 159 children participated including 77 with ASD (M = 8.51 years, SD = .21), 39 with ADHD symptoms (M = 8.46 years, SD = .19), and 43 with typical development (M = 8.47 years, SD = .19). The groups were divided and matched in Lower and Higher VIQ subgroups, ASD 90.4 (8.7), 113.4 (7.8), ADHD 92.2 (8.1), 117.5 (9.4), and TD Group 95.5 (7.1), 119.5 (9.3), respectively. ASD diagnosis was confirmed with the ADOS-2, and ADHD symptoms were confirmed with the Conner's Parent Rating Scale-3. The students were assessed three times over 30 months with the Numerical Operations and Problem Solving Scales of Wechsler Individualized Achievement Tests-V, as well as the Wide Range Assessment of Memory and Learning, and the Gray Oral Reading Tests-5, and a silent movies Theory of Mind (ToM) task. The WASI was used for IQ and the Block Design Scale provided the spatial processing index.

Results: The TD group exhibited better performance on both math measures than the clinical groups, which did not differ, $F(2, 106) = 11.20$, $p < .001$, partial $eta^2 = .18$. The ASD group performed better on Numerical Operations than Problem Solving, $F(1, 49) = 12.8$, $p < .001$, partial $eta^2 = .21$, but this effect was not observed for the other groups. Greater difficulty in Problem Solving in the ASD versus TD comparison was evident in the lower VIQ subgroups than higher subgroup, $F(1, 87) = 4.42$, $p < .04$, partial $eta^2 = .04$. ToM was only associated with math performance in the ASD group. However, regressions indicated that only Time-1 VIQ, Block Design and Symbolic Working memory predicted Time- 3 Problem solving in the ASD sample, $adj\ R^2 = .58$, $p < .001$. Different patterns of predictors were observed in the other groups.

Conclusions: Difficulty with math learning may be a characteristic of many students with ASD, especially those with VIQs below 105. Thus, learning differences associated with IQ may be important to examine among ASD students without intellectual disabilities. The math learning of lower average IQ students with ASD may require greater classroom support than is currently recognized and perhaps specific assistance with spatial and working memory development. These data are not consistent with the hypothesis of a general mathematics advantage for ASD students.

137 **113.137** Understanding the Role of Leadership in Supporting High Quality School Services for Students with ASD

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Background:
Children with autism spectrum disorder (ASD) receive a majority of their therapeutic services in schools. Although evidence-based practices (EBPs) for students with ASD exist (Wong et al, 2015), the research on implementation in schools indicates low usage and fidelity. To improve service quality and student outcomes, we must focus not only on testing practices but also on how to effectively implement and sustain EBPs in schools. Current literature across other fields indicates leadership support as critical to successful implementation. Therefore, it is important to understand the leadership structure and processes for implementation of EBPs in schools.

Objectives:

To identify key factors related to implementation and sustainment of EBPs for ASD in schools by exploring: 1) leadership involvement, 2) current processes across job types, and 3) implementation barriers.

Methods:

Survey data were analyzed from 340 educators, representing 231 education agencies across California. Participants included High-level administrators (n=19), Mid-level leaders (autism/behavior specialists; n=111), School site principals (n=15), Direct service providers (n=153), and Mental health providers (school psychologists; n=33).

Results:

Leadership Involvement: Participants reported Mid-level leaders as having the most impact in implementation, including identifying new ASD educational programs (57%), choosing interventions to implement (48%), and actively providing training (76%). However, responses varied by respondent job type. For example, 63% of High-level leaders identified High-level leaders as most responsible for identifying new programs compared to 27% of Mid-level leaders. 25% of School site principals identified themselves as having the most impact in providing training, while only 1.5% of all other participants selected them.

Implementation and Sustainment Processes: A majority of School site principals (75%) indicated schools use similar processes to identify, choose, implement and sustain programs for students with ASD as is used for use for other **special education programming**. Only 40% of Mid-level leaders agreed that the process is the same. In contrast, participants reported the process used to identify, choose, implement and sustain ASD programs differs from the process uses for general education student services.

In planning for sustainment, 88% of High-level leaders reported planning to support use of the intervention after training ended, however, only 44% of Direct service providers agreed this was the case (see Table 1).

For the 110 respondents that provided coaching in National Professional Development Center identified EBPs for ASD, both more frequent meetings with High-level leaders and more frequent meetings with their direct supervisor about implementation activities were significantly associated with higher frequency and quality of coaching ($B = 1.1$, $p < .02$; $B = 1.9$, $p = .001$ respectively).

Barriers: Participants reported time for training as the top barrier to implementation of EBPs (25.6%), followed by lack of substitutes (16.5%), and limited foundational skills (11.5%).

Conclusions:

Leadership is an important aspect of EBP implementation in community programs. In schools, there is a disconnect between High level leaders and direct service providers regarding the amount of planning, training and implementation support provided for new EBPs. Understanding how leaders can better support providers is a next step in ensuring EBP are implemented and sustained effectively.

138 **113.138** A Comprehensive Secondary Education Program for Students with ASD

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Background: The combination of autism spectrum disorder (ASD), adolescence, and the tumultuous nature of high school settings makes providing an appropriate education program for adolescents with ASD one of the most challenging tasks for public education in the US. The Center on Secondary Education for Students with Autism Spectrum Disorder (CSESA) created a comprehensive treatment program to address the variety of educational and learning needs for adolescents with ASD. The CSESA program consists of four features that focused on literacy, independence, social competence, and transition/families, with these features implemented over at two-year period.
Objectives: To determine the efficacy of the CSESA program, investigators conducted a cluster randomized control trial.

Methods: Sixty high schools located in three regional locations in the US (CA, NC, WI) were randomly assigned to CSESA and services as usual (SAU) conditions and 545 high school students with educational diagnoses of autism and their families participated in the study. The mean age of the students at the beginning of the study was 16 years; 86% of the student participants were male; 45% of the students had race/ethnicity other than white, nonHispanic; 39% of the student were from low income families; and the students spanned the range of autism severity. An assessment of program quality was collected at the beginning and end of the study in all schools. During the course of the study, multiple measures of implementation were collected and assembled as an "implementation index." A battery of standardized measures collected at the beginning of the study and again at the end of the study included two Woodcock-Johnson literacy measures, Vineland Adaptive Behavior Scale-3, Social Responsiveness Scale, AIR Self-Determination Scale, the Support Intensity Scale, the Family Empowerment Scale, and the Zarit Burden Inventory. Also, Goal Attainment Scales (GAS) were collected for individual student goals related to literacy, social competence, independence, and transition.

Results: A standard ANCOVA, controlling for site and pretest scores, revealed significant differences in program quality favoring CSESA. Implementation index scores found significant difference between CSESA and SAU schools' implementation of CSESA program features and also a range of "levels" of implementation within the CSESA group. A multilevel analysis with students nested within schools and regional sites as a control was conducted for all standardized and GAS measures. The CSESA families scored significantly higher on the Family Empowerment Scale than SAU group families, and CSESA students scored significantly higher on the mean GAS scores than students in the SAU condition. However, significant difference were not found on the standardized student measures.

Conclusions:

This study demonstrated that this multicomponent comprehensive treatment model implemented at the school level can significantly impact program quality, families' perceptions of empowerment, and accomplishments of student goals (which are the most proximal assessment of intervention effects), although the more distal student measures did not detect treatment effects. In addition, the range of levels of implementation across schools in the CSESA sample reflect the challenge of conducting large scale RCTs in authentic public school settings.

139 **113.139** A 2-Year Iterative Study of an Informal STEM Educational Program for Neurodiverse Adolescents

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Background: Given that affinity for technology is common in autism (Baron-Cohen, 2009; Wei et al., 2013), technology-focused programs for youth with ASD may help them transition into meaningful careers. However, there are few evidence-based programs to help youth with ASD turn STEM interests into marketable skills that will help them succeed in college and the workplace. The extracurricular, not-for-profit Tech Kids Unlimited (TKU) provides a supportive environment rich in technological instruction for students with ASD and other disabilities in NYC.
When we conducted our first evaluation of TKU's summer programming in 2017, participants reported gains in technology and social skills and expressed a desire to enter STEM fields but their job plans remained very vague. Student feedback highlighted a preference for hands-on, multimodal instruction, consistent with the tenets of Universal Design for Learning (UDL). In 2018, we implemented a UDL planning/evaluation rubric and conducted a pilot 10-day long workshop to determine if longer workshops featuring UDL-aligned instructional practices help neurodiverse students learn.

Objectives: Examine if and how participation in an increasingly UDL-aligned summer technology program helps neurodiverse students develop technology, social, and job-related skills.

Methods: In 2017, adolescents with autism were recruited across TKU's summer workshops (*n*=20, *Mage*=15.6). In 2018, we focused evaluation on a popular transit-themed, game-design workshop, lengthening it from TKU's standard workshop length of 5 to 10 days (*n*=16, *Mage*=16.2). We developed and implemented a UDL curriculum template for instructors program-wide. After obtaining reliability, we coded instructional practices for 8 of 10 days using the new UDL Curriculum Template and Social-Emotional Checklist (Figure 1). In-person, semi-structured interviews and online surveys were conducted with students and parents, respectively, each year.

Results: Results suggest improvement in parent perceived social skill learning in 2018, with its heightened focus on collaboration and UDL-aligned techniques, relative to 2017 (Table 1). The specificity of student's job plans also improved numerically when comparing 2017 to 2018. When asked what skills they learned from the workshop, students continued to overwhelmingly cite technology skills.

Coding of instructional techniques revealed that multiple teaching methods were used. Instructors used lectures (87.5% of days), group discussions (100%), hands-on activities (100%), video tutorials (75%), and self-guided independent work (87.5%). Students checked-in regularly to evaluate progress (100% of days) and received feedback from staff at key junctures (87.5%). Students were encouraged to review what they learned (87.5% of days), practiced time management (100%), and discussed their goals as a group (50%). Icebreakers and social games occurred 75% of the days coded.

Conclusions: Our structured UDL curriculum/assessment template shows promise as a strategy to engage neurodiverse adolescents in STEM education. Instructors were receptive to the new template and demonstrated varied and creative teaching techniques throughout the two-week program. However, additional areas for programmatic improvement remain apparent. Programming should continue to adapt based on student feedback and to highlight scaffolded opportunities to develop collaboration skills and explore potential career paths.

140 **113.140** A Review of Barriers and Facilitators to Intervention Implementation in Special Education.

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Background: In the autism literature, "evidence-based practices" (EBPs) are practices which have repeatedly been shown effective in addressing key deficits associated with autism (Odom et al., 2010). These practices have been found to lead to optimal outcomes for students with autism and special education teachers (Bond et al., 2016; Wong et al., 2013). Traditionally, however, teachers' engagement in EBPs has been poor, with teachers engaging in classroom practices that have little scientific support (McMahon & Cullinan, 2014). Factors that may affect teachers engagement in EBP's have been theorised to include staff training and buy-in (Forman et al., 2013), however, these factors have not yet been delineated.
Objectives: This study aimed to synthesise and analyse findings related to the barriers and facilitators to the implementation of evidence-based practices in special education.

Methods: Papers were extracted from the following databases: Academic Source Complete, ERIC, Education Source and PsycInfo. A total of 3452 papers were returned and screened by abstract and title. 188 papers were included for full text review. From these, 8 quantitative papers and 7 qualitative papers were included for data synthesis and analysis.

Results: Results indicate that the barriers to implementation are yet to fully be delineated. Barriers and facilitators were present across different systems, including; the individual teacher, the school environment and external policies. Barriers and facilitators within these systems included resources, training, administrative support, and school wide supports.

Conclusions: Barriers and facilitators to intervention implementation in special education are evident at the macro, meso and micro levels of the individual. Whilst little can be done by special education teachers at the macro level, this paper has identified key factors at the micro level which could be used to inform interventions to alleviate barriers to intervention implementation.

141 **113.141** A Social Network Analysis of Middle and High School Students with ASD in an Inclusive Public Charter High School

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Background: Inclusive education—or the co-participation of students with and without disabilities in general education classrooms—increases academic and social outcomes in children with and without disabilities (Abramovitch et al., 1987; Cosier et al., 2013; Gallagher, 2000; Stoneman et al., 1987; 1989). However, students with disabilities in inclusive classrooms may be at increased risk for social rejection (Ochs et al., 2001), which may hinder their social and academic development (Siperstein & Parker, 2008; Cooc & Kim, 2017). To optimize inclusive education's outcomes, students with disabilities must be effectively integrated into peer social networks. This is particularly important for students with autism spectrum disorder (ASD), who, due to their difficulties with social communication, are at increased risk of social isolation, and resulting negative social and academic outcomes (Lasgaard et al., 2010; OECD, 2003).
Objectives: The present study examines the extent to which secondary students with ASD are socially included in peer networks at an inclusive charter school serving a high proportion (~50%) of students with disabilities. Relationships between social inclusion and social competence, self-

efficacy, and depression symptoms are also investigated, in students with and without ASD.

Methods: Chronological age-matched students (10-20 years) with and without ASD (n_{ASD}=31; $n_{non\text{-}ASD}$ = 67) completed electronic questionnaires about their friendships, self-efficacy, and depression symptoms. Each student's social competence was also assessed using a brief teacher-report questionnaire. Social network analysis methods were used to explore ASD students' social inclusion in peer networks at school, and within-group correlations tested for associations between measures of social inclusion and age, social competence, self-efficacy, and depression symptoms, in students with and without ASD.

Results: On average, students had equal proportions of friendship ties with students with and without ASD, regardless of their own diagnostic status (External-Internal $Index_{ASD}$ = -0.199 [-0.443, 0.045]; E-I $Index_{non\text{-}ASD}$=-0.015 [-0.134, 0.103]; $t_{ASDvnon\text{-}ASD}$=1.537, $p_{ASDvnon\text{-}ASD}$=0.128). That is, students with/without ASD reported having roughly equal numbers of friends with and without ASD. However, students without ASD tended to report more friendships than students with ASD (p=0.009). For students with ASD, numbers of friendships were positively associated with teacher-reported social competence (ASD: r=0.417, p=0.020; non-ASD p=0.300). Furthermore, number of friendships was positively associated with self-efficacy (r =0.477, p=0.010), and marginally negatively associated with depression symptomatology (r=-0.388, p=0.050) in students with ASD (all non-ASD p>0.120). None of the variables examined varied significantly by age in the sample.

Conclusions: The school under study serves a population of students with disabilities four times higher than the U.S. national average, thus presenting a unique opportunity to examine the social relationships of students with and without disabilities in an inclusive educational context. Students in this context did not self-segregate into peer networks based on the presence or absence of an ASD diagnosis, although students with ASD appeared to have fewer friendships on average than those without ASD. Given the relationships between numbers of friends, self-efficacy, and depression symptoms in students with ASD, the current results emphasize the importance of strong peer networks for promoting positive mental health outcomes in secondary school students with ASD.

142 **113.142** ASD Knowledge in Medical Students and Residents

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Background:

As autism spectrum disorder (ASD) is diagnosed more frequently, possessing accurate literacy of the disorder becomes increasingly important for physicians. Previous research has investigated knowledge and attitudes of ASD possessed by medical professionals who are likely to work with individuals with ASD and primary care practitioners (Heidgerken et al. 2005). Compared to a group of ASD specialists, medical professionals, including primary care practitioners, were more likely to maintain incorrect beliefs regarding certain components of ASD. For example, non-ASD specialists were less likely to believe children with ASD share social attachments/affectionate behaviors with caregivers and peers. Additionally, these professionals endorsed the false notion that ASD is more prevalent in families of a higher socioeconomic status (Heidgerken et al., 2005). This study suggests individuals in the medical field, particularly those who do not frequently work directly with individuals with ASD, may hold incorrect and inaccurate beliefs about ASD and may not be aware of their lack of knowledge.

Objectives:

The primary goal of this study was to investigate perceived and actual knowledge of ASD possessed by medical students and residents.

Methods:

A sample of 141 medical students and residents (61.5% female) completed a battery of assessments including a demographic survey and A Survey of Knowledge of Autism Spectrum Disorder (ASK-ASD; Hansen, 2015), assessing perceived and actual knowledge of ASD. Approximately 27% of the participants endorsed receiving previous ASD training, such as lectures during medical school and ASD-focused clinical rotations.

Results:

Participants' actual knowledge of ASD was high (85%), and participants perceived themselves to be moderately knowledgeable (M = 1.95, SD = .34). The correlation between perceived and actual knowledge was significant, r = .23, p = .006, indicating that when knowledge was higher, so was their confidence in their knowledge. Additionally, receiving ASD training was significantly correlated with both perceived and actual knowledge, r = .40, p < .001 and r = .19, p = .03, respectively. To further examine the relation between training and ASD knowledge, Steiger's (1980) method for comparing two dependent correlations (i.e., those sharing one common variable—previous training on ASD) was used to determine whether the magnitude of the correlation between perceived ASD knowledge and training was greater than the magnitude of the correlation between actual knowledge and training. The difference between the magnitudes of the correlations was significant, $t(137)$ = -2.57, p = .01, indicating the correlation between training and perceived ASD knowledge is significantly higher than the correlation between training and actual ASD knowledge.

Conclusions:

Generally, participants were highly knowledgeable regarding ASD and higher levels of knowledge were associated with higher confidence in their own knowledge levels. Nevertheless, this correlation was modest. Additionally, analyses revealed several significant correlations between perceived and actual ASD knowledge and previous ASD training, and the magnitude of these correlations were significantly different. That is, medical students' training appeared to improve their perceived knowledge more than it improved their actual knowledge. This finding may, in part, be due to a high level of actual knowledge overall, creating a ceiling effect.

143 **113.143** ASD in STEM: Major Selection and Grades in Higher Education

B. E. Cox*, Educational Leadership and Policy Studies, Florida State University, Tallahassee, FL*

Background:

Both public stereotypes and "systematizing" theories of autism suggest that students with autism are particularly well-suited for the STEM (Science, Technology, Engineering, Math) fields. It is presumed that autistic students are both drawn to and successful in these fields because the characteristics of these fields - linear, logical, computations, and often with clear "right" answers - are consistent with the way in which an autistic brain processes information. Indeed, emerging evidence (particularly using data from the NLTS2 dataset) suggests that postsecondary students with autism disproportionately pursue STEM-related degrees and successfully transition from 2-year to 4-year institutions more readily than do their non-STEM peers. However, to date, no published studies have compared the relationship between autism and academic performance in

STEM vs. non-STEM fields.

Objectives:

This study addresses two overarching research questions: 1) Do college students with autism-related characteristics disproportionately pursue majors in the STEM fields? 2) Do students with autism-related characteristics have better academic performance (GPA) in STEM fields than they do in other fields of study. The analyses for both questions also examine whether the answers to either of the two research questions varies across students' year in school (e.g., sophomore, senior).

Methods: This study uses 7 variables drawn from a sample of 812 undergraduate students in United States. Students' institutional records provided information on each students' major course of study, GPA, SAT score, race/ethnicity, gender, and year in school. Students' autism related characteristics were measured via a continuous variable derived from responses to the short form of the Autism Quotient assessment instrument. Any missing data were augmented through Multiple Imputation (MI) or Full Information Maximum Likelihood (FIML) procedures. Analyses presented in this paper include descriptive statistics, comparison of means, correlations, and structural equation models (SEM), and included statistical controls for student gender, race/ethnicity, and SAT scores.

Results:

Three results warrant particular attention. First, our findings support the conclusions of other studies that autistic students are drawn to STEM fields. Second, overall results suggest that students' major program of study has only minimal effects on the relationship between students' autism-related characteristics and their GPA; throughout the first three years of coursework, students with similar degrees of autism-related characteristics perform similarly (in terms of GPA) regardless of their major program of study. Third, in the final year of undergraduate studies, students with higher levels of autism-related characteristics in non-STEM majors (e.g., humanities, social sciences) begin to experience lower GPAs than their counterparts in STEM fields.

Conclusions:

The study suggests that students with autism are disproportionately pursuing STEM related degrees, apparently with good reason. The results demonstrate that these students may find more academic success in STEM fields than in other fields of study, especially as they approach completion of their undergraduate degree. These findings related to GPA are particularly important for life-long outcomes because employers and graduate schools consider GPA as one of the primary indicators of graduates' potential for future success.

144 **113.144** Connections between Autism-Related Characteristics and Postsecondary Gpa

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Background:

Despite a dramatic recent uptick in the frequency with which autistic students pursue postsecondary education, current literature suggests that fewer than half of these students will complete their studies and earn a degree. Yet there have been remarkably few studies exploring the reasons behind this phenomenon. The few studies addressing these students' postsecondary outcomes have addressed only enrollment and completion. To date, there have been no large-scale studies exploring one of the key factors affecting student persistence and graduation: their grades. Not only do student grades serve as a more granular and timely indicator of students of secondary success, many employers use GPA as a screening tool when considering applications for employment.

Objectives:

The present study fills an important gap in the literature by examining the relationship between students' autism-related characteristics and their postsecondary GPAs. The study is guided by an overarching question: To what extent do students autism-related characteristics relate to their academic-year GPAs? The study further explores this relationship by examining the manner in which it varies for students of different racial/ethnic identities, gender identities, and year in school.

Methods:

This study uses 6 variables drawn from a sample of 812 undergraduate students in United States. Students' institutional records provided information on each students' GPA, SAT score, race/ethnicity, gender, and year in school (e.g., sophomore, senior). Students' autism related characteristics were measured via a continuous variable derived from responses to the short form of the Autism Quotient assessment instrument. Any missing data were augmented through Multiple Imputation (MI) or Full Information Maximum Likelihood (FIML) procedures. Analyses presented in this paper include descriptive statistics, comparison of means, correlations, and structural equation models (SEM).

Results:

Counter to the researchers' expectations, the results reveal no statistically significant relationship between students' autism-related characteristics and their GPAs. The lack of such a relationship was consistent across both genders, all racial/ethnic groups, and for students at every point in their undergraduate progress. The robustness of these results are evident in their consistency across all of the variations in our statistical analyses.

Conclusions:

These results are important for at least 3 reasons. First, this study's results may provide some hope and reassurance to autistic individuals who may wish to pursue postsecondary education. These students will benefit from knowing that their academic performance is unlikely to be negatively affected by their autistic traits. Second, the study informs practice by suggesting that interventions to support student completion need not focus on students' classroom performance. Rather, such interventions should focus on other factors of the postsecondary experience that may be curtailing these students continued enrollment to graduation. Third, because the results suggest that the low graduation rate for autistic students is not likely a result of poor grades, researchers studying the topic will need to examine other potential factors (e.g. social isolation, mental health) that may be causing autistic students to drop out before completing their postsecondary degrees.

145 **113.145** Adolescents with ASD Perform Better in Listening Comprehension Than in Word Reading

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Background:Skilled reading requires the ability to integrate phonological and semantic information to decode written text (Lam et al., 2017). The Simple View of Reading (SVR) framework (Hoover & Gough, 1990) suggests that skilled reading depends on two interrelated conditions that contribute to reading comprehension: word reading and linguistic comprehension (i.e., listening comprehension). A weakness in word reading or listening comprehension results in poor reading comprehension (Norbury & Nation, 2005). Thus, the SVR framework has been widely used to understand and identify reading difficulty (Catts et al., 2003). Using this framework, Nation et al. (2006) showed that adolescents with autism have better word reading skills relative to listening comprehension. Solari et al. (2017) also used the SVR framework to understand reading comprehension difficulties in higher-functioning individuals with autism, and found that word reading predicted reading comprehension more than other factors (i.e. listening comprehension). Research has yet to apply this framework with lower functioning individuals with autism.
Objectives:The purpose of this study is to investigate the role of word reading and listening comprehension to predict reading comprehension in predominantly lower functioning adolescents with ASD, as defined by Weschler FSIQ. Based on previous studies, we expect that both listening comprehension and word -reading will predict reading comprehension.

Methods: We tested 22 adolescents with ASD aged 13-17 years [M_{FSIQ} =58.7 (25.5); n_{male} = 19, n_{female} =3]. Participants completed three subtests of the Wechsler Individual Achievement Test - Third Edition (WIAT-III): reading comprehension, listening comprehension, and word reading. For reading comprehension, participants responded to literal and inferential questions. Listening comprehension has two subtests: receptive vocabulary, where participants point to pictures that best illustrate the meaning of a word and oral discourse comprehension, where participants listen to passages and respond to examiner's questions. For word reading, participants read a list of words aloud without time limitation.

Results: A linear regression model with word reading and listening comprehension predicted reading comprehension: R^2 = .561, p < .001. Specifically, results showed that performance on listening comprehension significantly predicted reading comprehension, b = .703, p < .001; however, word reading did not predict reading comprehension, b = .210, p > .05.

Conclusions: Contrary to expected results, word reading did not predict reading comprehension for low-functioning adolescents with autism. Hence, our results support previous research demonstrating a discrepant relationship between word reading and reading comprehension in participants with autism (Nation, 2006; William, 2005). Our results, in conjunction with previous research, highlight the heterogenous nature of reading skills in adolescents with low-functioning ASD (Jones et al. 2009). Additionally, our findings contribute to the understanding of individual differences in ASD profiles in terms of oral language competence. Future research should address whether word reading in ASD is possibly tempered by other language deficits (Nation, 1999). Overall, our data suggest that listening comprehension may play a bigger role than previously assumed. Educational practices may benefit from these findings, in particular in the implementation of reading interventions for listening comprehension.

146 **113.146** An Autism Public Health Education Initiative (launch of a novel) Aimed at Parents, Educators and Peers in a Developing Country.

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Background:

Supportive peers, educators and parents make a significant difference to the quality of life of children with Autism Spectrum Disorder (ASD). In our setting, even though the education policy is inclusion, an ASD diagnosis often leads to non-acceptance into mainstream schools. In the mainstream schools also, children with ASD are oftentimes teased, bullied and targeted by their peers rather than being supported. Resource constraints also result in children with ASD not receiving adequate support in school; teacher aides are often in short supply

Even in the context where resources are constrained, sensitizing and educating peers and educators would impact the quality of the school experience for children with ASD by changing perspective and attitudes.

Story telling is an age old tradition through which children can be taught ideals and values. This project aimed at educating through telling a story about a boy with autism in the local context.

Objectives:

We aim to describe a public/Non Governmental Organisation (NGO) partnership project to launch a novel about a boy with autism and the initiatives to have the novel available in schools.

Methods:

In November 2018, a community paediatric service, an autism support group and another local NGO partnered to launch a fictional novel about a boy with autism.

The novel was written by the community paediatric consultant to describe the features of autism through the life course and to take the reader on a journey through the challenges faced by the family through three perspectives: the boy, his sister and his mother. Book publication was funded by the local NGO. The launch was hosted by the autism support group. The book was endorsed by a famous local artiste, a local university lecturer in child health and a professor from a research institute for autism in the USA. The launch was done as a charity fundraiser for autism.

The second phase of the project sought sponsors to donate books to schools nationwide.

Results:

The book launch was attended by the Director of Health for the region and the Minister of Health recognising the event as a public health education initiative. Parents, educators, health professionals and NGOs all attended. The book review was done by a paediatric trainee and mother of a child with ASD. Book readings were done by children with ASD.

In the second phase which is ongoing, funding is being sought to donate books to schools nationwide. The initial response has seen, three banks, two NGOs and individuals giving donations covering eighty five schools.

The committee would also advocate for the book to be on the schools literature curriculum.

Conclusions:

This public/NGO partnership project is an autism public health education initiative aimed at promoting awareness and understanding among peers, educators and parents. In resource constrained countries, this type of project can go a long way to improve the quality of life for children

with ASD.

147 **113.147** Artea – Artistic Practices with Children in the Autism Spectrum

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Background:
Brazil doesn't have robust epidemiological data on prevalence of ASD. Our education has worked from the perspective of inclusive education since 1994, but the law that regulates this model was only enacted in 2016. In 2007, official data from the city's municipal education office in Belo Horizonte, Minas Gerais, pointed only 38 children with autism in early childhood education (0 to 60 months). In 2008, this number rises to 68; and in 2016, 140 students. However, in 2018, we identified (through document analysis) 12 children diagnosed with ASD in only one of the 131 schools in the network.

Children at this age spend between 20-38h weekly at school. Knowing the importance of children's time quality, the importance of early intervention, and knowing the lack of knowledge of those teachers on ASD, we built a pilot project called ArTEA (art-ASD, in portuguese), using art-education as main tool.

Objectives:

To present ArTEA as a tool to expand the range of possibilities for offering ASD care in the context of early childhood education in Brazilian context;

Identify if artistic practices can be useful for early intervention and sensitization of Early Childhood teachers;

Reflect on the potential of using methodologies to work with art education in the field of inclusion, as well as the importance of interdisciplinary work in addition to health and education courses, including Visual Arts, Dance, Music and Theater.

Methods:

Pilot Project with a group of Municipal Unit of Early Childhood Education-UMEI: 20 children aged 4/5 years, 2 with ASD, 2 teachers and 2 auxiliaries of inclusion (paraprofessionals, with no professional licensure and almosto no training in ASD);

20 4-hour meetings of artistic workshops, focusing on group corporal movement experimentation, aiming at inclusive activities, that instill the corporality of all in the activity. We used some principles of the Early Star Denver Model (ESDM) as a coadjuvant, namely: following child leadership, reciprocity (being play partners), and positive affect. We also use sensory-body and rhythmic proposals, using different materials (percussive musical instruments, tissues, hula hoops, balloons, etc.);

10 training meetings with teachers, coordination and paraprofessionals;

Application of post interview and questionnaire (with Likert scale) pre and post project for teachers.

Results:

We note inclusive power of artistic work when performed in conjunction with typical children, especially in aspects of relational improvement among pairs and play repertoire expansion of childrens in the spectrum. We observe the importance of planning activities based on elements children in the spectrum bring - preferences, focus of attention, etc.

Teachers feel more secure and interested after participating in the workshops, although the school hasn't been able yet to schedule the theoretical training sessions.

Conclusions:

The project is situated in a frontier territory between art, education and clinic. Artistic practices, even though they are neither therapeutic nor educational in their origin, place us face multiple possibilities of encounter. It is important that new practices and research be done, filling the gap of methodological and experiential knowledge about the arts with children with ASD and early childhood education.

148 **113.148** A Parent-Mediated Intervention to Increase Academic Motivation for Homework Completion Among Students with ASD

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A parent-mediated intervention to increase academic motivation for homework completion among students with ASD
Background: Students with Autism Spectrum Disorder(ASD) often exhibit limited motivation to complete academic tasks and consequently engage in a number of off-task and disruptive behaviors (Koegel,L.,Singh,& Koegel,R.,2010). This limited motivation can also impact home-based academic tasks, making homework completion exceptionally challenging for both the student and parents(Endedijk,Denessen,&Hendriks,2011). Although studies indicate that behavioral interventions in the classroom can increase academic performance in students with ASD (Koegel,L.,Matos-Freden,Lang,&Koegel,R.,2012), few have focused on in-home academic challenges and practical strategies parents can implement to alleviate these difficulties(Abel,Gadomski,&Brodhead,2016). Proper parentfacilitation can increase child engagement with homework(Hampshire,Butera&Bellini,2011),making it likely that themotivational components of Pivotal Response Treatment (PRT;Koegel,R.,Koegel,L.,Vernon,&Brookman-Frazee,2018) can be used as a framework to enhance in-home academic engagement.

Objectives: The current study adapted the motivational techniques of the PRT model to a parent-delivered program focusing on the teacher-assigned academic homework.Previous academic adaptations of PRT used highly customized academic activities to teach general concepts toparticipants (Koegel et al.,2010);however, these activities did not include actual school assignmentsthat students were required to complete.By adapting assigned homework to fit within a PRT framework, the current study aimed to directly target the student's mastery of the classroom curriculum.This study set out to see how these motivational techniques can be applied in the context in the home by parentsand evaluate the feasibility and acceptability of these teaching methods.

Methods: Participants were three grade-school students in inclusive general education classrooms at different schools with a current diagnosis of ASD(ages 7,8, and 9) and their parents(2 mothers, 1 father).During intervention, parents were provided with a manualized intervention outlining adapted PRT strategies for homework, as well as immediate in-vivo feedback from a clinician trained in PRT.Using a multiple baseline across

participants design, parents were provided with information and examples on the PRT techniques of child choice(Reutebuch,El Zein&Roberts,2015), task interspersal(Cowan,Abel&Candel,2017), reinforcement with preferred interests(El Zein,Solis,Lang &Kim,2016), and self-management(Lee,Simpson&Shogren,2007).Sessions were video-recorded and behaviorally coded for on-task behavior, latency to begin work, disruptive behavior, negative comments, and frequency of adult redirection.Follow up data were also collected.

Results: Results indicate that overall on-task behavior increased between baseline and intervention (Cohen's d=5.50); while latency to begin work (Cohen's d=2.05), disruptive behavior (Cohen's d=2.36), negative comments (Cohen's d=5.0), and frequency of adult redirection (Cohen's d = 4.18) decreased. Social validity surveyswere indicativeof parent and student perceptions that the intervention was useful and effective: Meanparent rating was 4.41and the meanparticipant rating was 4.43,on a scale from 1 (strongly disagree) to 5 (strongly agree).When asked about the impact of specific PRT strategies, parents found the techniques of embedding child choice (4.75) and incorporating preferred interests (4.75) the most effectivehomework modifications.

Conclusions: This research may help inform the development of an intervention package that parents can use to alleviate persistent homework challenges for their child.Many students with ASD face academic challenges, and homework can be mutually stressful for both child and parent.This study has important implications for both the parent-child relationshipthe context of homework, in additional to child perceptions of academic confidence and mastery.

149 **113.149** Challenging Stereotypes of Math Giftedness and Math Disability in Students with Autism Spectrum Disorder (ASD)

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Background: People with autism spectrum disorder (ASD) are often stereotyped as gifted mathematicians—like the socially inept physicist, Sheldon Cooper from the TV series *The Big Bang Theory*. Essentially, the dominant view suggests that the symptoms of ASD are somehow related to math ability. This bias may foster unrealistic expectations and lead to frustration for students with ASD who are not so highly skilled. An accurate description of the prevalence of math giftedness and disability in ASD is critical, but little research exists. Results from Jones et al. (2009) showed that there were 5.5x more students with ASD who would be considered low-achievers compared to the rate of low-achieving students found in the general population. Yet, Foley-Nicpon et al. (2012) showed that the math skills of gifted students with ASD were advanced. Together, these two studies highlight that while a diagnosis of ASD may impact math ability, ASD seems to predict higher than expected rates of both mathematical giftedness and disability, yet the reasons for this are unclear. To begin to elucidate which underlying processes are most important to the students' math achievement, we will explore the relative impact that language ability, fluid reasoning (FR) skills and ASD symptomology have on math ability of students with ASD.
Objectives: We examined the:

- rates of high- and low-achieving students with ASD in math and compared the observed rates to the rates of high- and low-achievers in the general population; and
- relative impact of ASD symptomology, language and FR in predicting the children's math ability.

Methods: 36 youth with ASD (5–12yrs; FR scores > 80) completed the following tests.

FR: *Raven's Progressive Matrices* and the Sequential Order subtest of the *Leiter-3*.

Language: *Clinical Evaluation of Language Fundamentals-5* Expressive Language Index and *Peabody Picture Vocabulary Scale-4*.

Math: *KeyMath-3 Diagnostic Assessment* (Cdn. Ed.) Basic Concepts (e.g. algebra, geometry), Operations (i.e., arithmetic), and Applications (i.e., problem-solving).

ASD Symptomology: *Social Responsiveness Scal*e (SRS-2).

Results: Across the three KeyMath-3 composites, the rates of low-achieving students with ASD were 1.5–3.5x higher than the rates found in the general population (Fig. 1). Similarly, the rates of high-achieving students with ASD were 3.3–4.6x higher than the expected rates. Chi-squared analyses showed that these differences were significant. Neither age nor SRS-2 scores were correlated with math ability, while language and FR were each large and significant predictors with standardized betas ranging from 0.3 to 0.7 (Table 2).

Conclusions: This research investigated whether a diagnosis of ASD is associated with math ability. The first analysis showed that there are greater than expected numbers of students with ASD who have either significant math strengths or math weaknesses suggesting that autism somehow leads to both. However, the second analysis showed that ASD symptomology per se was not the primary cause of these differences. Instead, this suggested that knowing about a student's FR and language ability was more important to understanding their math skills than knowing that the student had a diagnosis of ASD.

150 **113.150** Combination between the Two Approachs Teacch, ABA & the Serious GAME "JE Stimule" for a Strong IEP of an Autistic CHILD

ABSTRACT WITHDRAWN

Background: Autism spectrum disorders (ASD) is a complex neurodevelopmental disorder characterized by difficulties in social and interpersonal communication, combined with stereotyped and repetitive behaviors and interests.Otherwise, the factors influencing the parents' decision about what method to follow are usually the recommendations of others, practical issues, effectiveness of the intervention, and proven scientific evidence they do agree that these children should receive treatment, very quiqly, and must be better one (Escandell et al, 2015). the relevance of digital tools, also the implications of research on brain-compatible learning have led to the development of technology-assisted learning that has been and is being adapted and introduced into the classroom as a valuable and effective aid to understanding the benefits of different educational options.

Objectives:

Our aim of this present work is to establish a strong and adequate educational program for children with autism in Morocco using a method inspired by two different approaches ABA and TEACCH, and a software developing emotional recognition at the autistic children. The secondary goal was to determine whether the use of this software would positively influence the autistic enjoyment at school, as assessed by their teachers, and whether there is a combination of educational programs: ABA, TEACCH and the software "JeStimule".

Methods:

A 10 children participated in the research, in AL-AMAL association at Sale diagnosed with autism by health professionals (child psychiatrist and child psychologist), and 4 educators who were able to follow with us the program during a school year with a remediation of emotions included on the different parts of the educational program (TEACCH + ABA). After the beginning of the year a comparison was made of JeStiMULE results before and after using both approach.

Results:

The result show that self-esteem and self-efficacy of educators after the use of the program is higher than before starting the program, while the Wilcoxon test shows a significant result ($p<0.05$) at Levels 1 and 2 of the game “Je StiMULE” which leads to a remarkable improvement after the educational program,

Conclusions:

The sample, which we used, is not enough but our goal is to establish a Moroccan version approach inspirit from TEACCH & ABA and a including technology by using software as “Je StiMULE” in education to autistic children, Which may change their future.

151 **113.151** Comparing Implementation of ASD Interventions between Urban and Rural Schools

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Background:

Although evidence-based practices (EBPs) for students with autism spectrum disorder (ASD) exist, implementation in schools is limited and research indicates that EBP implementation varies based on school and district factors. Research suggests that differences in services exist between Urban and Rural school districts such as staff retention, parent satisfaction with services, and access to services (Knapczyk, Ghapman, G, Rodes, & Ghung, 2001; Murphy & Ruble, 2012). Understanding systematic variability in factors that support EBP use will inform implementation efforts that are tailored to school district characteristics.

Objectives:

The objective of the current study is to identify how district factors are related to implementation and sustainment of EBPs for ASD in school programs.

Methods:

*Participants.*Participants included 30 members of the California Autism Professional Training and Information Network (CAPTAIN). A total of six focus groups were conducted with participants who worked within Urban (n=20) and Rurally located school districts (n=10).

Procedure. Focus group questions targeted: 1) key personnel involved in decision making and change, 2) perceived barriers to implementation, 3) resources needed and how they would be accessed, and 4) perceived likelihood of success across exploration, preparation, implementation and sustainment phases.

Audio recording of the focus group sessions were transcribed and independently coded by research associates, and inter-rater reliability was assessed by comparing coding and discussing discrepancies to arrive at agreement. N*Vivo qualitative software was used to evaluate frequency of codes and identify themes within and across district types.

Results:

Results identify some common factors serving as barriers and facilitators across district types. Participants from both Urban and Rural school districts identified attitudes and buy-in and district structure as main barriers to implementation. Specifically, participants reported a disconnect between general education staff and leadership and special education staff. In contrast, leadership support was identified as a main facilitator for the implementation of EBPs. Training was discussed as both a barrier and facilitator in both Urban and Rural focus groups (See Tables 1 and 2).

Differences between Urban and Rural groups also emerged. In Urban, but not Rural, groups, funding and resources emerged as barriers and facilitators. Staff knowledge and skills were discussed as both a barrier and facilitator in Urban focus groups, while in Rural focus groups they emerged solely as a barrier. Rural focus groups also identified frequent administrative changes as a barrier to implementation, while time (for trainings) emerged as a barrier in Urban focus groups.

Although district structure emerged as a barrier across groups, Urban district participants emphasized district policy and communication with leaders and district growth as concerns, whereas Rural district participants discussed regional challenges (having to travel long distances for trainings), difficulty tailoring interventions for a diverse range of students and high staff turnover.

Conclusions:

Across groups, attitudes toward EBP and district support were identified as barriers to implementation. These may be useful intervention targets to include in implementation planning. There were also clear differences across Urban and Rural district participants, indicating support for tailored implementation plans to maximize EBP use and sustainment.

152 **113.152** Accommodations for College Students with Autism Spectrum Disorder at a Designated Hispanic Serving Institution

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Background:
This study examined the demographic characteristics and accommodations of college students with autism spectrum disorder (ASD) as compared to students with other/invisible disabilities from a designated Hispanic Serving Institution (HSI). Despite a growing body of literature on students with ASD in higher education (Cullen, 2015; Grogen, 2015), less is known about HSIs; how post-secondary demographic characteristics and received accommodations of students with ASD differ from other students with disabilities.

Objectives:

The study aimed to compare the demographic differences between students with ASD and other disability groups at an HSI. Secondary aims sought to examine differences in the amounts/types of accommodations provided to individuals with ASD and other disability groups.

Methods:

Data from 827 students with disabilities were obtained from a four-year state HSI's Office of Institutional Research. Along with descriptive analyses for demographic information, a balloon plot was generated to explore race/ethnicity differences in the primary disability categories. Poisson regression was utilized to examine whether the individuals with ASD were provided greater numbers of accommodations compared to those with other disabilities (all) and with invisible disabilities (invisible). A Chi-square test of independence was conducted for each type of accommodation to explore a significant relationship between the type of accommodation and the type of disability (ASD v. all; ASD v. invisible) As a follow-up logistic regression models were fit to investigate whether students with ASD were provided certain accommodations significantly more compared to other groups.

Results:

Demographic differences between ASD and all disability groups revealed that those with ASD were significantly *more likely* to be younger, a male, live off campus for the first semester, live on campus for the last semester, and were *less likely*to be financial aid eligible or a transfer student. The proportion of ASD was larger among Whites (9.0%, *n*= 29) than Hispanics (5.5%, *n*= 13). Individuals with ASD received significantly higher amounts of accommodations than those with all and invisible disabilities. The expected log count increase for the ASD group was .17 (all; 95%CI, .10 to .25, *p*<.001) and .15 (invisible; 95% CI, .07 to .22, *p*<.001). Students with ASD were more likely to receive disability-related counseling (all, 95%CI, .47 to .1.77, *p*<.001; invisible, 95%CI, .29 to 1.59, *p*<.001), extra time (all, 95%CI, .68 to 2.88, *p*<.001; invisible, 95%CI, 1.11 to 3.78, *p*<.001), notetaking (invisible, 95%CI, -0.004 to 1.52, *p* = .05), and room-alone (all, 95%CI, .14 to .1.16, *p*<.05) accommodations compared to other disability groups.

Conclusions:

The study university was an HSI with 49% students qualifying for financial aid and 59% being first-generation college. Students with ASD were significantly more likely to be white, middle class, and have parents who attended college, compared to other disability groups. Students with ASD received significantly *higher amounts of* and *different accommodations* than those with other, invisible disabilities. These results raise questions about general issues of equity, and imply a need for transition supports and coordinated recruitment efforts to attract individuals of color with ASD.

153 **113.153** Contest of Teenagers Youtubers with Asperger Syndrome, Awareness, and Bridging for Development

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Background: For the autistic people, the awareness around the knowledge provided by scientific research could be a perhaps unique way of understanding and personal development. Some characteristic autistic tendencies in thinking and behavior are valuable keys for better results in a Youtubers contest about science. Both was reasons for planning a Youtubers contest conceived as occasion for public communication of science about particularities of the autistic people brain. This activity is official part of Brain Awareness Week.
Objectives: Allow to Youtubers To investigate and express themselves about a topic of their interest. To share information about autism, in particular about Asperger's Syndrome. To share a space joyfully 'nerd'. To apply curiosity to the knowledge of himself, to understand himself better and treat himself with more love.

Methods: This contest was coordinated by a community organization that contacted Dana Foundation, organizer of Brain Awareness Week, and as well as other community organizations with complementary profiles, formed by families of autistic people. It was honored with the participation as Juries of nationally recognized personalities of Education, Psychology, Biology, and Neuroscience. The call and the bases were disseminated by a web, and this was communicated mainly by social networks. The prizes were magnifying glasses, watercolor pencils boxes, and science books for young audiences. In the context of the contest, the short "Amazing things happen" (Dir. Alex Amelines) was made available, with authorization.

Results: Only boys were registered. Six children were pre-enrolled accompanied by a caregiver; only four of them presented works (7, 8, 10 and 12 years old). The evaluation of the videos shows a high degree of compliance with the planned objectives. In general, the themes adopted focused on attitudinal aspects and not (yet) on those that had been proposed by the contest The returns of the J had in all cases an impact on the adolescents. As planned, the communication of the results was appropriate and favored a deepening in the awareness of the participants about their own work.

Conclusions: Through the contest process was possible to collaborate with autistic people in their own empowerment through the construction of knowledge and shared practices. Youtube videos resulted for the participants a means of expression and natural communication. The communication of the evaluations had the effect of bridging and created areas of proximal development in relation to the areas highlighted by each participant. After the contest there was news that each of the contestants progressed very prominently in the same line of development - in all cases in collaboration and with the support of his family. One of the teenagers, whose video had dealt with his difficulties to speak in public, was summoned to share in the first person before legislators and numerous public in favor of the rights of children. Another participant is currently participating in a theater group that gives public performances. In two cases, the status of winners of a Yotutube course earned the participants great popularity and admiration among their schoolmates.

154 **113.154** Creating a Multisite Developmental Neuropsychiatric Curriculum Using a Modified Delphi Process

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Background: Several non-accredited developmental neuropsychiatry fellowships have been initiated across the nation to help increase the number of providers with expertise in treating patients with autism and developmental disabilities. Providing education on the most essential and current topics is of utmost importance for the education of the fellows and the integrity of the programs.
Objectives: All graduates should have a basic unified knowledge base upon completion of their training. Currently, programs are all running separate educational lectures. The purpose is to create a more unified curriculum.

Methods: Faculty expertise was utilized across training programs and from expert clinicians and researchers in the field. A core educational curriculum of 12 topics was proposed for Developmental Neuropsychiatry fellowships. A subcommittee was formed within the Autism and Intellectual Disability committee of AACAP (American Academy of Child and Adolescent Psychiatry). Members of this subcommittee were experienced clinicians, educators and researchers in the field. At the 2016 annual AACAP meeting, an initial list of 24 educational topics was created and reviewed by the subcommittee. Experts were identified to participate in a modified Delphi process to revise topics and then narrow down the curriculum to 12 topics. Experts included members of the Autism and Intellectual Disability Committee and members of the Developmental Neuropsychiatric Fellowship subcommittee. IRB exemption was obtained through Maine Medical Center.

Results: Three rounds of the Delphi process produced 12 final topics. See uploaded image.

Conclusions: During the process, several new topics were added and others were modified. Using a modified Delphi process to obtain expert consensus was successful in creating a core curriculum that could be provided to Developmental Neuropsychiatric Fellowships at a national level.

155 **113.155** Current State of ASD Knowledge in the General Population

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Background:
Autism Spectrum Disorder (ASD) occurs in 1 and 59 children (Baio et al., 2018). Early identification is crucial and is linked to successful outcomes (Dawson et al., 2010). Parents/caregivers may be among the first in a child's life to notice developmental delays. Knowledge and a strong understanding of ASD may result in parents noticing and reporting ASD symptoms to appropriate professionals (e.g., pediatrician) allowing for earlier diagnosis and intervention. Measuring ASD in the general population is an important first step in understanding the importance of ASD knowledge and providing insight into potential knowledge-based interventions within this population.

Objectives:

This presentation describes the current level of ASD knowledge in the general population and investigates the relationship between specific demographic factors (e.g., age, race/ethnicity, SES, education, parent status) and ASD knowledge.

Methods:

Adults (*N*=180) from the general population participated in the current study. Participants were predominantly White, male, and married or in a domestic partnership. All data were collected electronically on Qualtrics via Amazon's Mechanical Turk (MTurk). Following consent, participants completed screening questions, a brief demographic questionnaire, and the Autism Spectrum Knowledge Scale, General Population Version (ASKSG; McClain, Harris, Schwartz, Benallie, Golson, & Benney, in review), a 31-item measure of ASD knowledge. Descriptive statistics and analysis of variance (ANOVA) with post hoc analyses where appropriate were used to analyze data.

Results:

Overall, the general population answered 62% of the ASKSG questions correctly, on average. Only five questions (16.12%) were answered with an accuracy greater than 80%. Additionally, nine questions (29.03%) were answered with an accuracy less than 50%. Participants were less knowledgeable about the assessment and diagnosis of ASD and the most knowledgeable about ASD symptoms and behaviors. Results also indicated a significant difference in ASD knowledge across gender, race/ethnicity, education level, parent status, and child disability status. More comprehensive results will be presented and discussed.

Conclusions:

The general population's knowledge of ASD is limited, particularly surrounding assessment and diagnosis, etiology and outcomes, and treatment of ASD. ASD knowledge was found to differ across demographic variables. Specifics will be discussed in the presentation. Although the general population, namely parents/caregivers, have great opportunities to witness signs and symptoms of ASD in early childhood, their limited knowledge of ASD may prevent them from recognizing and reporting signs to trained professionals. These results may have implications for early diagnosis and intervention. This might partially explain why the average age of diagnosis is 4 years old (Christensen et al., 2016) but professionals can reliably diagnosis at 2 years of age (Baio et al., 2018). If the general population is properly educated regarding ASD, early diagnostic rates may improve. In turn, more children may be able to receive earlier intervention services and experience better outcomes. This presentation will provide attendees with implications of the research and how the results can be utilized to improve ASD knowledge within the general population.

156 **113.156** Developing a College Access Program for Neurodiverse Learners

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Background: Despite often high academic potential, transition-aged youth with ASD are significantly less likely to pursue post-secondary education than students with most other disabilities (Wei et al., 2016). However, once enrolled, college students with ASD may enroll in STEM majors and persist in college more than neurotypical peers (Wei et al., 2013; 2014). To address the need to help students with ASD bridge the gap between high school and college, innovative transition programs for students with autism have begun to emerge (e.g., Hotez et. al, 2018; White et. al, 2017). However, students on the spectrum do not always identify with autism and may not wish to engage with programming that is specifically for students with autism (Gillespie-Lynch et al., 2017). Building from prior literature and student feedback, we developed a transition program for neurodiverse students more generally at a popular extracurricular, non-profit specializing in technology education for neurodiverse students,

Tech Kids Unlimited (TKU).
Objectives: Evaluation of TKU's first College Access Program aims to identify students' attitudes toward college at pre-test and examine if participation in programming designed in response to students' interests and concerns is associated with improved attitudes toward college.

Methods: A cohort of 16 neurodiverse students aged 14-21 (*M* = 16.4) will attend seven classroom sessions and two college visits in 2018-2019. In the online application for the program, students selected topics they were interested in learning about from a list of potential topics and wrote in additional topics of interest. Students also responded to an 18-item attitudes about college survey wherein they rated their agreement with statements about college (Table 1) and a 25-item college self-efficacy survey, rating their self-efficacy in different college-related domains (Table 2). At the end of the program, students will complete identical post-tests to assess potential improvements in attitudes toward college and self-efficacy associated with programming.

Results: In their applications, students expressed interest in learning about the following topics: how to choose a college/program that is right for you (100%/75%), essay writing (81.25%), time management (87.5%), and social situations (interacting with roommates/classmates, 81.25%). Students described college as an opportunity for exploration of self, interests, and social experiences through academic and career-oriented learning (Table 1). Students expressed significantly greater self-efficacy in academic relative to daily living (e.g., live independently, p=0.04), social (e.g., work with other students on coursework, p=0.04) and self-regulation domains (e.g., manage stress, p = .05; Table 2).

Conclusions: Based on analysis of pre-test data, CAP students have particular concerns about social situations, self-regulation and daily living skills in college, though some anticipated academic challenges. Consequently, the CAP curriculum focuses on self-understanding, career and college exploration, self-presentation skills (e.g., resume development, interviewing, personal statement writing), and daily living skills (e.g., time budgeting, developing routines). By developing programming in response to the needs and interests of diverse students, we aim to provide opportunities for them to learn from one another to promote self-efficacy and enable informed decision making about post-secondary options.

157 **113.157** Disseminating Information on How to Teach Sex Education Online

***S. L. Curtiss**, Michigan State University, East Lansing, MI*

Background: Expressing sexuality is a critical part of well-being but this can be particularly difficult for individuals autism spectrum. The impairments associated with autism are characterized by social communication deficits (Ozonoff, 2012); however, social communication is a key component of expressing human sexuality. Individuals on the spectrum may have difficulty learning informally, especially about social relationships (Stokes, Newton & Kaur, 2007; Realmuto & Ruble, 1999) which can cause struggles with understanding sexual humor, flirting, innuendo and conversations about sexual behavior. Despite the need for high quality sex education, youth on the autism spectrum rarely receive it (Curtiss & Ebata, 2013).
Objectives: The objectives of this study were to examine efforts to disseminate information on how to teach sex education to individuals on the autism spectrum. Specifically, the following four research questions were evaluated: (1) what search terms are used to look for sex education resources; (2) what social media sites elicited the most referrals; (3) what content was most frequently viewed; and (4) which links to external content were most clicked on?

Methods: Analytic data from the past five years from the website asdsexed.org was used to answer the research questions. Asdsexed.org is a website that provides resources for teaching human sexuality education to individuals on the autism spectrum and with developmental disabilities. It includes curricula, lists of resources, and tips for instruction. The analytic data was provided through Jetpack.

Results: In answer to research question one, the top five search terms were "masturbation training" (n = 76), "physical relationship stages" (n = 37), "relationship pyramid" (n = 34), "sexuality" (n = 28), and "relationship levels" (n = 27). In answer to research question two, the top referrers to the site were Facebook, Pinterest, Wordpress, Tumblr, and Twitter in that order. In answer to research question number three, the top five pages viewed on the site were "Privacy Social Stories" (n = 2,642), "Explaining Anatomy" (n = 1,913), "Relationship Pyramid" (n = 1,648), "Circles of Sexuality" (n = 1,611), and "High School Human Sexuality 101: Week 1" (n = 1,083). In answer to research question four, the top clicks on external content were for "Sexual Safety Social Stories" (n = 513), ASD sexed on Tumblr (n = 354), Advocates for Youth (n = 270), Vanderbilt's Healthy Bodies Toolkit (n = 267), and "Dealing with Middle School Crushes" video (n = 165).

Conclusions: The search terms varied considerably and, with the exception of "relationship pyramid," did not correlate directly with the top content pages. The search terms were dissimilar from the "tags" commonly used with posts and, generally, did not seem to indicate viewers looking for autism-specific content. Although Facebook was the top social media referrer, there was much more content posted to the Facebook page than the Pinterest page. This suggests that Pinterest posts have a higher yield of return compared to Facebook posts. Tumblr, although the lowest performing referrer, was commonly referred to from the website. This data provides insights into how sex education resources can be disseminated online.

158 **113.158** Early Childhood Special Educators of Children with Asd's Use of Evidence-Based Practices

***J. Dynia**, The Ohio State University, Columbus, OH*

Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder with impairments in cognitive, communicative, and social abilities that affects 1:59 individuals across the lifespan (Baio et al. 2018). The importance of understanding the course, nature, and treatment of this syndrome in the early preschool years is often emphasized (Courchesne & Pierce, 2005; Dawson, 2008; Mundy & Sigman, 1989; Mundy, Sullivan, & Mastergeorge, 2009). However, there is a gap in what is known about early childhood special education (ECSE) teachers of children with ASD. Objectives: Specifically, this proposal aims to examine whether and to what extent ECSE teachers of preschool-aged children with ASD utilize evidence-based practices.

Methods: The current proposal uses data from a large study on ECSE classrooms in Ohio. The larger study included 77 teachers and 750 children. Forty-five teachers from the larger study indicated that they serve children with ASD and answered open-ended questions about the instruction they use in their classrooms across a wide-range of skills. Their responses are being coded based on the 27 evidence-based practices identified by Wong et al. (2015).

Results: Preliminary results indicate that ECSE teachers seem to be using evidence-based strategies when targeting social and communication

goals; however, they may not be implementing evidence-based practices as frequently when targeting motor and joint attention goals. Further analyses to will describe the use of evidence-based practices. Potential correlations with teacher demographics and classroom characteristics will be explored.

Conclusions: These results will be discussed as they pertain to the research to practice gap. The implications of these findings for both classroom instruction and teacher preparation will be discussed. The overall discussion will center on the potential interconnectedness of each of the findings and the overall implications for children with ASD.

159 **113.159** Preliminary Evidence for a Training Improving Police Knowledge and Confidence to Work with Persons with Autism

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Background: An article from Phoenix, Arizona, on September 19, 2017, detailed an incident in which a police officer detained an individual with Autism Spectrum Disorder (ASD) because he misinterpreted his behaviors and believed the individual's rigid and unfamiliar movements were a sign of drug intoxication. The bodycam captured upsetting footage of the exchange between the officer and individual, and the family released photos of the boy's injuries from the brief detainment (Helsel, 2017). Unfortunately, this incident is not an anomaly. Without appropriate training in how to identify and properly respond, first responders may misinterpret the behaviors of individuals with ASD. In order to address this need, investigators designed a training to improve first responders' knowledge and confidence to work with individuals with ASD.
Objectives: The primary aim of this study was to evaluate the initial effectiveness of PACT (Police Autism Community Training; see Table 1). This study will focus on three measures of preliminary effectiveness: first responders' knowledge of ASD, their self-reported confidence for working with individuals with ASD, and their consumer ratings of the training.

Methods: First responders (N = 193) completed a survey to assess their (a) knowledge of autism, (b) confidence to work with individuals with autism, and (c) consumer ratings of the training they received (see Table 2).

Results: Pre-test to post-test knowledge. Participants' self-rated knowledge about ASD significantly improved, t (21) = 7.26, p =.001, from pretest (M = 2.18, SD = 1.3) to posttest (M = 3.86, SD = 0.9).

Pre-test to post-test confidence. Participants' self-rated confidence in responding to a call involving an individual with ASD significantly improved, t (21) = 3.74, p =.001, from pretest (M = 3.14, SD = 1.1) to posttest (M = 4.00, SD = 0.9).

Consumer satisfaction ratings. Participants also responded to three items regarding their impressions of the training using a 5-point scale with 1 reflecting the lowest rating and 5 reflecting the highest rating. Participants endorsed the training favorably, indicating that the training met their expectations (M = 4.58, SD = 0.6), was helpful (M = 4.66, SD = 0.6), and clearly presented (M = 4.67, SD = 0.6).

Conclusions: This study offers an intervention that will help to improve relationships between community first responders and individuals with ASD. This study will challenge the lack of training that first responders are receiving on unique populations like ASD, and provide proactive solutions before negative experiences continue. Details of the training and intervention will be provided in the larger study.

Our data collection is ongoing, and as we collect more data in preparation for this presentation, we will conduct statistical tests to determine effect sizes and to account for our nested data structure. The initial results are promising, but serve only as preliminary evidence for the successfulness of the training. Future studies will establish answers to research questions addressing the active ingredients of the training such as the delivery method (e.g., face-to-face versus online) and or instructor influence.

160 **113.160** Establishing a Capacity Building Approach to Whole School Autism Provision

R. Ferguson[1], ***C. Smyton***[2], *S. Cross*[1] *and F. McCaffrey*[3], *(1)Middletown Centre for Autism, Armagh, United Kingdom of Great Britain and Northern Ireland, (2)Learning Support, Middletown Centre for Autism, Armagh, United Kingdom, (3)Middletown Centre for Autism, Middletown, Co Armagh, United Kingdom of Great Britain and Northern Ireland*

Background: Education plays a pivotal role in every child's life. For students with autism, school can both compound and intensify the difficulties they already have with social communication, understanding the world around them and managing their emotions and responses.
In Northern Ireland, the majority of children and young people with a diagnosis of autism attend a mainstream school (62%) (NAS, 2012). Despite the notable increase in mainstream placements over the past decade (Lindsay et al., 2013), inclusion of students with autism within the mainstream school setting is still a poorly understood area of education (Humphrey & Lewis, 2008). Both teachers and principals have reported that they feel ill equipped and need more training to fully support the learning needs of students with autism within a mainstream setting (Enam & Farrell, 2009; Horrocks et al., 2008).

Additionally, it has been reported that a third of parents of children and young people with autism in Northern Ireland feel that the education their child receives is not adequate to their specific needs (NAS, 2012). Subsequently, many young people with autism do not achieve their academic potential (O'Brien & Daggett, 2006; Howlin et al., 2004) which has negative repercussions for their successful transition into adulthood (Gerhardt & Lainer, 2011).

Considering the discrepancy between what is currently acknowledged as best practice and the expertise schools have the capacity to provide, Middletown Centre for Autism (MCA) devised a flexible model designed to build capacity within the school and incorporate best evidenced based autism practice.

Objectives: The primary aim of the pilot project was to investigate the effectiveness of implementing the MCA PACS model to build the capacity of a school to meet the needs of students with autism.

Methods: The PACS model (which focuses on Policy and Procedures; Autism Awareness; Capacity Building; and School Environments) has been refined through whole school projects MCA has introduced to 6 school across Northern Ireland since 2014. In 2017, MCA began a ten-month project with Taughmonagh Primary School, Belfast. Using the PACS model, the school's awareness of autism was rated pre and post MCA intervention using the Autism Competency Framework (Autism Education Trust, 2012) which informed the development of a school autism policy. Additionally, staff and members of the school community took part in training and capacity building sessions and completed evaluations and interviews.

Results: Overall, the PACS model had a positive impact on the school. This presentation will discuss the flexibility of the PACS model and how it

was implemented in this school. The effect the capacity building PACS model had on the staff, children and families of the school will be discussed.

Conclusions: The MCA PACS model offers a flexible solution to developing appropriate learning pathways for students with autism within mainstream educational facilities. This capacity building model encourages flexibility and offers 'opportunity' to students with autism by focusing on making change throughout the school environment and forging relationships within the local community.

161 **113.161** Evaluating How Autistic Traits and Social Anxiety Influence University Transition Outcomes Amongst First Year University Students

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Background:

First-year university students experience many academic and social challenges. Factors influencing students' social competency such as social anxiety and level of autistic traits might affect their ability to establish a new social network structure (SNS) and access support at university. Partitioning the long-term impact of social anxiety and autistic traits on transition outcomes by adopting a longitudinal design can help stakeholders develop more focused interventions relevant to students on the autism spectrum, who often experience high levels of social anxiety, eliciting a more positive transition experience.

Objectives:

Using a longitudinal design to assess:

1) Changes in SNS/Perceived Social Support (PSS) across first-year of university

2) How changes in SNS/PSS relate to university transition outcomes

3) Whether social anxiety or autistic traits influence transition outcomes beyond changes in SNS/PSS

Methods:

78 first-year typically developing students (age: M(SD) = 18.24(0.49) years; 10 Male) completed three online questionnaire sessions, each spaced three months apart, during October (T1), December (T2), and March (T3) across first year at university. At T1, students completed: 1) Autism Quotient-28; 2) Social Anxiety Scale for Adolescents; 3) Social Network and Perceived Social Support (SNaPSS). SNaPSS measures a) SNS: name up to 20 network members who are important to you; b) PSS: the frequency and quality of support each network member provides across academic, daily-living, and socialisation areas. At T2 and T3, students completed SNaPSS to assess changes in SNS and PSS over time, and also Student Adaptation to College Questionnaire (SACQ) to assess university transition outcomes. Analyses included repeated measures MANOVA (Bonferroni corrected for multiple comparisons) and multiple linear regressions.

Results:

Objective 1: At T1, higher levels of social anxiety and autistic traits were significantly associated with a smaller SNS. Over time, students reported decreasing social network size, a relative decrease in percentage of family members, and increase in percentage of friends (Figure 1). For PSS, students perceived a decline in quantity of support received over time. Friends provided the greatest quantity and quality of support compared to family and university staff. Students perceived academic support to be the most infrequent and lowest quality. Objective 2: Changes in SNS and PSS showed differential patterns of association to transition outcomes at T2 (Table 1a) and T3 (Table 1b). Objective 3: When controlling for changes in SNS and PSS, autistic traits did not account for any additional variance associated with transition outcomes. However, greater social anxiety had a significant negative impact on both socialisation and institution attachment at T2 and T3, though not in personal/emotional or academic adjustments.

Conclusions:

Although both social anxiety and autistic traits were related to a smaller network size at T1, only higher social anxiety, and not autistic traits, had a more persistent negative impact on transition outcomes for first-year university students, beyond that accounted for by changes in SNS and PSS over time. Social anxiety is a frequent co-occurring condition in autistic young people. Targeting social anxiety during university transition may support all students to make more positive changes in their SNS/PSS, improving transition outcomes.

162 **113.162** Evaluating the Role of Social Anxiety and Autistic Traits on Social Network and Support in One to One Matched First-Year University Students with and without Autism

J. Lei[1], *M. Brosnan*[2], *C. Ashwin*[3] *and A. Russell*[4], *(1)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (2)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland, (3)University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland, (4)Psychology/Centre for Applied Autism Research, University of Bath, Bath, United Kingdom*

Background:

Students transitioning to first-year of university face increasing academic (ACA), daily-living skills (DLS), and social (SOC) demands, and experience changes in their social network structure (SNS) and perceived social support (PSS). For students with Autism Spectrum Disorder (ASD), autism-related social impairments might affect one's ability to cope with new challenges at university, and to establish a new SNS to access support. Many students also experience social anxiety, further impacting social engagement. Understanding how autistic traits and social anxiety affect first-year students' university experience can help identify targets for interventions supporting university transition.

Objectives:

Investigate differences at the time of university transition between ASD and typically developing (TD) students in:

1) Perceived distress frequency in ACA, DLS, and SOC;

2) SNS and PSS; AND

3) Assess the influence of social anxiety and autistic traits on significant differences identified under objectives 1) and 2).

Methods:

28 ASD and 28 TD first-year university students (M: 18.32/18.39 years) 1:1 matched by age, sex, ethnicity, pre-university academic performance, and university degree completed online questionnaires assessing autism traits (Autism Quotient-28), social anxiety (Social Anxiety Scale for Adolescents), and Social Network and Perceived Social Support (SNaPSS). SNaPSS measures: a) students' perceived distress frequency across ACA, DLS, and SOC areas at university; b) SNS: each student names up to 20 people that they are close to and are in contact with; c) PSS: perceived support provided by each network member. We conducted independent samples t-tests (bootstrapped, 2000 resamples) and step-wise hierarchical linear regressions.

Results:

ASD students had significantly higher levels of autistic traits and social anxiety, and perceived greater distress frequency in ACA and DLS than TD students. For SNS and PSS, ASD students reported a smaller social network size than TD students, but perceived similar quantity and quality of support (Fig 1). Using step-wise hierarchical linear regression (Table 1a), higher social anxiety (step 1) was associated with greater distress frequency in ACA, DLS, SOC, and a smaller SNS size across all students. Adding autistic traits and diagnostic group in step 2, social anxiety was no longer significantly associated with SNS size, and diagnostic group was a significant predictor for perceived ACA distress frequency. Conducting step-wise linear regressions to investigate group differences, when autistic traits was included in the model, higher social anxiety was associated with greater perceived distress ACA frequency in ASD students only, but not in TD students (Table 1b).

Conclusions:

Using a 1:1 matched sample, higher social anxiety, not autistic traits, showed a more pervasive association to first-year ASD and TD students' perceived distress across ACA, DLS, and SOC areas, and SNS size. In particular, higher social anxiety exerted a greater negative impact on ASD students' academics than TD students. Social anxiety and autistic traits both affect social competency, and may have accounted for shared variance in SNS size. Reducing social anxiety might help alleviate perceived distress in social and non-social aspects of university life for both TD and ASD students, and particularly in ACA for ASD students, fostering a more positive university transition.

163 **113.163** Evidence-Based Practices and Classroom Strategies Reported By Teachers of Students with Autism Spectrum Disorder

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Background:

The recent rise in diagnostic rates (CDC, 2018), paired with changes in laws addressing educational services, has led to an increasing number of children with ASD in general and special education classrooms (Hart & Whalon, 2012). However, teachers' training in and knowledge of ASD-specific evidence-based practices (EBPs) vary widely (Hendricks, 2011), and general education training programs often do not reflect adequate ASD-specific training when compared to special education training programs (Cameron & Cook, 2007).

Objectives:

The current study examines: 1) Teachers' knowledge of ASD-specific EBPs; 2) The strategies teachers report using to teach students with ASD in their own classrooms, and the frequency in which they accurately or inaccurately define these strategies as an ASD-specific EBP.

Methods:

Participants included 303 preK-12 special and general education teachers with varying levels of ASD experience. Data were collected via an online survey, and a combined inductive and deductive approach was used to code and categorize open-ended responses. The Evidence-Based Practices for Children, Youth, and Young Adults with Autism Spectrum Disorders (Wong et al., 2014) was used to classify EBPs (e.g., reinforcement, prompting, visual support). Other reported practices were assigned to one of four additional categories: insufficient empirical support (e.g., sensory diet, music therapy), IEP practices/enhanced support (e.g., modified instruction, speech therapy), good teaching practices (e.g., behavior intervention, clear/concise directions), and intervention programs (e.g., ABA, TEACCH). Responses that were left blank, indicated a lack of knowledge, or were too vague were categorized separately. Within each category, the following groups were examined: 1) *strategy used only*: teachers who reported using a strategy in the classroom, but did not identify it as an ASD-specific EBP in later survey responses; 2) *reported EBP only*: teachers who defined a strategy as an ASD-specific EBP, but did not report using the practice; 3) *both*: teachers who defined a strategy as an ASD-specific EBP and reported using it in their classroom.

Results:

Within the EBP category, 14.2% of teachers reported using an ASD-specific EBP without defining it as such (*strategy used only*); 6.3% appropriately identified one or more ASD-specific EBPs, but did not report using any ASD-specific EBPs in their classroom (*reported EBP only*); and 25.1% appropriately identified one or more ASD-specific EBPs, and reported using ASD-specific EBPs in their classroom (*both*). Furthermore, while only 31.4% of teachers accurately identified and categorized ASD-specific EBPs, 39.3% reported using at least one teaching strategy classified as an ASD-specific EBP. However, responses in other categories revealed that 52.8% of teachers incorrectly identified one or more teaching practices as an ASD-specific EBP, and 37% reported using these practices in the classroom. See Figure 1 for responses within each category.

Conclusions:

Overall, these results highlight gaps and discrepancies in teachers' reported knowledge and application of ASD-specific EBPs. As teacher training programs adapt to the increasing number of children with ASD in all classrooms, these strengths and weaknesses in teachers' knowledge and application of best practices should be considered, as appropriate implementation of EBPs is vital to the overall success of students with ASD.

164 **113.164** Exploration of Writing Attitudes and Genre Knowledge in Children with and without Autism Spectrum Disorder: The Impact on Writing Quality

E. Hilvert[1] *and D. Davidson*[2], *(1)Waisman Center, University of Wisconsin-Madison, Madison, WI, (2)Psychology, Loyola University Chicago, Chicago, IL*

Background: Previous research has demonstrated that writing is one of the most challenging academic skills for children with Autism Spectrum Disorder (ASD), with a majority of children demonstrating a learning disability in writing (Mayes & Calhoun, 2006). However, little is known about how other factors impact the writing process, such as knowledge about text structure or attitudes towards writing. This is of interest as research with neurotypical (NT) children has shown that both factors are related to writing achievement (Graham et al., 2007; Olinghouse et al., 2015).
Objectives: We examined whether children with ASD had similar attitudes towards writing and knowledge of genre structure compared to NT children. Relations between writing attitudes and knowledge and overall text quality were also examined.

Methods: Forty-three children, 21 with ASD (M_{age}= 11;11) and 23 NT children (M_{age}= 10;07), participated in this study. Children with ASD had a previously established diagnosis of ASD. Diagnoses were confirmed with the Social Responsiveness Scale (SRS-2; Constantino, 2012) and Childhood Autism Rating Scale (CARS-2; Schopler et al., 2010). See Table 1 for additional participant characteristics.

Following parent and child consent, children completed a narrative and an expository writing task, and received a holistic rating of writing quality for each. After completing these tasks, the experimenter asked the child, "What do you think are important things or elements to include when writing a good story/essay?". Children's responses were classified into one of four ratings, from 1 = doesn't have a good grasp of story/essay elements, to 4 = has a very good grasp of story/essay elements.

Children also completed the 12-item writing attitudes subtest adapted from Graham, Berninger, & Abbott's (2012) Writing and Reading Attitude Measure. This includes questions such as "How do you feel when you write in school during free time?" or "How do you feel when you start to write a new paper?" Additional questions were asked to determine which aspects of writing children found to be most challenging.

Results: Despite children with ASD having lower overall writing quality scores, children with ASD did not differ from NT children in their ability to define the important elements of narrative and essay writing, or in their overall attitude towards writing (see Table 2). However, children with ASD were more likely to identify lower-level processes of writing (e.g., handwriting, attention/motivation, spelling) as the most challenging aspect of writing compared to NT children whose most common complaint was idea generation.

In terms of associations with writing quality, greater knowledge of narrative and essay structure was related to the production of higher quality texts, but only for NT children. No relations were found between writing attitudes and quality for either group.

Conclusions: These findings suggest that the process of writing may be more challenging for children with ASD to execute, even when they understand the requirements of a given text type and feel similarly about the writing process. Thus, writing instruction for children with ASD may need to focus on the unique challenges these children face (e.g., handwriting, spelling).

165 **113.165** "It's When You See the World in a Different Way" - a Pilot Study Examining the Impact of a Teacher Delivered Autism Awareness Program for Mainstream Primary School Pupils

*D. Borghi[1], S. Tyce[1], C. Droney[1], C. Ward[1], R. Whur[1] and **J. Galpin**[2], (1)The Bridge Outreach Service, London, United Kingdom, (2)The Bridge London Trust, London, United Kingdom*

Background: Pupils with autism in mainstream schools are at a greater risk of bullying than their non-autistic peers. One key area identified as contributing to this is a lack of knowledge and understanding about autism. This can lead to increased negative stigma and also negatively impact on pupils' development of self-identity. Increasing autism awareness can reduce these negative outcomes. Previous research has identified three effective types of information provision for reducing negative stigma and increasing understanding: descriptive Information; explanatory information and directive information. In collaboration with teaching staff an autism peer awareness programme (APA) for primary school aged pupils was created that focused on the concept of neurodiversity and included all three types of information. APA was designed to fit in with the existing school curriculum and be delivered by existing school staff.
Objectives: The aim of the study, produced by and for school-based professionals, was to examine the impact of a teacher delivered five week autism awareness program on increasing knowledge and understanding of autism in children aged between nine to eleven years old attending mainstream educational settings.

Methods: 110 pupils from four government funded mainstream primary schools in the UK took part. Participants ranged in age from 9 years 8 months to 11 years 2 months (*M*= 10 years; 2 months; *SD*= 0;7). The five week APA program consisted of five 45 minute lessons. Baseline and post intervention questionnaires were taken. The questionnaire consisted of an open question '*What is autism?*' and thirteen statements about autism that pupils had to judge as either 'True' or 'False', or select 'Don't know'.

Results: Pupils answered significantly more of the statements correctly following the APA sessions (80%, *n*=1148) than at baseline (57%, *n* = 814), χ^2 = 56.86 (1), $p < 0.001$. In response to the *'What is autism?'* question 37% of children at baseline either did not know what autism was (*n* = 36) or left the question blank (*n* = 5). All children provided a response after the APA, these were also more detailed, with post APA responses containing significantly more words (*M*=10.05, *SD*=5.09) than those at baseline (*M* = 8.47, *SD* = 5.45), *t*(218) = -2.21, *p* = 0.03. The word clouds in Figures 1 (baseline) and 2 (Post) [attached] display the terms most frequently used to describe what autism is. At post there was more awareness of the main areas of difference associated with autism, including sensory and communication differences with no reference to anger.

Conclusions: The results from the study are promising and indicate that the APA program can increase students' knowledge and understanding of autism. Furthermore, it demonstrated that school staff can deliver the programme to fit in with the existing school curriculum, with little disruption. The lesson plans developed for the study could therefore be easily adopted by more schools to support autism awareness in Primary school aged pupils. Further research is needed to see if the increase in knowledge results in less stigma and tangible benefits for autistic pupils within the school.

Poster Session
114 - Epidemiology/population studies
11:30 AM - 1:30 PM - Room: 710

166 **114.166** : The Association between Race and Age of First Evaluation Among Children with Autism Spectrum Disorder.

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NJ Medical School, Newark, NJ, (3)Pediatrics, Rutgers NJ Medical School, newark, NJ, (4)Rutgers New Jersey Medical School, Newark, NJ

Background:
Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by social communication impairments and restricted and/or repetitive behaviors. Impairments are evident early in childhood. Despite increasing ASD awareness and increasing prevalence of ASD, the age of ASD identification has not changed. A key public health goal is to identify children with ASD early and provide early intervention. Studies have shown the benefits of early interventions; however, studies have also shown race-based and SES disparities in access to healthcare services.

Objectives:

The aim of this study was to determine if there is an association between race/ethnicity and age of first evaluation among children with ASD. We predict race-based disparities in age of first evaluation among children with ASD.

Methods:

Children with ASD born in 2010 and residing in New Jersey (NJ) in 2014 were identified from active surveillance, using a Centers for Disease Control and Prevention (CDC), ascertainment method, based on retrospective review and analysis of information contained in health and education records. Information on race/ethnicity, sex, SES (mother's education level), impairment level, and age of first evaluation was analyzed. We examined the unadjusted and adjusted odds ratio for Black, non-Hispanic versus White, non-Hispanic children and Hispanic versus White, non-Hispanic children as the predictor variable, and if they did not receive a comprehensive evaluation by age 36 months as the outcome. Regression Models were adjusted for other covariates. Pearson Chi-Square Tests and multivariate logistic regression models were used for analysis.

Results:

Overall, 518 4-year-old children were identified with ASD in 2014. The prevalence estimate was 28.6 (95% CI 26.2,31.2). The sample was predominately male with a 4.4 (3.3,5.8) ratio. This sample was further restricted to children born in NJ (n=407). Overall, 67% of children received a comprehensive evaluation by age 36 months. There were no differences by sex, SES, or impairment level; however, there was a significant difference by race/ethnicity (p=.0012). Unadjusted and adjusted odds ratios were the same for Black, non-Hispanic compared to White, non-Hispanic Children. Unadjusted OR = 2.0 (95% CI 1.1,3.5) and adjusted OR=2.0 (95% CI1.2,3.6). For Hispanic compared to White, non-Hispanic children, the unadjusted and adjusted odds ratios were slightly different. Unadjusted OR = 1.9 (95% CI 1.1,3.5) and adjusted OR=1.7 (95% CI 1.0,3.0). The adjusted OR for Hispanic compared to White, non-Hispanic children was no longer significant. Females were more likely than males to receive evaluations early, adjusted OR = 0.8 (95%CI 0.5,1.4), and mild impairment vs severe impairment adjusted OR was 1.7 (95% CI 0.9,3.1); however, these findings were non-significant.

Conclusions:

Overall, we found significant race-based disparities in access to services. Black, non-Hispanic children with ASD were half as likely to receive a comprehensive evaluation by 36 months compared to White, non-Hispanic children with ASD. When we adjusted the model for sex, mother's education level, and degree of impairment, the findings did not change. Our findings are consistent with previous findings and underscore the importance of universal screening to enhance early identification and decrease race-based disparities.

167 **114.167** Adaptive Behavior Scores As an Indicator of Severity of Functional Limitations in Children with Autism Spectrum Disorder: Results from a Population-Based Study

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Background: Few epidemiologic studies of autism spectrum disorder (ASD) include information on functional status or severity of functional limitations, despite the increased emphasis in autism and disability classification systems on variations in functioning and levels of support required over the life course. Measures of adaptive behavior such as the *Vineland Adaptive Behavior Scales* were developed to measure levels of functioning in individuals with intellectual disability (ID), but their usefulness for measuring level of functioning in individuals with ASD, including those without co-occurring ID, is unclear.
Objectives: The aims of this study were to (a) describe variations in adaptive behavior scores in a large, population-based sample of children with ASD, including those with and without co-occurring ID; and (b) evaluate whether variations in adaptive behavior scores are associated with ratings of the level of impairment by clinician reviewers and other clinical features that might be related to ASD severity.

Methods: The Autism and Developmental Disabilities Monitoring (ADDM) Network is a multisite surveillance system that incorporates information from clinical and educational records of all 8-year-old children meeting diagnostic criteria for ASD in selected populations in the United States. For the present study, we combined cross-sectional data from the 15 ADDM Network sites that contributed ASD surveillance data for the period 2000-2012. Adaptive behavior, IQ scores and clinician ratings of autism symptom severity and other clinical data were available for 10,795 (47.3% of) children with ASD (8,843 boys, 1,952 girls). Adaptive behavior scores were classified based on population normative data as ≥average; borderline (between 1 and 2 standard deviations (sd) below the population mean); mild limitations (2-3 sd below the mean); and moderate to profound limitations (≥3 sd below the mean). Correlation and categorical (chi-square) analyses were used to evaluate associations between adaptive behavior results and indicators of autism symptom severity, overall and in analyses stratified by IQ categories and sex.

Results: Adaptive behavior scores were positively correlated with IQ (Spearman rho=0.5, p<0.0001), as expected, and children with ASD and co-occurring ID were more likely (29.1%) to have ≥moderate limitations in adaptive behavior than were those without ID (6.6%, p<0.0001). Among the 3,639 children with ASD and IQ >85, adaptive behavior scores indicated functional limitations that were borderline for 40.0%, mild for 31.1% and moderate to profound for 5.3%. In this group, adaptive behavior scores were significantly (p<0.0001) inversely associated with the number of developmental concerns recorded, number of ASD diagnostic criteria met and clinician ratings of severity of autism impairments, but the strength of these associations were weak to moderate (rho=0.04 to 0.260). Stratified analyses showed similar patterns for boys and girls.

Conclusions: Adaptive behavior scores available in clinical and educational records may provide a reliable indicator of severity of functional limitations in children for use in epidemiologic studies of ASD. This analysis suggests that adaptive tests are capturing some of the variation in functional limitations in children with ASD that is not fully accounted for by variations in IQ or clinician ratings of impairment based on autism symptoms.

168 **114.168** An Examination of Vaccination Rates and Related Factors in Children and Adolescents with Autism Spectrum Disorder

*L. Dodds[1,2], **C. J. Filliter**[2], L. A. Campbell[1,2], N. MacDonald[1,2], S. Shea[1,2], I. M. Smith[1,2], È. Dubé[3] and J. H. Filliter[1,2], (1)Dalhousie University, Halifax, NS, Canada, (2)IWK Health Centre, Halifax, NS, Canada, (3)Institut national de santé publique du Québec, D'Estimauville, QC, Canada*

Background: Youth with ASD may be under-vaccinated for many reasons, including: 1) persisting parental beliefs in a connection between vaccines and ASD, 2) difficulty with medical procedures, including needles, experienced by many youth with ASD, and 3) factors contributing to vaccine hesitancy in the general population. Understanding of vaccination uptake in youth with ASD is limited, and studies to date have primarily assessed vaccination status through parent report.

Objectives: We sought to determine whether vaccination rates in school-aged youth with ASD differ from those of their peers without ASD.

Methods: We conducted a retrospective cohort study by linking perinatal, administrative health, and vaccination databases. We included youth born between 1992 and 2005 in Nova Scotia (NS), Canada. ASD cases were identified using our previously developed, validated, and published algorithm. In our main analysis, youth with ASD were compared to their peers without ASD in the general population regarding uptake of scheduled school-based vaccinations. The primary outcome variable was receipt/non-receipt/partial receipt (i.e., not all doses) of any scheduled school-based vaccine and was determined using Public Health and physician billing databases. Chi square tests were used to test the association between vaccine receipt among youth with ASD compared to peers without ASD.

Results: Our overall cohort size was 41,287 (of which 746 had ASD) for Hepatitis B and Tetanus, Diphtheria, and Pertussis (TDAP) vaccines and 24,527 (of which 256 had ASD) for Human Papillomavirus (HPV) vaccine, due to a later introduction of the HPV vaccine. For receipt of any vaccine, youth with ASD were less likely to be vaccinated (71%) than their peers without ASD (78%), $p < 0.0001$. For Hepatitis B, 58% of youth with ASD were fully vaccinated and 13% were partially vaccinated vs. 67% and 11%, respectively among youth without ASD ($p<0.0001$). Similarly, for TDAP, 68% of youth without ASD were vaccinated vs. 60% of youth with ASD ($p<0.0001$). Vaccination rates were even more divergent for HPV, with 72% of youth without ASD being vaccinated vs. 57% of youth with ASD. ($p<0.0001$).

Conclusions: This project is important because it suggests that school-aged youth with ASD are at high risk of under-vaccination. Vaccines are a critical component of our disease-prevention strategy, and youth with ASD represent at least 1% of the population. Under-vaccination in this group would contribute to an increased risk of infectious disease for youth with ASD, their families, and the community. Strategies for delivering school-based vaccines to accommodate the unique needs of youth with ASD should to be considered.

169 **114.169** An Exploratory Investigation of Organic Chemicals Measured in Deciduous Teeth: Differences between Children with and without Autism.

***R. Palmer**, The University of Texas Health Science Center San Antonio, San Antonio, TX*

Background: Shed baby teeth have been established to hold a record of exposure to heavy metals *in utero* and early childhood. Semi-volatile organic chemicals have been studied in shed baby teeth and this has been identified as a potential epidemiological tool to identify environmental triggers of developmental disorders such as autism.

Objectives: We have applied a comprehensive high-throughput non-targeted screening method to extensively catalog and categorize semi-volatile organic chemicals in shed baby teeth. Chemical concentrations in teeth were then compared between children and without autism.

Methods: Comprehensive two dimensional Gas Chromatography Time-of-Flight Mass Spectrometry *analysis was performed.*

Results: A total of 11,971 chemicals from 38 shed baby teeth were cataloged, including unknowns without a suitable library match. The average was 315 compounds per tooth. Of the 38 teeth, 22 were from children with autism spectrum diagnoses and 16 were from typical developing children. In general these are xenobiotic compounds with a high confidence score, many of potential interest as toxic agents. A total of 161 compounds of interest were identified. Topical analgesics, ingredients of personal care products, flavors, fragrances, solvents, insecticides and repellants were well represented in the data-set, suggesting the oral or dermal absorption routes of deposition as an active mechanism. Of the 161 compounds of interest, 53 were significantly elevated in the teeth of children with autism compared to the teeth of children without autism. These were largely insecticides, fungicides, microbiocides, solvents such as ethol-based compounds or fuel additives, and phthalates (plastics).

Conclusions: Hair, urine, or saliva samples are limited measures of exposures because they only reflect relatively recent exposures. Using deciduous teeth, like rings of a tree, chemical exposures are laid down over time and sequestered in layers of tooth enamel which begins forming in the 2nd trimester. These initial investigations are important for informing future epidemiologic research about the types of compounds that are present during critical periods of development. This research has implications for promoting avoidance of specific compounds of toxic chemicals during early development.

170 **114.170** Antidepressants during Pregnancy: Assessing Risk of Autism Spectrum Disorders in Exposed Offspring Using UK Primary Care Data

*H. Heuvelman[1], N. Davies[2], Y. Ben-Shlomo[3], A. Emond[3], J. Evans[4], D. Gunnell[3], R. Liebling[5], R. Morris[4], R. Payne[4], M. Viner[6] and **D. Rai**[7], (1)University of Bristol, Bristol, United Kingdom of Great Britain and Northern Ireland, (2)Population Health Sciences, Bristol Medical School, MRC Integrative Epidemiology Unit, Bristol, United Kingdom, (3)Population Health Sciences, University of Bristol, Bristol, United Kingdom, (4)University of Bristol, Bristol, United Kingdom, (5)University Hospitals Bristol NHS Foundation Trust, Bristol, United Kingdom, (6)Mothers for Mothers, Bristol, United Kingdom, (7)Population Health Sciences, Bristol Medical School, Centre for Academic Mental Health, Bristol, United Kingdom*

Background:

Several recent studies have raised the possibility of an increased risk of autism spectrum disorders (ASD) in children with an in-utero exposure to antidepressants. However, the results have been inconsistent and the possibility of confounding by indication has been acknowledged. A major limitation of previous studies is the use of secondary care data to ascertain depression despite it being overwhelmingly managed in primary care. Furthermore, the comparisons drawn in some prior studies (e.g. exposure to antidepressants versus no mental illness) are of limited clinical use as they do not directly inform the decision to initiate/continue antidepressant treatment for pregnant women with depression.

Objectives:

This study aimed to apply a range of traditional and advanced causal inference analytic methods including multivariable regression, propensity

score matching, discordant sibling comparisons, negative controls and instrumental variable analysis to observational data on a large primary care database.

We simulated two common clinical scenarios that would be tested in a randomized controlled trial: In women with depression (i) whether initiating a prescription for antidepressants in pregnancy versus offering no pharmacological treatment is associated with an increased risk of ASD in exposed offspring, and (ii) whether continuing an existing antidepressant prescription into pregnancy versus discontinuing it prior to conception is associated with an increased risk of ASD in exposed offspring.

Methods:

The Clinical Practice Research Datalink (CPRD) is an ongoing primary care database of anonymised medical records covering roughly 4.4 million active patients (6.9% of the UK population). A nested pregnancy and mother-baby register allows linkage between the clinical records of mothers and their live-born offspring. Between 1/01/1995 and 31/12/2017 we identified 46,874 mothers whose primary care records indicated depression around pregnancy, linked with 52,685 children followed up for at least 4 years. We used detailed information in the mother's clinical history prior to becoming pregnant and applied propensity score matching methods to assess severity of depression and balance the treatment groups. Children's diagnoses of ASD were identified using validated Read code lists.

Results:

57.8% of depressed mothers in our study population were treated with antidepressants during pregnancy (8.5% initiated, 49.3% continued) and 42.3% were not (13.8% no treatment, 28.5% discontinued). We identified 723 children with ASD (1.37%). The results did not support any strong association between initiation of antidepressants in pregnancy and a greater risk of ASD before (OR=1.16, 95%CI 0.85-1.58) or after matching on propensity scores (OR=1.07, 95%CI 0.75-1.54). Similarly, there was little evidence to suggest that continuation of an existing prescription into pregnancy was associated with greater ASD risk before (OR=1.05, 95% CI 0.86-1.27) or after propensity score matching (OR=0.98, 95%CI 0.79-1.22).

Conclusions:

The results of analyses completed to date suggest that for mothers with a history of depression around pregnancy, initiation or continuation of antidepressants during pregnancy did not lead to additional risk of ASD in their offspring. The results of other ongoing analyses will be presented and will provide further evidence to strengthen the causal meaning of these findings.

171 **114.171** Knowledge, Attitudes, and Practices of Family Physicians Related to Autism Spectrum Disorder in Romania: A Preliminary Analysis

M. A. Bach[1,2], *M. H. Rahbar*[1,2,3], *I. Dobrescu*[4], *M. Stancu*[4], *M. Hessabi*[1] *and F. Rad*[4], *(1)Biostatistics/Epidemiology/Research Design (BERD) core, Center for Clinical and Translational Sciences (CCTS), The University of Texas Health Science Center at Houston, Houston, TX, (2)Department of Epidemiology, Human Genetics, and Environmental Sciences, School of Public Health, The University of Texas Health Science Center at Houston, Houston, TX, (3)Division of Clinical and Translational Sciences, Department of Internal Medicine, McGovern Medical School, The University of Texas Health Science Center at Houston, Houston, TX, (4)Child and Adolescent Psychiatry Department, Carol Davila University of Medicine and Pharmacy, Psychiatry Clinical Hospital Alexandru Obregia, Bucharest, Romania*

Background: Autism spectrum disorder (ASD) is typically diagnosed in early childhood, and studies show that early intervention leads to better prognosis. Family physicians can assist by recognizing symptoms and providing timely referrals to the appropriate health care providers. Data on ASD from middle income countries such as Romania are lacking. Prior studies have identified the need to integrate mental health practices into primary care in Romania to reduce barriers to care. In 2011, a nation-wide program was initiated to increase ASD awareness, which included continuing education courses about ASD for family physicians.

Objectives: To assess the knowledge, attitudes, and practices regarding ASD of family physicians in Romania.

Methods: Investigators at the University of Texas Health Science Center at Houston and "Carol Davila" University of Medicine and Pharmacy (UMF) developed, translated, and administered a questionnaire to a cross-sectional convenience sample of n=383 family physicians in Romania to assess their knowledge, attitudes, and practices regarding ASD.

Results: A majority of participants were women (77.2%) and an average of 49.9 years old. All participants graduated from medical school in Romania, and 57.4% attended "Carol Davila" UMF. Participants practiced medicine 23.6 years on average and 51.6% reported that they had completed continuing education courses since 2015. Most participants practiced in Bucharest (60.2%), had patients from urban settings (72.5%), and reportedly spent an average of 16.7 minutes with each patient. A majority strongly agreed/agreed that children with ASD are detached from their family and peers (74.4%), children can grow out of ASD (74.5%), children with ASD require special education (95.2%), there is a stigma against ASD in the community (59.5%), diagnosing a child with ASD will lead to discrimination against the child and their family (50.4%), and there is generally a negative opinion toward children with ASD (63.5%). A majority disagreed/strongly disagreed that ASD is a possible result of neglect by the parents (57.5%), ASD is a precursor for schizophrenia (53.4%), and children with ASD deliberately misbehave (71.4%). Most participants correctly identified the symptoms necessary for ASD diagnosis, including impaired social interaction (88.3%) and communication (84.9%) as well as restricted and repetitive behavior (65.9%). A majority also recognized many symptoms that are often associated with ASD including lack of eye contact (87.5%), language disturbances (90.4%), hypersensitivity (75.8%), and anxiety (58.4%).

Conclusions: We found that a majority of participants agreed with true statements, disagreed with common misconceptions, correctly identified diagnostic criteria and common comorbidities related to ASD, and agreed that there is a stigma against ASD in their communities. However, up to 1/3 were "undecided" or responded "do not know." These preliminary results suggest that most family physicians in Romania are receiving adequate education about ASD to recognize the symptoms, though a sizable proportion of family physicians may be unable to recognize ASD, and there may be stigma against ASD in Romania. In future analyses, we will assess which factors are associated with higher knowledge of ASD among Romanian family physicians. However, there are many limitations in this study and results should be interpreted with caution.

172 **114.172** Association of Polychlorinated Biphenyls and Organochlorine Pesticides with Autism Spectrum Disorder in Jamaican Children

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Background: Polychlorinated biphenyls (PCBs) and organochloride (OC) pesticides are persistent organic pollutants (POPs) of public health concern. They are hypothesized to play a role in disorders such as autism spectrum disorder (ASD) by interfering with the endocrine or immune systems. Jamaicans may be at high risk for exposure to PCBs and OC pesticides as they have been detected in water, sediment, fauna, and shrimp across Jamaica.

Objectives: To examine the associations of PCBs and OC pesticides with ASD among Jamaican children.

Methods: We conducted an age- and sex-matched case-control study in which we enrolled n=141 pairs of Jamaican children 2-8 years old. ASD cases were confirmed using the Autism Diagnostic Observation Schedule, second edition and Autism Diagnostic Interview–Revised. Developmental delay was ruled out in typically developing (TD) controls using the Social Communication Questionnaire. Socioeconomic status and food frequency questionnaires were administered to the parents/guardians of each child. We collected 2-3 mL of whole blood for genetic analysis by the Human Genetics Center in Houston, Texas and 4-5 mL of serum for analysis of PCBs and OC pesticides by the Michigan Department of Health and Human Services. For PCBs and OC pesticides with ≥30% above the limit of detection (LoD), we replaced observations below LoD with $2^{-1/2}$LoD and calculated arithmetic and geometric means for cases and controls, separately. We dichotomized concentrations at the 75th percentile and used them as independent variables in conditional logistic regression models to assess the associations of these POPs with ASD. Finally, we conducted interactive models to explore possible interactions between POPs exposures and genotypes of three glutathione *S*-transferase (GST) genes in relation to ASD.

Results: A majority (79.4%) of cases and controls were male. The mean age of cases and controls was 59.6 months and 59.8 months, respectively. Compared to controls, cases had lower geometric mean concentrations of PCB-153 (14.3 ng/g-lipid vs. 16.5 ng/g-lipid), PCB-180 (6.4 ng/g-lipid vs. 7.2 ng/g-lipid), total PCB (26.0 ng/g-lipid vs. 29.4 ng/g-lipid) and 4,4'-DDE (54.7 ng/g-lipid vs. 76.6 ng/g-lipid), however none of these comparisons were statistically significant (all *P*>0.06). Using concentrations dichotomized at the 75th percentile, PCB-150, total PCB, and 4,4'-DDE were not associated with ASD in either univariable or multivariable models (all *P*>0.09). We found a marginally significant interactive effect between PCB-180 and *GSTP1* in relation to ASD (interaction term *P*=0.06); those with the Ile/Ile genotype had a different level of association (adjusted MOR=0.77, 95% CI: 0.53–1.23) compared to those with Ile/Val (adjusted MOR=0.51, 95% CI: 0.25–1.03) or Val/Val (adjusted MOR=0.59, 95% CI: 0.34–1.03) genotypes.

Conclusions: We found that cases had lower serum concentrations of PCB-153, PCB-180, total PCB, and 4,4'-DDE compared to controls, though differences were not statistically significant. These differences may be explained by diet, as one of the major routes of exposure to these POPs is through poultry and red meat; Jamaican children with ASD may eat less poultry and red meat compared to TD children. Furthermore, we reported a possible interactive effect between PCB-180 and *GSTP1*, which should be replicated in other studies.

173 **114.173** Autism and Metabolomics in Maternal Pregnancy Serum

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Background:

The exposures and biologic mechanism that may contribute to autism during fetal development are still largely unknown. Interrogating maternal metabolic features during pregnancy may help identify pathways relevant for the development of autism in the offspring.

Objectives:

The aim of this study is to comprehensively profile the blood metabolome during mid-pregnancy using untargeted high-resolution metabolomics (HRM) in order to identify maternal metabolic features and pathways associated with autism in offspring.

Methods:

We retrieved stored serum samples from 114 mothers sampled in mid-pregnancy. All subjects lived in the Central Valley of California which is a largely immigrant Hispanic community. Of these, 52 had given birth to a child diagnosed with autism in childhood according to the California Department of Developmental Services records and they were matched (by birth year and gender) to 62 controls randomly selected from the California Birth Records. Using liquid chromatography-high resolution mass spectrometry, we obtained metabolic profiles in an untargeted approach and used partial least squares discriminant analysis (PLS-DA) to select metabolic features that were statistically significantly different in case and control mothers while controlling for potential confounders selected *a prior*. Pathway and network analyses were employed using the *mummichog approach*.

Results:

In total we extracted 4030 and 4994 metabolic features from maternal serum samples in the HILIC column (positive ion mode) and the C18 column (negative ion mode), respectively. Controlling for confounders, 90 and 68 discriminatory metabolic features (HILIC and C18, respectively) were selected according to the criterion Variable Importance In projection (VIP) greater than 2. Pathway enrichment analysis for discriminatory features indicated that the steroid hormone pathway was upregulated in case mothers and we also found alterations in inflammatory and oxidative stress related pathways that distinguished case from control mothers.

Conclusions:

Profiling metabolomic features and generating pathways from maternal serum in mid-pregnancy, we found that differences in steroid hormones, inflammatory and oxidative stress pathway may contribute to the development of autism in the offspring.

174 **114.174** Migration or Ethnic Minority Status and Risk of Autism Spectrum Disorders and Intellectual Disability: Systematic and Scoping Reviews

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Background: There is emerging evidence that parental migration and ethnic minority status are associated with risks of autism spectrum disorder (ASD) and intellectual disability (ID). However, the mechanisms behind any such association remain unknown.
Objectives: To investigate whether any such association is specific to ASD or ID and whether the severity of ASD or ID plays a role; to examine whether any increased risks of being diagnosed with ASD and ID results from migration-related factors or ethnically determined factors; and to explore potential underlying mechanisms for any association.

Methods: In the systematic review, a systematic literature search was conducted for observational studies that reported on proportion, prevalence, odds ratio or relative risks of ASD and/or ID among immigrants and/or ethnic minorities. Risks of any ASD, ASD+ID, ASD–ID, and any ID were reviewed regarding different migration and ethnic minority status, with consideration of study quality. In the scoping review, possible underlying mechanisms suggested in the included studies were summarized.

Results: 35 unique studies were included in the review. The results indicated an increased risk of ASD+ID and severe ID and a decreased risk of ASD–ID and mild ID in children of immigrant parents and those with ethnic minority status. The association appeared more pronounced with maternal immigrant status, with parental origin in low-income countries, and among second generation migrants. The suggested potential underlying mechanisms were environmental factors in pregnancy and genetic factors for ASD+ID and severe ID and ascertainment bias for ASD–ID and mild ID.

Conclusions: Migration-related factors may be more important drivers of ASD risk in immigrants than ethnically determined factors. The increased risk of severe types of ASD and ID may depend on such migration-related factors, and the decreased risk of milder types may depend on underdiagnosis.

175 **114.175** Can Computational Surveillance of Autism Spectrum Disorder Fuel Big-Data Science?

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Background: The research community is increasingly recognizing that in order to unravel the complex heterogeneity associated with autism spectrum disorder (ASD) we will need to be able to meaningfully access extremely large datasets tied both to important phenotypic and genetic data. To this end, a number of initiatives have been established that aim to develop big and/or open data resources and collections for autism research. However, construction of these datasets has often relied on expensive and intensive methods for recruiting and phenotyping children in companion with collection of biological samples. As such, even the most successful consortium collections may fall well short of the numbers and quality of data necessary to help answer extremely important questions.
Objectives:

In the current study, we describe our methods and work for utilizing advanced computational methods to model and validate cohorts of individuals with ASD within an existing large electronic health record (EHR) structure that also contains important neurodevelopmental and genetic information (BioVU).

Methods: We describe our process for utilizing machine-learning to develop and validate ASD case models across (a) an existing 'gold-standard' tertiary clinical research center and (b) sequential cohorts of children identified as part of the CDC ADDM network. We hypothesized that robust models developed from deep and broad data sources could result in hybrid computational surveillance and case identification methods by which existing EHR structures could be leveraged to identify 'collections' of individuals with ASD. Notably, this model was employed within a bioinformatics structure simultaneously banking phenotypic and genetic material as part of standard care.

Results:

We successfully linked both our clinical research registry (differentiating over 3,500 individuals with ASD from other complex neurodevelopmental conditions) and our initial 2006 cycle CDC ADDM population (all 8 year-olds in surrounding 11 county region) to our university EHR bioinformatics structure. Some 73.9% of our population catchment (18,436 of 24,940 children within the birth year) were represented within the EHR. Initial model results examining prediction of entire population case-status from the clinical research model in comparison to simple administrative (code based) identification was compared. Both strategies yielded the ability to identify large numbers of children quickly (≥68.5% of children identified by across models/process); however, our results highlighted several potent challenges related to applying advanced computational surveillance and un/supervised learning within the EHR. Importantly, despite having relatively large numbers of children in our system (11.8% of studied EHR population), these numbers were still relatively small given the sparse population of data within EHR for important variables/codes. As such, many key variables were left data hungry due to large amounts of variation within class (i.e. 15,962 medication codes; 4,010 CPT codes for sample).

Conclusions:

Advanced computational methods may prove successful for creating large, meaningful data structures for unraveling complex neurodevelopmental and genetic underpinnings of ASD. However, such methods will likely require even larger cohorts of individuals for predictive modeling and may still will require hybrid methodologies for optimization.

176 **114.176** Cannabis Use in Peri-Pregnancy and Autism Spectrum Disorder in the Offspring: Findings from the Study to Explore Early Development

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Background: In the US, the prevalence of prenatal cannabis use increased substantially between 2002 and 2016, from 2.85% to 4.98%. Whether prenatal cannabis use adversely affects later outcomes such as cognition or behavior in the offspring has not been established. It is therefore important to examine the potential effects of prenatal cannabis use on neurodevelopmental disorders such as autism spectrum disorder (ASD).
Objectives: To determine whether ASD is associated with maternal cannabis use during the 3 months prior to conception or during pregnancy.

Methods: The Study to Explore Early Development (SEED) is a US multi-site case-control study of children aged 30-68 months born in 2003-2006 (SEED1) or 2008-2011 (SEED2). ASD cases (n=1397) were determined using standardized ASD-specific diagnostic instruments including the Autism Diagnostic Observation Schedule and the Autism Diagnostic Interview-Revised. General population controls (n=1586) were recruited from randomly sampled birth certificates. Each child's mother was interviewed by telephone after enrollment and asked about her marijuana (cannabis) use in each month from 3 months prior to conception through delivery ("peri-pregnancy"). Associations between maternal cannabis use and ASD in her offspring were examined using a generalized linear mixed model, including site as a random effect, adjusted for demographics, other substance use (tobacco, alcohol, illicit drugs), and enrollment period.

Results: Maternal peri-pregnancy cannabis use was reported for 5.4% of children with ASD and 4.5% of control children. Prevalence among maternal cannabis users declined in both the ASD and control groups from preconception (95% and 83%, respectively) to the first trimester (48% in both groups) to the third trimester (11% and 13%, respectively). Peri-pregnancy cannabis use was associated with lower caregiver education level, lower household income, and higher use of tobacco, alcohol and illicit drugs during pregnancy. In adjusted analyses, the odds of cannabis use in the peri-pregnancy period were not significantly different between cases and controls (adjusted OR [aOR] = 0.82 [95%CI: 0.55, 1.20]), nor was there a significant interaction between peri-pregnancy cannabis use and tobacco use in their association with ASD (p=0.30). There were also no associations observed between ASD and cannabis use in the three months prior to conception (aOR=0.99 [0.66, 1.49]) or during pregnancy (aOR=0.74 [0.44, 1.23]).

Conclusions: ASD in the offspring was not significantly associated with maternal use of cannabis in the peri-pregnancy period in these data. However, cannabis use was uncommon (consistent with national data), limiting study power, and we lacked information about route of ingestion, dose, and frequency of cannabis use. Further, we did not find evidence that cannabis and tobacco use together have a greater effect on the odds of ASD, as has been previously reported. With medicinal and recreational cannabis increasingly becoming decriminalized or legalized in many states, larger, longitudinal studies with more detailed information on frequency, amount and mode of intake are needed to establish whether any association exists between cannabis use and ASD risk.

177 **114.177** Characteristics of Boys and Girls with and without Autism Spectrum Disorder in the Study to Explore Early Development

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Background: In population-based studies of autism spectrum disorder (ASD), there is a 4:1 sex ratio of boys to girls. Girls with ASD may be under-recognized by healthcare professionals, which could increase the likelihood for delayed or absent ASD diagnosis. Consequently, some studies have examined whether sex differences exist among behavioral and developmental characteristics of children with ASD and if these differences contribute to differential performance on ASD screening and diagnostic instruments. These studies have produced mixed results, especially among young children. Moreover, no studies have included a population-comparison group (POP) to examine how sex differences in ASD compare to those in the general population.
Objectives: (1) Compare preschool boys and girls with ASD, other (non-ASD) developmental delay (DD), and POP on behavioral and developmental characteristics; and (2) Compare preschool boys and girls with ASD on results of ASD screening and diagnostic instruments, as well as the presence of a previous ASD diagnosis.

Methods: Children 2-5 years of age were enrolled in the Study to Explore Early Development Phases1&2 (SEED1+2). The Social Communication Questionnaire (SCQ) screened all children for ASD symptoms upon study enrollment, and the Mullen Scales of Early Learning (MSEL) assessed developmental characteristics in all children. Those with an SCQ score of 11 or higher or a previous ASD diagnosis received additional evaluation that consisted of the Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview – Revised (ADI-R). Results of the ADOS and ADI-R determined ASD status. Parents reported whether their child had a previous ASD diagnosis and completed the Child Behavior Checklist (CBCL) to assess child behavioral characteristics.

Results: The sample included 4,936 children: 1,480 ASD, 1,805 DD, and 1,651 POP. The sex ratio varied by case classification with more boys in the ASD sample (81.7%) versus DD (66.9%) and POP (52.5%), and more boys in DD than POP (p<.01). There were no sex differences in child age, family income, maternal age, maternal ethnicity, or maternal race in any study group. Girls in the POP group had better MSEL expressive language, receptive language, and fine motor abilities than boys (p<.001). These sex differences were not present in the ASD or DD samples. There were no sex differences in MSEL non-verbal cognitive abilities or CBCL externalizing or internalizing behavior problems in any study group. Among children with ASD, there were no sex differences in SCQ total score, ADOS domain scores, ADI-R domain scores, or presence of a previous ASD diagnosis.

Conclusions: Children in the ASD and DD groups did not show similar sex differences in developmental or behavioral characteristics than those in the POP group, where girls scored higher in language and motor development than boys. There were no sex differences in the behavioral or developmental characteristics of children with ASD, or with their performance on ASD screening and diagnostic instruments. Future research of sex differences in other samples of preschool children could consider whether sex differences are unique to particular ASD phenotypes and/or emerge as children with ASD age.

178 **114.178** Comorbid Mood and Anxiety Disorders in Autism Spectrum Disorder: A Longitudinal, Population-Based, Birth Cohort Study

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Background: Increased risk of comorbid mood and anxiety disorders among individuals with autism spectrum disorder (ASD) has been reported in the literature; however, estimates of co-morbidities range widely. Diverse methodology and samples (e.g., inpatient unit, clinic-referred samples) have yielded discrepant findings about the risk of comorbidity. The few existing population-based studies have been cross-sectional, primarily examining medical or broad psychiatric categories, and have not yielded clear, generalizable findings about the risk of specific psychiatric concerns in this population.

Objectives: Since psychiatric symptoms are known to impact functioning in social, academic, and vocational environments, understanding the risk for mood and anxiety disorders is critical to improve long-term outcomes for individuals with ASD. The current study uses a large, longitudinal population-based birth cohort to examine the cumulative incidence of depression, anxiety, and bipolar disorders during childhood through early adulthood in individuals with ASD relative to controls.

Methods: Using symptoms uniformly abstracted from medical and educational records, 1,014 cases of ASD (73.7% male) were research-identified (ASD-R) from a population-based cohort of individuals born in Olmsted County, MN from 1976 to 2000 (N=31,220). For each ASD-R case, 2 age- and sex-matched controls (N=2,028) were identified from the birth cohort. Diagnoses of depression, anxiety, and bipolar disorder were electronically-obtained from diagnostic codes in medical records through December 2017. The cumulative incidences of mood and anxiety disorder diagnoses were estimated using the Kaplan-Meier method. Cox proportional hazards models were fit to estimate the association between ASD case status and each diagnosis.

Results: Among individuals with ASD-R, the estimates of cumulative incidence by age 35 years were 12.4% (95% CI=7.2-17.4%) for bipolar disorder, 58.3% (95% CI=53.2- 62.8%) for depression, and 56.7% (95% CI=51.8-61.1%) for anxiety. By comparison, the estimates of cumulative incidence by age 35 years for bipolar disorder, depression, and anxiety were 1.7% (95% CI=0-3.4%), 34.8% (95% CI=29.7-39.5%), and 32.3% (95% CI=27.0-37.2%), respectively, in the control group (Figure).

ASD-R individuals were significantly more likely to have comorbid bipolar disorder (HR=9.34; 95% CI=4.57-19.06), depression (HR=2.81; 95% CI=2.45-3.22), and anxiety (HR=3.56; 95% CI=3.06-4.13) compared to controls. Significant associations were observed separately among males and females, although the association between ASD-R status and depression was significantly higher (p=0.01) among males (HR=3.17; 95% CI=2.67-3.77) compared to females (HR=2.28; 95% CI=1.82-2.86).

Compared to controls, ASD-R individuals met criteria at a younger age for depression (median:18.1 vs 15.7 years, p<0.001) and anxiety (median:20.1 vs. 14.8 years, p<0.001).

Conclusions: This research demonstrates individuals with ASD are at increased risk for depression, anxiety, and bipolar disorder compared to controls. Over 50% of individuals with ASD are diagnosed with mood or anxiety disorders across their lifespan. While females in general are at greater risk for depression overall, a diagnosis of ASD more strongly increases the risk for depression among males. Additionally, individuals with ASD are more likely to be diagnosed at earlier ages. This highlights the importance of early, ongoing screening for psychiatric comorbidities across the lifespan and supports the need for targeted treatments to address the psychiatric needs of individuals with ASD.

179 **114.179** Comorbid Rate of Other Neurodevelopmental Disorder with Autism Spectrum Disorder in a Total Population Sample of 5-Years-Old Children.

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Background: Recently patients with autism spectrum disorders (ASDs) have significant comorbidity of mental and physical disorders has well known. The distinct comorbid rate of other NDD with ASDs have been few extensively studied in preschool age based on behavioral criteria from the DSM-5.

Objectives: The objective of this study was to investigate the patterns of co-occurrence of neurodevelopmental comorbidities in ASDs in a Total Population Sample of 5-years-old children.

Methods: Using a total population sample in Hirosaki city in Japan (N=5016), all 5-year-old children in the catchment area underwent the screening phase annually from the year 2013 until the year 2016. Children who screened positive (using ASSQ, ADHD-RS, SDQ, DCDQ, PSI) were invited to comprehensive assessment, including child and parent interview (using DISCO, SRS-2, Conners-3, Sensory Profile), behavioral observation, cognitive testing (WISC-IV), and motor function testing (MABC-2, S-JMAP). The Autism Diagnostic Observation Schedule (ADOS-2) was conducted only for children whose parents agreed. All cases were discussed in a multidisciplinary research team, where ASD cases were ascertained based on the best clinical judgement. The same screening tools and diagnostic assessment batteries as well as diagnostic criteria (the DSM-5) were consistently used throughout the 4 study years. We estimated comorbid rate of other NDD with ASDs.

Results: Our study findings showed that only 11.5% (10/87) of 5-year-old children had ASDs alone; the remaining and that the rest of 88.5% (n=77) of children were found to have at least one co-occurring NDD (i.e. one or more among ADHD, DCD, ID, and/or borderline intellectual functioning). Of note, 20 cases (23%) had 3 co-occurring NDDs. Of eighty-seven 87 children who were diagnosed with ASDs, 44 children (50.6 %) were confirmed to have ADHD (male: female = 3:1), while 55 children (63.2 %) were identified to as having co-occurring DCD (male: female = 2.1:1). Co-occurring cognitive impairment was as follows; ID defined as (IQ below <70) in 32 children (36.8%) and Borderline Intellectual Functioning (70<IQ<85), defined as IQ between 70 and 85 in 18 children (20.7 %).

Conclusions: Our study suggested high rates of co-occurring NDDs of ASDs. The comorbid rates of ADHD and DCD in the present study might be higher than the findings from extant research.

180 **114.180** Comparison of Characteristics of Autistic Adults between Different Age Groups across the Lifecourse in a UK-Wide Adult Autism Spectrum Cohort Study

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Background:
The lived experience of autistic adults during adulthood is poorly understood. The ASC-UK cohort study aims to recruit a sufficiently large group of participants to investigate how the skills and needs of autistic people change across the lifespan.

Objectives:

To compare the characteristics (demographics, autism symptomatology, rates of mental and physical health diagnoses, and everyday experiences) of autistic adults from different age groups.

Methods:

Participants were recruited through health teams, voluntary sector organisations, and the autism community. All participants reported a clinical diagnosis of autism spectrum condition. Adults either gave informed consent or a relative/carer acted as 'consultee' (for those who lacked capacity to consent for themselves). All completed a registration questionnaire and Social Responsiveness Scale-2 (SRS-2).

Results:

1663 participants from four age groups (n=430, 16-25 years; n=576, 26-40 years; n=522, 41-60 years; and n=104, 61+ years) joined ASC-UK between 2015 and 2018 (45 months): 893 males, 729 females, 41 'other' gender/preferred not to report/not reported; mean age 37.6 years, SD 14.0, range 16-88). 1397 had capacity to consent for themselves; 113 adults lacked capacity. Mean total SRS-2 score was 111.9 (SD 28.9). Approximately 60% of participants reported having both a diagnosed mental and physical health condition.

Rates of anxiety (43-55%) and depression (37-55%) were high across all age groups. Rates of anxiety did not differ by age; however, people in the youngest (16-25 years) and oldest (61+ years) groups reported lower rates of depression (37% and 43%, respectively) compared to those aged 26-60 years (50-55%). The rates of successfully accessing mental health services (57-62%) did not differ across age groups. However, people aged 26-40 years had tried to access mental health services more frequently (78%) than 16-25 year olds (65%). The proportional difference between people trying to access services and successfully accessing services was lowest for 16-25 year olds and highest for people aged 26-40, suggesting greater unmet need in this latter age group.

Sleep problems were common across all age groups (22-29%). 12-34% of all adults experienced gastrointestinal disorders (e.g., constipation, acid reflux; higher in adults aged 41+). Obesity was reported more frequently in adults aged 26-40 (13%) than those 25 years and under (5%). As expected, compared to adults aged 16-40, older adults (aged 41+) reported higher rates of: arthritis (16% vs 3%), diabetes (8% vs 3%), hypertension (17% vs 3%), and hypercholesterolaemia (16% vs 2%).

Rates of unemployment remained consistent across age groups (35-40%). Compared to unemployed adults, employed adults aged 26-60 reported slightly lower rates of anxiety (24% vs 30%) and depression (23% vs 29%). For adults aged 26-40 and 41-60, rates of living with a family member or partner were 62% and 53%, respectively. Across the age groups, two-thirds of adults reported they spend time with friends.

Conclusions:

Rates of mental and physical health conditions, employment, and everyday social and living experiences of autistic adults are mostly similar across the lifespan. These data will inform hypothesis-driven accelerated cohort research studies and inform the development of effective life-stage appropriate support and interventions.

181 **114.181** Interpregnancy Intervals and ADHD with and without Comorbid Autism Spectrum Disorders: A Finnish Birth Cohort Study

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Background: Short or long interpregnancy interval (IPI) has been consistently associated with increased risk of autism spectrum disorders (ASD). Attention deficit hyperactivity disorder (ADHD), like ASD, is a neurodevelopmental disorder with a complex etiology including the influence of the prenatal environment. There is substantial co-morbidity between ASD and ADHD. However, whether there is a relationship between IPI and ADHD, and whether this varies by the presence or absence of co-morbid ASD, has been largely unexplored.
Objectives: To determine whether the IPI is associated with the risk of offspring ADHD in subsequent births, and to assess whether this varies by co-morbidity with ASD.

Methods: A case-control study was nested in a national cohort of all births in Finland. All persons born in Finland between 1991-2005 and diagnosed with ADHD (ICD-9 (314x) or ICD-10 (F90.x)) from 1995-2011 were identified using the Finnish Hospital Discharge Register. Each case was matched to 4 controls based on sex, date of birth, and place of birth. A total of 9564 cases and 34,479 matched controls were included in the analyses. IPI was calculated as the time interval between sibling birth dates minus the gestational age of the second sibling. ASD diagnosis was based on ICD-10 codes F84.0, F84.5, or F84.8-F84.9 in the FHDR. Conditional logistic regression was used to estimate the association between IPI and ADHD, adjusting for potential confounders. Models were stratified by the presence or absence of ASD in the case to assess heterogeneity by ASD comorbidity.

Results: Relative to births with an IPI of 24 to 59 months, those with the shortest IPI (<6 months) had an increased risk of ADHD (adjusted odds ratio [aOR (95% CI)] = 1.25 (1.07, 1.45); p=0.005) and the aORs for longer IPI births (60-119 months and ≥120 months) were 1.17 (95% CI = 1.06, 1.30; p=0.002) and 1.37 (95% CI = 1.18, 1.60; p<0.0001), respectively. Twelve percent of subjects with ADHD also had a comorbid diagnosis of ASD. However, tests of heterogeneity indicated that the association between IPI and ADHD did not significantly differ for cases with versus without ASD. The increased odds of ADHD among children who were first born were greater for those with co-morbid ASD (OR=1.76 (1.42, 2.18)) versus those without (OR=1.17 (1.09, 1.27); p-value for interaction=0.0002).

Conclusions: Similar to ASD, the risk of ADHD may be increased among children born following short or long IPIs. Further study is needed to explain the mechanisms of association, which may be different for short than for long intervals.

182 **114.182** Cross-Disorder Investigation of Environmental Associations with Autism Spectrum Disorder and Attention Deficit

Hyperactivity Disorder

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Background: Neurodevelopmental disorders like autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) are phenotypically heterogenous and potentially encompass etiologically distinct subgroups. The identification of modifiable risk factors for neurodevelopmental impairments may be enhanced by systematic, quantitative comparison of risk factor associations across phenotypic subgroups.

Objectives: As proof of principle, we made quantitative comparisons of the strength of associations between urbanicity at birth and maternal smoking during pregnancy with three neurodevelopmental phenotypic subgroups defined by diagnoses of ASD and ADHD.

Methods: From iPSYCH, a Danish population-based case cohort study (singleton births 1981- 2005, known mother, residing in Denmark at 1st birthday; random 2% sample as controls), we further restricted to births January 1991 - December 1999, with complete follow up and no emigration or death until the 13th birthday. Cases had an ICD-10 ASD (F84.0,1,5,8,9) and/or ADHD (F90.0) diagnosis reported to the Danish Psychiatric Central Research Registry prior to the 13th birthday and controls comprised iPSYCH controls with cases removed. We estimated adjusted odds ratios (adjOR) and 95% confidence intervals using logistic regression for: ASD/- ADHD (n=3,905), ADHD/-ASD (n=3,556), and ASD+ADHD (n= 891) comparing the most urban birth residence (capital region – Copenhagen, 13% of controls) to regions with 50% or less urban area (22% of controls) and also evaluated maternal smoking (28% of controls) versus no smoking. We adjusted for birth year, maternal smoking (urbanicity analyses only), inter-pregnancy interval, urbanicity (smoking analyses only), marital status, maternal and paternal immigrant status, education, employment, ages, and incomes. To compare the strength of association across the 3 subgroups while accounting for non-independence of these ORs, we used a Bayesian multiplier bootstrap method to estimate the variance-covariance matrix for log ORs. We computed Wald-type p value tests of the equivalency of pairs of adjORs, using a conservative alpha = 0.005 given multiple comparisons and preference for stringency in concluding different risk between phenotypic groups..

Results: Urbanicity was associated with subgroups including autism: ASD/-ADHD adjOR 1.7 (1.4, 1.9) and ASD+ADHD adjOR 2.3 (1.7, 3.1) and these associations were statistically of similar strength (p = 0.045). In contrast, urbanicity was not associated with ADHD alone: ADHD/-ASD adjOR 1.0 (0.8, 1.2), an association statistically distinct from the other subgroups (both p = 0.000). Maternal smoking in pregnancy was associated with ADHD alone: ADHD/- ASD: adjOR 1.5 (1.3, 1.6) but not autism alone: ASD/- ADHD adjOR 1.0 (0.9, 1.1), with a p contrasting these ORs = 0.000. The association of maternal smoking and ASD+ADHD: adjOR 1.2 (1.0, 1.5) was not statistically distinguishable from associations with the single diagnosis groups: ASD/-ADHD (p = 0.018) or ADHD/-ASD (p = 0.073).

Conclusions: Risk from urban residence at birth and maternal smoking in pregnancy differed significantly across ASD and ADHD neurodevelopmental phenotypic subgroups, thereby highlighting at-risk cross-diagnosis subgroups as potential targets for further analyses of pathogenic mechanisms associated with these modifiable risk factors. Our approach supports attempts to align phenotypic and etiologic heterogeneity to clarify the risk architecture underlying neurodevelopmental impairments.

183 **114.183** Cumulative Incidence of Autism Spectrum Disorders in a Total Population Sample of 5-Year-Old Children

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Background: Recent reports from Center for Disease and Control and other research suggest an increase in Autism Spectrum Disorder (ASD). Despite a growing number of publications reporting on the ASD prevalence, however, it remains unknown if there is a true increase in ASD prevalence. An increase in the prevalence and the incidence of ASD can be attributable to: 1) better ascertainment; 2) broadened ASD diagnostic criteria; and, 3) a true rise in ASD incidence. One way to overcome this challenge is to examine the ASD incidence, another measure of ASD frequency and compare the incidence annually. However, only few studies have examined the ASD incidence mainly due to the methodological challenges in estimating incidence; more specifically, the difficulty in identifying the time of disease onset in ASD research.

Objectives: To determine whether there is a true increase in ASD prevalence by investigating the cumulative incidence of ASD annually.

Methods: Using a total population sample in Hirosaki city in Japan, all 5-year-old children in the catchment area underwent the screening phase annually from the year 2013 to the year 2016. Children who screened positive were invited to comprehensive assessment at the University Clinic, including child and parent interview, behavioral observation, cognitive testing, and motor function testing. Each case was discussed in a multidisciplinary research team, and the best estimate diagnosis was determined based on findings from screening tools and diagnostic assessment, as well as clinical judgement. The same screening tools and diagnostic testing as well as the same diagnostic criteria (DSM-5) were used in all study years to minimize the impact of changing criteria on ASD ascertainment and of changing diagnostic criteria on prevalence and incidence estimates. We estimated cumulative incidence of ASD up to 5 years of age for each study year by dividing the number of children diagnosed with ASD who were born in the catchment area by the number of the birth cohort in the catchment area each study year.

Results: Caregivers of 3,954 children completed and returned the screening packet for a participation rate of 78.8%. Among 773 children who were screen-positive, 559 children underwent the assessment, and 87 children were eventually diagnosed with ASD. The cumulative incidence of ASD up to 5 years of age for the total study years was 1.31% with the 95% CI of 1.00 – 1.62. Although the 5-year cumulative incidence increased from the year 2013 to the year 2014 and from the year 2014 to the year 2015, further analysis, using a generalized linear model revealed that there were no significant linear trends in 5-year cumulative incidence over the study years 2013 – 2016.

Conclusions: Taking advantage of the sequential study design allowed us to compare the annual 5-year cumulative ASD incidence and successfully demonstrate that there was not a true rise in ASD incident cases over the 4-year study period in the study catchment area.

184 **114.184** Does the Prevalence of ASD Continue to Rise?

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Background:
The rise in Autism Spectrum Disorder (ASD) prevalence has generated considerable concern. However, the literature has long debated whether this increase reflects changes in diagnostical practices (e.g., improved screening, better community awareness, shift of diagnosis), or rather a true increase in the risk of developing ASD. The process of establishing an ASD diagnosis in Israel underwent two major changes during the last decade; the 2007 decision that ASD diagnosis given by a medical specialist will be confirmed by a developmental psychologist, and the release of the DSM-V in 2013 which requires a higher threshold of symptoms for ASD diagnosis. The effects of these changes on ASD diagnosis rates have not yet been thoroughly examined.

Objectives:

The aim of the current study was to depict the prevalence and incidence of ASD in Israel, and to examine possible effects associated with increasing the threshold for diagnosis. To achieve this goal, we examined all ASD diagnosis given by medical specialists in a nationally representative cohort of children born between 1999 and 2016.

Methods:

This study used retrospective data obtained from computerized records of Maccabi Health Services, the second largest healthcare service in Israel. Records of children born between 1999 and 2016 were examined until 31 December 2017. Unlike previous studies that assessed ASD indirectly or used self-reported measures, the current study included only children with a definite ASD diagnosis, based on meeting the following criteria: (1) ASD diagnosis was given by a child neurologist or psychiatrist with further confirmation by a developmental psychologist; or (2) ASD diagnosis was given by a child neurologist or psychiatrist, with further confirmation through individual review of medical records to ensure DSM criteria for ASD were met.

Results:

Data indicate a steady rise in ASD prevalence over time, especially in boys. The overall prevalence of ASD among 8-years-old children increased from 0.70% (girls 0.24%; boys 1.14%) in 2007 to 1.17% (girls 0.39%; boys 1.91%) in 2017. Cumulative annual incidence of ASD increase more readily for children born in later birth years, but a delayed age of diagnosis was still observed for many children.

Conclusions:

Our results demonstrate that ASD prevalence continues to rise, despite efforts to increase the threshold for diagnosis. The rise in cumulative annual incidence in later birth years may be additionally attributed to a trend for earlier age at diagnosis, but additional efforts need to be made to identify children who do not receive diagnosis or are missed by early evaluations. Our findings suggest that the rise of ASD prevalence is evident even when using restrict and definite ASD diagnosis, providing some support for etiological involvement of biological and environmental factors in ASD risk.

185 **114.185** Early Life Air Pollution Exposure and Autism Spectrum Disorder: Findings from the Study to Explore Early Development

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Background: Epidemiologic studies have reported associations between prenatal and early postnatal air pollution exposure and autism spectrum disorder (ASD); however, findings differ by pollutant and developmental window.
Objectives: We examined associations between early life exposure to $PM_{2.5}$ and ozone in association with ASD across multiple U.S. regions.

Methods: Our study participants included 674 children with confirmed ASD and 855 population controls from the Study to Explore Early Development, a multi-site case-control study of children born from 2003 to 2006 in the United States. We used a satellite-based model to assign air pollutant exposure averages during several critical periods of neurodevelopment: three months before pregnancy; each trimester of pregnancy; the entire pregnancy; and the first year of life. Logistic regression was used to estimate odds ratios (OR) and 95% confidence intervals (CIs), adjusting for study site, maternal age, maternal education, maternal race/ethnicity, maternal smoking, and month and year of birth.

Results: The air pollution-ASD associations appeared to vary by exposure time period. Ozone exposure during the third trimester was associated with ASD, with an OR of 1.22 (95% CI:1.05, 1.42) per 6.6 ppb increase in ozone. We additionally observed a positive association with $PM_{2.5}$ exposure during the first year of life [OR = 1.26 (95% CI: 1.02, 1.57) per 1.6 $\mu g/m^3$ increase in $PM_{2.5}$].

Conclusions: Our study corroborates previous findings of a positive association between early life air pollution exposure and ASD, and identifies a potential critical window of exposure during the late prenatal and early postnatal periods.

186 **114.186** Examining the Role of Home Language and Race on Autism Diagnoses in a Metropolitan Autism Center

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Background: Several studies have identified diagnostic asymmetries in autism spectrum disorder (ASD) based on race (e.g. Mandell et al., 2009), but less is known about interactions between race and home language.
Objectives: To explore interactions among language, race, and variables characterizing the ASD diagnostic process among children evaluated at a metropolitan autism clinic that sees all children regardless of ability to pay.

Methods: De-identified clinical records of children (n=13516) seen at a high-volume metropolitan Autism Clinic were examined. Participants whose

first visit was not captured, and Race groups that could not be interpreted or analyzed were excluded (remaining, n=10090) (**1a**).

Results: (**1b**) ANOVA looking at Age of First Visit by Race and Language indicated main effects of Race (p<.001), marginal interaction Race*Language (p=.09), and no effect of Language. In English-Speaking Homes, White children had a First Visit at an older age than other races. (**1c**) A similar logistic regression examining First Visit ASD diagnosis probability controlling for Age indicated Race (p<.001) and Age (p<.001), but no other, effects. Hispanic children were diagnosed with ASD less often than Asian (p<.001), Black (p<.001), and White (p=.03) children, but not children of Mixed Race (p=.13). Asian Children received an ASD diagnosis more often than White children (p=.02). (**1d**) 94.3% (n=3747) of children who received a diagnosis of ASD at their first visit retained their diagnosis by their last visit. However, 41.8% (n=2109) of children who did not receive an ASD diagnosis at their first visit had an ASD diagnosis at their last visit (though this sometimes only reflected delays in seeing specific staff); 58.2% (n=2939) remained without an ASD diagnosis. (**1e**) We examined the probability of ASD diagnosis by Last Visit (by Race and Language), controlling for age of First Visit, in children without an ASD diagnosis at First Visit. Race (p<.001) and Age (p<.001), but no other, effects were observed. Asian Children transitioned Non-ASD→ASD more often than all other Races (ps<.03) except Black Children (p=.15); Black Children transitioned Non-ASD→ASD more often than Hispanic Children (p=.05). (**1f**) We examined ANOVA to examine ASD Diagnosis Delay (Age when First Diagnosed with ASD - Age of First Visit) in children who transitioned Non-ASD→ASD. Both Race (p=.03) and home Language (p=.02) contributed significant variance in predicting Diagnosis Delay. However, results were difficult to interpret, with wide confidence intervals, and only one clearly significant contrast (among Children who spoke English at Home, Asian Children had a shorter delay to receive a diagnosis as compared to White Children, p<.01).

Conclusions: Results suggest a limited, but nuanced role of home language in the ASD diagnostic process of this high-volume clinic. Results show parallels to Becerra et al. 2014 despite not being an epidemiological survey, and the late average age of diagnosis. Mechanisms underlying higher diagnostic rates of Asian and lower of Hispanic children at multiple points in the diagnostic process need to be clarified. Younger child ages associated with non-English speaking families may reflect on the service such a center provides to the community.

187 **114.187** Grand-Maternal Smoking during Pregnancy and Autism Spectrum Disorder/Attention-Deficit/Hyperactivity Disorder in Grandchildren

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Background:

Animal experiments indicate that environmental factors can alter gene expression to induce multigenerational transmission of biological traits to subsequent generations through the germline. However, there is very little data on such effects in humans. Cigarette smoke is one exposure that is known to alter germline DNA methylation patterns, but only a single study has investigated the association between grand-maternal smoking in pregnancy and grandchild's diagnosed autism, using data from the Avon Longitudinal Study of Parents and Children (ALSPAC).

Objectives:

To examine the associations between grandmother smoking while pregnant and risk of autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) in her grandchildren.

Methods:

We analyzed data reported by nurses in The Nurses' Health Study (NHS) II, the participants of which were born between 1946 and 1964. In 1999, nurses (F1) were asked whether their mother (F0) smoked during her pregnancy with them. ASD and ADHD cases were identified according to the nurses' report of whether or not they had ever had a child (F2) diagnosed with ASD (2009) or ADHD (2013).

In NHS II, each nurse can have more than one child causing clustering of the outcome in the F2 generation. Because the exposure (F0 smoking) could affect the number of children (F2) per nurse (F1), and neurodevelopmental deficits in the F2 generation could affect the number of children a nurse has, the clustering could be informative. To address the correlated data structure and possible informative clustering simultaneously, the associations of maternal in utero exposure to smoking and ASD and ADHD were analyzed using cluster-weighted generalized estimating equations with a logit link. Models were adjusted for several potential confounders. Additionally, sensitivity analyses were conducted by repeating our main analyses adjusting for potential mediators (i.e., F1 smoking during pregnancy with F2).

Results:

For ASD, N=44,660 F1 mothers had data on exposure, outcome, and confounders, and for ADHD, N=42,218 F1 mothers had complete data. For both outcomes, the prevalence of F0 smoking during the pregnancy with the F1 nurses was similar (24.9% and 24.7% for ASD and ADHD outcomes, respectively). Of 100,670 and 95,218 F2 children, 1,272 (1.26%) were diagnosed with ASD and 7,173 (7.53%) were diagnosed with ADHD. Grand-maternal smoking during the pregnancy with the nurses was associated with an increased risk of ADHD among the grandchildren with adjusted odds ratio (aOR) of 1.18 (95% CI, 1.11-1.27), whereas an association was not observed between F0 smoking during the pregnancy with F1 and a risk of ASD among the F2 generation (aOR = 0.97; 95% CI, 0.85-1.12). Controlling for the F1 level potential mediators did not substantially change the findings. When the analyses were repeated as performed in ALSPAC, the results for the outcome of ASD diagnosis remained the same.

Conclusions:

Maternal prenatal exposure to smoking is associated with an increased risk of ADHD, but not with ASD. Further exploration of these third generation associations is needed in other epidemiological study settings.

188 **114.188** Interaction between Maternal Immune Activation and Antibiotic Use on Subsequent Risk of Autism Spectrum Disorder

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Background:
Maternal immune activation (MIA) is emerging as a consistent risk factor for ASD. However, the specific sources of MIA or the mechanisms underlying MIA-ASD association are unclear. Animal literature suggests that the maternal gut microbiota interact with her immune system to influence fetal neurodevelopment and manifest autism-like symptoms in the offspring. Antibiotic use modifies the maternal gut microbiota, but its role in modifying the MIA-ASD association is unknown.

Objectives:

We assessed whether MIA and antibiotic use during pregnancy interact to influence the risk of ASD in the offspring in a prospective birth cohort.

Methods:

Participants include 3,123 mother-child pairs from the Boston Birth Cohort, a prospective birth cohort enriched for preterm birth recruited and followed at the Boston Medical Center. MIA during pregnancy was assessed using electronic health records (EHR) reports of infection and a postpartum maternal questionnaire. Antibiotic use was assessed using EHR outpatient/inpatient prescription drug information during pregnancy, chart extraction during labor and delivery (intrapartum), and a postpartum maternal questionnaire. ASD diagnosis was based on ICD-9 diagnostic codes. Typically developing children (TD) did not have ASD, ADHD, or other intellectual/developmental disabilities. We used logistic regression to estimate potential interaction between MIA and antibiotic use on odds of ASD. Models were adjusted for maternal age, maternal education, maternal race, marital status, child sex, child's year of birth, delivery type, preterm birth, low birth weight, and smoking during pregnancy.

Results:

At delivery, mothers were 28.5 years old on average. Most were black/African-American (58%) and had high school education level of higher (72%). Five percent of the offspring had ASD, of which 74% were males. In our multivariable logistic regression models, we found a significant interaction between flu in the second trimester and EHR-abstracted antibiotics during pregnancy on ASD risk (p for interaction=0.03). When stratified by antibiotic use, flu in second trimester was only a risk factor for ASD among mothers who did not receive an antibiotic during pregnancy (OR=6.8, p=0.09 vs. OR=1.2, p=0.74). We also found a potential interaction between fever in the second trimester and intrapartum antibiotic use (p for interaction=0.07). When stratified by intrapartum antibiotic use, fever remained a risk factor only among the mothers who did not receive an intrapartum antibiotic (OR=3.7, p=0.01 vs. OR=0.66, p=0.58). We did not find evidence of interaction in the first or third trimester between flu/fever and antibiotic use.

Conclusions:

In this enriched risk cohort study, we found evidence of a potential interaction between second-trimester flu or fever and antibiotics during pregnancy on ASD risk. Offspring with maternal flu/fever who did not receive antibiotics were at highest risk. We did not find evidence of interactions in the first or third trimester, or overall pregnancy. This study builds on existing animal literature demonstrating an interaction between MIA and antibiotic use and ASD-like symptoms in the offspring. More work is needed to replicate this finding.

189 **114.189** Interaction between a Mixture of Heavy Metals (Lead, Mercury, Arsenic, Cadmium, Manganese, Aluminum) and GSTP1 in Relation to Autism Spectrum Disorder

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Background: Humans are regularly exposed to many environmental chemicals with potentially toxic effects on human health. These exposures often do not occur in isolation, but as a mixture of chemicals; however limited information is published regarding the effects of exposure to mixtures of chemicals on human health, including autism spectrum disorder (ASD). We previously reported on the presence or absence of a significant association of ASD with each of the following six metals: lead (Pb), mercury (Hg), arsenic (As), cadmium (Cd), manganese (Mn), and aluminum (Al). In this study we perform mixture analysis of the six metals in relation to ASD.
Objectives: To investigate the additive or interactive associations between a mixture of the six metals and glutathione *S*-transferase *pi 1* (*GSTP1*) genotypes in relation to ASD.

Methods: We used data from 266 case-control pairs of children 2-8 years old from our autism project in Jamaica. To minimize potential multicollinearity between concentrations of the six metals, we generated a mixture index using generalized weighted quantile sum regression based on conditional logistic regression models, in which the genotype-specific weights of certain metals are determined to assess its additive or interactive association with *GSTP1* genotypes in relation to ASD. Positive and negative overall effects of the six metals on ASD were modeled separately. We also evaluated individual effects of each metal on ASD.

Results: Findings from our univariable negative model indicate that lower overall mixture score was significantly associated with ASD [MOR=0.35, 95% CI=(0.22,0.55), $p<0.01$]. We also found that association of three metals (Pb, Hg, Mn) with ASD appeared to differ by *GSTP1* genotype with a marginally significant interaction effect ($p=0.08$). After adjusting for potential confounders including maternal age, parental education levels, parish of child's birth, and consumption of seafood, the overall index effect on ASD was significant [adjusted MOR=0.47, 95% CI=(0.28,0.80), $p<0.01$] with similar patterns in estimated weights of the metals, but the interaction effect was no longer statistically significant ($p=0.21$). When the positive overall mixture index was evaluated [unadjusted MOR=1.13, 95% CI=(0.78,1.63), $p=0.52$; adjusted MOR=1.51, 95% CI=(0.79,2.9), p=0.22), though interaction effects were not statistically significant ($p=0.90$ for unadjusted model, $p=0.52$ for adjusted model], we found that higher blood Mn concentrations were associated with ASD for the *GSTP1* Ile/Ile genotype (weight for Mn in the positive adjusted model= 0.32), but this association was attenuated among children with Ile/Val (weight for Mn in the positive adjusted model =0.04) or Val/Val (weight for Mn in the positive adjusted

model =0.02) genotypes.

Conclusions: Findings from mixture analysis of the six metals in relation to ASD are somewhat similar to our previously reported findings based on analysis of the role of individual metals in additive and interactive models. However, the mixture analysis provides useful information about the positive and negative effects of the mixture index on ASD for both additive and interactive models. The finding of a potential role of *GSTP1* as an effect modifier when assessing the role of blood Mn concentration in ASD based on mixture analysis is consistent with our previous reports.

190 **114.190** Concentrations of Lead, Mercury, Arsenic, Cadmium, Manganese, and Aluminum in Blood of Romanian Children Suspected of Having Autism Spectrum Disorder

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Background: Perinatal or postnatal environmental exposure to lead (Pb) has been associated with Autism Spectrum Disorder (ASD) in children. Higher concentrations of mercury (Hg), arsenic (As), cadmium (Cd), manganese (Mn), and aluminum (Al) in blood or urine of children have been associated with ASD. In collaboration with faculty at Carol Davila University of Medicine and Pharmacy in Romania, we conducted a pilot study to assess the feasibility for conducting epidemiologic research on gene-environment interactions in relation to ASD in Romania.
Objectives: To estimate blood concentrations of six metals (Pb, Hg, As, Cd, Mn, and Al) and identify their associated factors for children with ASD or suspected of having ASD in Romania.

Methods: From 2015-2107, sixty (60) children 2-8 years old who were suspected of having ASD were administered translated versions of ADOS and ADI-R in Romanian. Those who exceeded the threshold for ASD based on either ADOS or ADI-R were classified as "ASD or suspected of having ASD". After assessment, 2-3 mL of blood was obtained from each child and analyzed for the concentrations of the six metals at the Michigan Department of Health and Human Services in Lansing, Michigan, USA. Concentrations below limits of detection (LoD) for each metal were replaced by $2^{-1/2}$LoD. For all six metals, we calculated geometric and arithmetic means and standard deviations (SD) of concentrations. For metals that had no more than 30% of the concentrations below LoD, we assessed factors associated with concentrations by using the log of metal concentrations as a dependent variable in univariable and multivariable linear regression models.

Results: The mean age of children was 51.9 months and about 90% were male. More than half (65%) of the children were born in Bucharest; 45.5% of fathers and 71.7% of mothers had education beyond high school. The percentage of concentrations below LoD for Pb, Mn, Al, Hg, As, and Cd were 0%, 0%, 30%, 61.7%, 90%, and 95%, respectively. Geometric mean concentrations of Pb, Mn, Al, Hg, As, and Cd were 1.14 µg/dL, 10.84 µg/L, 14.44µg/L, 0.35µg/L, 0.99µg/L, and 0.10µg/L, respectively. Univariable linear regression analysis revealed that children who ate fresh shellfish (lobster, crab, crawfish) had significantly higher Mn level (P=0.05) compared to children who did not. Similarly, significantly higher Al concentrations were observed in children who ate melon (P=0.04), shrimp (P=0.03), and lamb (P=0.03), compared to children who did not. Multivariable linear regression analysis indicated that children who were female, had less educated parents, exhibited pica, and ate cold breakfast (e.g., cereal), watermelon, and lamb had significantly higher concentrations of Pb compared to their respective referent categories (all P <0.05 except for eating lamb, which was marginally significant, P=0.053).

Conclusions: This is the first study from Romania that provides information about concentrations of the six heavy metals in blood of Romanian children with ASD. The factors associated with higher levels of Pb, Mn, and Al also provide important information for designing future epidemiologic studies for investigating the role of these six metals in ASD in Romanian children.

191 **114.191** Joint and Independent Contributions of Autism Spectrum Disorder and Intellectual Disability on Emergency Department Utilization during Adolescence

***B. N. Hand**[1], A. Boan[2], C. Bradley[3] and L. Carpenter[2], (1)Health and Rehabilitation Sciences, The Ohio State University, Columbus, OH, (2)Medical University of South Carolina, Charleston, SC, (3)Developmental-Behavioral Pediatrics, Medical University of South Carolina, Charleston, SC*

Background: Frequent utilization of emergency department (ED) services places considerable burden on medical resources and is costlier than treatment provided through primary and urgent care settings. Adolescents with autism spectrum disorder (ASD) and/or intellectual disabilities (ID) are at particularly elevated risk for high ED utilization due to co-occurring psychiatric and medical comorbidities and poor continuity of care. This study will build upon previous literature by determining the joint and independent contributions of ASD and ID on ED utilization during adolescence.
Objectives: The objective of this study was to compare ED utilization and monetary charges during adolescence between four mutually-exclusive cohorts: ASD without co-occurring ID (ASD-only), ASD with co-occurring ID (ASD+ID), ID without ASD (ID-only), and population controls (PC).

Methods: A cross-sectional, non-experimental design was used to analyze administrative records from ED visits that occurred in the state of South Carolina between the years 2004-2015. This study included 2,555 individuals aged 12-17 years. A majority of participants were Black Non-Hispanic (59%) or White Non-Hispanic (37%). Approximately 2% of participants had racial/ethnic backgrounds classified as other Non-Hispanic, and 1.8% were Hispanic. Similar to other studies of healthcare utilization, we stratified participants by high and low ED utilization, as high utilizers accounted for a disproportionate amount of ED visits. Participants were classified as high utilizers if they had at least 10 ED visits during adolescence and low utilizers if they had < 10 ED visits. Table 1 provides descriptive information as a function of cohort and ED utilization. Generalized linear models were used to compare cohorts on the number of ED visits and total charges, stratified by high and low ED utilization.

Results: Among high utilizers, adolescents with ID-only had the most frequent ED visits, with 1.2 times more visits than the PC cohort (95% CI = 1.0-1.3). However, average total ED charges were significantly higher for the ASD-only cohort (mean=$30k USD, 95% CI=$18-50k) than the ID-only

cohort (mean=$19k USD, 95% CI=$13-29k). Descriptive examination of primary diagnoses revealed that the ASD-only cohort tended to be seen for psychiatric conditions, while those with ID-only tended to use the ED for low-cost, low-acuity conditions (e.g., upper respiratory infections). High utilizers with ASD+ID did not significantly differ from other cohorts on the number of ED visits or ED charges. Among low ED utilizers, no differences between cohorts were observed for ED utilization or charges.

Conclusions: ED utilization is an important indicator of health outcomes and access to quality primary care. In this study, high utilizers with ID-only had the most frequent ED visits, but those with ASD-only incurred the highest ED charges. This may be because individuals with ASD-only tended to be seen for psychiatric concerns, which require longer length of stay and are costlier to treat. Further research is warranted to better characterize and meet the healthcare needs of individuals with ASD and/or ID during adolescence.

192 **114.192** Association between Prader Willi Syndrome and Autism Spectrum Disorder: A Survey Study

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Background:
Prader-Willi Syndrome (PWS) is a rare genetic disorder that results from a lack of expression of paternally derived genes on chromosome 15q11-13. There has been a growing recognition of the potential relationship between PWS and Autism Spectrum Disorders (ASD), but risk factors are unknown.

Objectives:

This study aims to investigate the association between PWS and ASD and explore their genotypic/phenotypic correlations via a large sample survey.

Methods:

Genetically-diagnosed PWS patients were separated into three groups according to their ages and handed out differently survey respectively to examine their probability of having ASD: (1) 0- 36 months: Ages & Stages Questionnaires, Third Edition (ASQ-3); (2) 18-36 months: Modified Checklist for Autism in Toddlers (M-CHAT); (3) over 36 months: Gilliam Autism Rating Scale: 3rd Edition (GARS-3). Survey was handed out to 465 subjects, and 328 results were retrieved, 276 of which were valid.

Results:

Both ASQ-3 and GARS-3 are used to determined Autism Level Index. The results of GARS-3 are autism level index by nature. As for ASQ-3 group, we classified the subject's autism level index by their total ASQ-3 scores: 0~53: level 3; 54~106: level 2; 107~159: level 1; 160~300: level 0. There are 37/123 (30.08%) participants with score level 3 in ASQ-3 group and 23/131 (17.56%) in GARS-3 group. The independent variables we considered include age, sex, weight, height, PWS genotypes, usage of growth hormones, comorbidity condition epilepsy, and mode of delivery. Linear regression was performed to examine the relationship between these factors and autism level index. In the univariate analysis, genotype is significantly associated with ASD score (p value of 0.04) in ASQ-3 group.

Conclusions:

This survey provides preliminary but valuable data to explore the relationship between PWS and ASD, we expect to identify some predictors for PWS patients who has co-morbid ASD and the severity and incidence of other complications.

193 **114.193** Longitudinal Study of Adverse Driving Outcomes Among Newly Licensed Adolescents with Autism

***A. E. Curry**[1], K. B. Metzger[2], M. E. Carey[1], P. P. Huang[3] and B. E. Yerys[4], (1)Center for Injury Research and Prevention, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Metzger Consulting, Austin, TX, (3)Autism Integrated Care Program, Children's Hospital of Philadelphia, Philadelphia, PA, (4)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA*

Background: The ability to drive independently enables opportunities for employment, education, and engagement in social activities; barriers to these during the period of transition to adulthood can be particularly limiting for autistic individuals. In a prior study we estimated that one-third of autistic teens successfully achieve licensure by age 21 (Curry et al., 2018). However, preliminary evidence also suggests that autistic adolescents may be at heightened risk for motor vehicle crashes.
Objectives: We conducted a retrospective cohort study to compare adverse driving outcomes—crashes, moving violations, and license suspensions—for newly licensed autistic and non-autistic adolescents.

Methods: This cohort included New Jersey residents who were born 1987-1997 and were patients of the Children's Hospital of Philadelphia pediatric healthcare network. Electronic health records were linked with NJ's statewide driver licensing and crash data. Autism status was classified via ICD-9-CM diagnosis codes; those with intellectual disability were excluded. The current study included a total of 53,320 licensed drivers, including 261 (0.5%) autistic and 53,059 (99.5%) non-autistic patients. Drivers were followed for up to 48 months post-licensure.

We calculated rates of overall and specific types of crashes—including injury, at-fault, nighttime, and involving peer passengers—as well as moving violations and suspensions. Further, we examined the proportion of crashes that were attributed to specific driver actions, such as unsafe speed, inattention, and failure to yield. Generalized estimating equation models were used to estimate adjusted rate ratios (aRR) and prevalence ratios (PR) comparing autistic and non-autistic drivers.

Results: In their first 48 months of licensure, 30.7% of autistic drivers and 30.5% of non-autistic drivers were involved in a police-reported crash. The average monthly overall crash rate over the study period was similar among autistic and non-autistic drivers (129.7 vs 109.2 per 10,000 drivers; aRR: 1.14 [0.92, 1.42]); rates of crash subgroups also did not differ among driver groups. Autistic drivers had lower moving violation rates (aRR: 0.68 [0.53, 0.86]) and half the rate of license suspensions (aRR: 0.45 [0.26, 0.78]).

The most common driver action for crashes among both autistic and non-autistic drivers was inattention (45.0% vs 39.4%; PR: 1.14 (0.93, 1.40]). Second most common among autistic drivers was failure to yield to the right-of-way (19.8% of all crashes), which was 1.6 times higher than among non-autistic drivers (8.6%; PR: 2.31; [1.56, 3.41]).

Conclusions: We found that newly licensed autistic drivers had similar crash rates and lower moving violation rates compared with non-autistic drivers; however, some characteristics of these crashes—including the specific crash-contributing driver actions—differed. In particular, crash-

involved autistic drivers were more likely to have failed to yield to pedestrians and other vehicles; this finding is consistent with previous studies demonstrating that autistic teens more often divert their gaze away from the roadway compared with other teens. Results from this study may help inform driving interventions for newly licensed autistic adolescents to reduce risk of adverse driving outcomes and increase independence.

194 **114.194** Longitudinal Trajectory Studies of Children with Autism Spectrum Disorder: A Scoping Review

S. J. Gentles[1], *E. D. Bednar*[1], *H. Baldawi*[1], *C. B. Putterman*[2], *A. Kata*[1], *I. Drmic*[3], *C. Roncadin*[3] *and S. Georgiades*[1], *(1)McMaster University, Hamilton, ON, Canada, (2)Canada/Israel Autism Research Initiative, Toronto, ON, CANADA, (3)Autism Spectrum Disorder Service, McMaster Children's Hospital - Hamilton Health Sciences, Hamilton, ON, Canada*

Background: Longitudinal trajectory studies are well suited for generating new knowledge about developmental conditions such as autism spectrum disorder (ASD), where variation over time is known to be an important characteristic. To more clearly understand the value of such studies, there is a need for a broad exploration and mapping of the literature that produces systematic knowledge regarding 1) where and how such research has been used to date, and 2) to inform where (i.e., research gaps) and how (i.e., methodologically) future research using this design can be conducted to optimize potential for producing clinically relevant, stakeholder-informed knowledge about ASD.
Objectives: The primary objective of this scoping review is to identify, summarize and describe the breadth and characteristics of research employing a longitudinal trajectory study design (cohorts followed for three or more timepoints) to study children (0-18 years) with a confirmed diagnosis of ASD. A secondary objective is to summarize methodological strengths, challenges, and innovations. This is an exploratory study, consistent with scoping study methodology.

Methods: Following published guidance for scoping reviews, we 1) identified relevant literature through librarian-assisted searches of multiple databases (MEDLINE, EMBASE, CINAHL, PSYCInfo, ERIC, Cochrane; combining terms for ASD, pediatric age, and trajectory study design) and by reviewing full text bibliographies; 2) conducted initial title and abstract screening, and planned aspects of data extraction, in duplicate; 3) iteratively developed the extraction form and planned results summaries to address review objectives according to emergent understanding of the literature; and 4) involved stakeholders to select relevant data presentations and inform interpretations of findings.

Results: The search yielded 12,325 records after removing duplicates; initial title and abstract screening yielded 263 articles for full text retrieval. Final eligibility screening of full text is proceeding in parallel with iterative data extraction, which has yielded the preliminary findings reported here. Growth in the use of trajectory study design is recent, with approximately two-thirds of studies published since 2009. Trajectory studies vary in important respects such as how they define trajectory groups (e.g., latent statistical categories, clustered endpoints), measures used in follow-up assessments, number of data timepoints, representativeness of sampling, covariates measured (including predictors, final outcomes), and statistical power to detect covariate effects. Opportunities and challenges discussed by authors of primary studies include the ability to characterize the complexity and heterogeneity of ASD along the dimensions of age and development, the potential to account for intervention, services and other contextual effects, and the need for sampling strategies that allow for generalizing (e.g., inception cohorts, complete consecutive samples).

Conclusions: Findings from this scoping review will provide wide-ranging information about the actual and potential uses and utility of trajectory studies for producing actionable knowledge about ASD—including by identifying opportunities for addressing outcomes and research questions most relevant to stakeholders (families, self-advocates, and care professionals). They will also produce a preliminary survey of existing methodological approaches , providing a basis for future efforts to discuss and describe best practices for longitudinal research in ASD.

195 **114.195** Maternal Androgen-Related Conditions and Risk of ASD

R. S. Rotem[1,2], *G. Chodick*[2], *M. Davidovitch*[3], *G. Koren*[2], *V. Shalev*[2], *R. Hauser*[1], *B. A. Coull*[1] *and M. Weisskopf*[1], *(1)Harvard T.H. Chan School of Public Health, Boston, MA, (2)Maccabi Institute for Research and Innovation, Tel Aviv, Israel, (3)Medical Division, Maccabi Healthcare Services, Tel Aviv, Israel*

Background:
Fetal exposure to elevated steroid sex hormone levels has been proposed to contribute to the development of ASD. While some support for this hypothesis comes from studies assessing in-utero androgen concentrations, measured levels may reflect androgens produced by the mother, placenta, or fetus. Thus, the possibility of reverse causation, i.e. that a fetus that will become a child with ASD produces more androgens than a typically developing fetus, rather than the high androgens causing the ASD, is difficult to rule-out. An association between high maternal androgen levels and ASD could more directly implicate androgen exposure as a causal factor. Previous publications reported associations between mothers with androgen-related conditions (namely polycystic ovary syndrome (PCOS) and hirsutism) and risk of ASD in progeny, but available data are limited and conflicting, and interpretation of the results is complicated by some evidence suggesting that direct transfer of maternal androgens to the fetus is restricted by the placental aromatase. This raises the possibility that any association between maternal hyperandrogenicity and ASD risk is mediated by other factors associated with maternal androgen excess, rather than being a direct result of the androgen hormones themselves.

Objectives:

To examine the association between PCOS, the primary cause of hyperandrogenicity in women of reproductive age, and risk of ASD in progeny, and to determine the extent to which this association is mediated by maternal androgen-related comorbidities such as metabolic and cardiovascular problems and use of infertility treatments. Additionally, to examine the association between risk of ASD and other maternal conditions that cause, or are caused by, excess androgens.

Methods:

The study included 437,222 singleton births (4,022 with ASD) occurring between 1999 through 2013 in a large health fund in Israel. Data on ASD diagnoses, maternal androgen-related conditions and comorbidities, drug dispensing, and laboratory test results were obtained through 2016. Maternal conditions and ASD cases were identified through ICD-9 codes with further verification through review of medical records and laboratory results. Analyses of androgen-related conditions were performed using generalized estimating equation (GEE) models. Causal mediation analysis for multiple mediators using an imputation approach was performed to obtain natural direct and indirect effects of PCOS on ASD risk.

Results:

Children born to mothers diagnosed preconceptionally with PCOS (n= 17,922) had higher odds of ASD compared to children born to mothers without this condition (OR=1.28, 95%C.I:1.10-1.49). Elevated effects were also observed for other maternal conditions possibly caused by androgen excess, including acne, hirsutism, and infertility. Causal mediation analysis for PCOS indicated that mediation through any of the mediators considered accounted for approximately $^1/_5$ of the total effect observed.

Conclusions:

Results suggest a link between maternal PCOS as well as other androgen-related conditions and ASD risk in progeny, and additionally indicate that the observed effect is not entirely mediated by common comorbidities associated with excess androgens. Findings provide some support for a possible direct involvement of maternal hyperandrogenicity in ASD etiology. Alternatively, the observed effects could also be caused by other factors that affect maternal androgen homeostasis and fetal neurodevelopment though independent mechanisms.

196 **114.196** Maternal Psychiatric Illness, Treatment with SSRIs, and Autism Spectrum Disorders (ASD)

L. A. Croen[1], *C. Ladd-Acosta*[2], *M. D. Fallin*[2], *Y. Qian*[1], *L. Schieve*[3], *C. DiGuiseppi*[4], *L. C. Lee*[5], *E. P. Kasten*[6], *L. England*[7], *G. Zhou*[6] *and J. A. Pinto-Martin*[8], *(1)Division of Research, Kaiser Permanente, Oakland, CA, (2)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (3)Centers for Disease Control and Prevention, Atlanta, GA, (4)Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO, (5)Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (6)Clinical and Translational Sciences Institute, Michigan State University, East Lansing, MI, (7)Center for Disease Control and Prevention, Atlanta, GA, (8)University of Pennsylvania, Philadelphia, PA*

Background: Depression and its treatment with antidepressants have increased over the past two decades. Selective serotonin reuptake inhibitors (SSRIs) are commonly used to manage depression during pregnancy. Evidence from several human studies indicates that prenatal exposure to SSRIs may increase the risk of ASD in the offspring. However, whether the treatment itself, or the underlying indication for treatment, i.e. – the psychiatric disorder, is the etiologically relevant factor remains to be clarified.

Objectives: To investigate history of maternal psychiatric illness, maternal treatment with SSRIs during pregnancy, and their association with risk of ASD in the offspring.

Methods: The study population was drawn from the Study to Explore Early Development, a multi-site case-control study conducted in six sites across the United States among children born between 2003-2011. Children were enrolled at 2-5 years of age. Final study group classification (ASD, developmental delay (DD), general population control (POP)) was determined by an in-person standardized developmental assessment. Maternal history of psychiatric disorders and use of antidepressants during pregnancy were ascertained in three ways: maternal telephone interview shortly after study enrollment, self-report on maternal medical history form, and review of maternal medical records. During the interview, the mother was also asked to specify type of psychiatric illness and date of onset, and types and timing of antidepressant medications taken during pregnancy. To evaluate the independent and multiplicative effects of maternal psychiatric illness and treatment with SSRIs on ASD risk (vs. POP), three separate logistic regression models were run by trimester of exposure: 1) independent effect of psychiatric illness: maternal psychiatric illness but no treatment (Psy-Yes + SSRI-No) vs. no illness and no treatment (Psy-No + SSRI-No); 2) independent treatment effect: psychiatric illness and SSRI use (Psy-Yes + SSRI-Yes) vs. psychiatric illness but no SSRI use (Psy-Yes + SSRI-No; 3) combined effect: psychiatric illness and SSRI use (Psy-Yes + SSRI-Yes) vs. no psychiatric illness and no SSRI use (Psy-No + SSRI-No). Covariates in adjusted analyses included maternal race, education, age at delivery, history of smoking, and household income during pregnancy.

Results: Maternal history of any psychiatric illness prior to the delivery of the study child (36% vs. 27%) and antidepressant use during pregnancy (10.8% vs. 7.2%) were significantly more common among the mothers of ASD cases (N=1367) than POP controls (N=1671). The adjusted odds of having a child with ASD were ~80% higher among women with a history of psychiatric illness independent of SSRI use (Psy-Yes + SSRI-No vs. Psy-No + SSRI-No: OR=1.81, 95% CI 1.44-2.27). The odds of ASD were **not** higher among children prenatally exposed to SSRIs independent of maternal history of psychiatric illness (Psy-Yes + SSRI-Yes vs. Psy-Yes + SSRI-No: OR=1.14, 95% CI 0.8-1.62). Children with both exposures had a doubling in odds of ASD compared with children with neither exposure (Psy Yes + SSRI Yes vs. Psy-No + SSRI-No: OR=2.0, 95% CI 1.5-2.8). Results did not differ by child sex.

Conclusions: We found no evidence that prenatal exposure to SSRIs is associated with increased risk of ASD independent of indication for treatment.

197 **114.197** Maternal and Neonatal Vitamin D Concentrations and Autism Spectrum Disorders: Findings from the Stockholm Youth Cohort

B. K. Lee[1], *D. Eyles*[2], *C. Magnusson*[3], *C. J. Newschaffer*[4], *J. McGrath*[5], *D. Kvaskoff*[6], *P. Ko*[5], *C. Dalman*[7], *H. Karlsson*[8] *and R. Gardner*[3], *(1)Epidemiology and Biostatistics, Drexel University, Philadelphia, PA, (2)Queensland Brain Institute, University of Queensland, St Lucia, Australia, (3)Karolinska Institutet, Stockholm, Sweden, (4)AJ Drexel Autism Institute, Philadelphia, PA, (5)Queensland Brain Institute, University of Queensland, Brisbane, Australia, (6)University of Queensland, Brisbane, Australia, (7)Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden, (8)Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden*

Background: Animal studies indicate that early life vitamin D is crucial for proper neurodevelopment. Few studies have examined whether maternal and neonatal vitamin D concentrations influence risk of autism spectrum disorders (ASD).

Objectives: Determine whether vitamin D concentrations assessed during pregnancy and the neonatal period were associated with risk of ASD in a population-based electronic register and biomarker study taking place in Sweden.

Methods: Participants were sampled from the Stockholm Youth Cohort, a register-based cohort in Stockholm County, Sweden. Concentrations of total 25-hydroxyvitamin D (25OHD) were assessed from neonatal dried blood and maternal sera samples using a highly sensitive liquid chromatography tandem mass spectrometry method. The neonatal analytic sample consisted of 1,399 ASD cases and 1,607 controls. The maternal analytic subsample consisted of 449 ASD cases and 574 controls. The maternal-neonatal analytic subsample consisted of 340 ASD cases and 426 controls.

Results: Neonatal 25OHD sufficiency (≥50 nmol/L) was associated with 0.75 times the odds of ASD (95% CI: 0.57, 0.98) as compared with 25OHD deficiency (<25 nmol/L). Sibling-matched control analyses indicated these associations were not due to familial confounding. Maternal 25OHD

sufficiency was associated with 0.65 times the odds of ASD (95% CI: 0.43, 0.96) as compared with 25OHD deficiency. Children with both maternal 25OHD and neonatal 25OHD above the median had 0.56 (95% CI: 0.34, 0.90) times the odds of ASD compared to children with maternal and neonatal 25OHD both below the median. In all analyses, the association between higher 25OHD and lower risk of ASD was much more evident in children with mothers born in Nordic countries than in children with mothers from elsewhere.

Conclusions: Higher concentrations of maternal and/or neonatal vitamin D were associated with lower odds of ASD. Our results are consistent with an increasing body of evidence suggesting that vitamin D in early life may influence risk of neurodevelopmental disorders including ASD.

198 **114.198** Birth Seasonality and Risk of Autism Spectrum Disorder

B. K. Lee[1], *R. Gross*[2], *R. Francis*[3], *H. Karlsson*[4], *D. Schendel*[5], *A. Sourander*[6], *A. Reichenberg*[7], *E. Parner*[8], *M. Hornig*[9], *A. Yaniv*[10], *H. Leonard*[11] *and S. Sandin*[12,13], *(1)Epidemiology and Biostatistics, Drexel University, Philadelphia, PA, (2)Epidemiology, Tel Aviv University, Tel Aviv, Israel, (3)Telethon Insitute for Child Health Research, Subiaco, Australia, (4)Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden, (5)Aarhus University, Aarhus, Denmark, (6)University of Turku, Turku, Finland, (7)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (8)University of Aarhus, DK-8000 Århus C, Denmark, (9)Center for Infection and Immunity, Mailman School of Public Health, Columbia University, New York, NY, (10)Tel Aviv University, Tel Aviv, Israel, (11)Disability, Telethon Kids Institute, West Perth, Western Australia, Australia, (12)Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (13)Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Stockholm, Sweden*

Background: Season of birth has been hypothesized to be a risk factor for autism spectrum disorder (ASD). However, the evidence has been mixed and limited due to methodological challenges.

Objectives: Examine birth and ASD diagnosis data across multiple countries for statistical evidence of birth seasonality in ASD.

Methods: We examine ASD birth trends for 9,560,874 births across 5 countries. ASD birth prevalence data were obtained from the International Collaboration for Autism Registry Epidemiology database, including children born in Denmark, Finland, Norway, Sweden, and Western Australia. Parametric and non-parametric methods including empirical mode decomposition and logistic regression were used to assess seasonality.

Results: We demonstrate seasonal variation in ASD births for the countries of Denmark, Finland, and Sweden, including a small increase in risk for children born in the fall (i.e., conceived in the winter). For example, for Sweden in the months of January, March, April, and June, the observed ASD rate was approximately 4 cases/10,000 births lower than would be expected, while for the months of September-December, an excess of births ranging from 2.8 cases/10,000 births to 7.1 cases/10,000 births was observed. For these three countries, solar radiation levels around conception and the postnatal period were inversely correlated with seasonal trends in ASD risk.

Conclusions: Assuming that season of birth is a proxy for temporally fluctuating environmental conditions, this study provides further support of the involvement of non-genetic risk factors in the etiology of ASD.

Poster Session
115 - Gastrointestinal (GI)
11:30 AM - 1:30 PM - Room: 710

199 **115.199** Altered Gut Microbiota in Chinese Children with Autism Spectrum Disorders

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Background: The results from previous studies of the link between gut microbes and autism spectrum disorders (ASD) were controversial and have not been explored in the Chinese population.

Objectives: To assess whether gut microbiota dysbiosis was associated with children with ASD in China.

Methods: We enrolled 45 children with ASD (6 to 9 years of age; 39 boys and 6 girls) and 45 sex- and age-matched neurotypical children. Dietary and other sociodemographic information was obtained via questionnaires. The composition of the fecal microbiota was characterized by bacterial 16S ribosomal RNA (16S rRNA) gene sequencing.

Results: The ASD group showed less diversity and richness of gut microbiota than the neurotypical group. The analysis of beta diversity showed an altered microbial community structure in the ASD group. After adjustment for confounders and multiple testing corrections, no significant group difference was found in the relative abundance of microbiota on the level of the phylum. At the family level, children with ASD had less richness of *Acidaminococcaceae* than the healthy controls (0.16% vs. 0.44%, P_{FDR}=0.029). Fewer organisms of the genera *Lachnoclostridium* (2.25% vs. 3.55%, P_{FDR}=0.005), *Tyzzerella_4* (0.13% vs. 0.50%, P_{FDR}=0.002), *Flavonifractor* (0.08% vs. 0.16%, P_{FDR}=0.002), and *unidentified_Lachnospiraceae* (0.06% vs. 0.13%, P_{FDR}=0.002) were found in the ASD group than in the neurotypical group. At the species level, *Clostridium_clostridioforme* were more abundant in the ASD group (0.22% vs. 0.10%, P_{FDR}=0.005).

Conclusions: This study provides further evidence of intestinal microbial dysbiosis in ASD and sheds light on the characteristics of the gut microbiome of autistic children in China.

200 **115.200** An Investigation of Developmental-Behavioral Profiles in Children with Autism Spectrum Disorder and Comorbid Gastrointestinal Symptoms

B. Restrepo[1], *D. G. Amaral*[2], *S. Rogers*[2], *S. Ozonoff*[3], *B. Heath*[2], *A. L. Hechtman*[3], *M. Solomon*[4], *C. W. Nordahl*[2] *and J. Cabral*[5], *(1)Pediatrics, UC Davis MIND Institute, Sacramento, CA, (2)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (3)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA, (4)Department of Psychiatry & Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, University of California, Davis, Sacramento, CA, (5)Department of Community Health, Tufts University, Boston, MA*

Background: Parents often voice concerns about gastrointestinal (GI) symptoms in children with autism spectrum disorder (ASD). The extent to which the underlying biology of ASD is also causal of GI problems and whether amelioration of GI problems may decrease core symptoms of ASD are currently unknown.

Objectives: To determine the frequency and severity of GI symptoms in preschool-aged children with ASD. We also examined whether the presence of GI symptoms is associated with differences in behavioral and developmental profiles.

Methods: 259 children with ASD and 129 age-matched typically developing (TD) controls were recruited as part of the UC Davis MIND Institute Autism Phenome Project (APP) and the Girls with Autism Imaging Neurodevelopment (GAIN) study. Participants enrolled between 2 and 3.5 years of age. The study protocols include four-time points; current analyses utilize the first-time point. GI symptoms, including abdominal pain, bloating, constipation, diarrhea, and sensitivity to foods, were assessed using parent-report. Frequency of symptoms was rated on a 5-point scale. Children with at least one symptom in the 'frequently' or 'always' range were categorized as having GI symptoms. Children with GI symptoms in each diagnostic group were compared to children without GI symptoms on measures of autism severity (ADOS Calibrated Severity Score [ADOS-CSS]), repetitive behaviors (Repetitive Behavior Scale Revised [RBS-R]), developmental and adaptive functioning (Mullen Scales of Early Learning [MSEL] and Vineland Adaptive Behavior Scales [VABS]), and problem behaviors (Child Behavior Checklist [CBCL]). Diagnosis by GI-group interactions were also investigated.

Results: GI symptoms were reported in 51.7% of children with ASD compared to 21.7% in the TD group (chi-square $p < .001$). The most commonly reported GI symptoms were sensitivity to food (64%), constipation (52%) and diarrhea (47%). Children with ASD were more likely to experience multiple GI symptoms; 27% reported two or more compared to 5% in the TD group. GI symptoms were reported at similar rates in males and females with ASD. The presence of GI symptoms was associated with increased internalizing ($p = .002$) and externalizing ($p = .0008$) CBCL t-scores in both ASD and TD children. Investigation of syndrome scale t-scores revealed significant effects for emotional reactivity, somatic complaints, sleep problems, attention problems, and aggressive behavior ($p's < .02$, uncorrected). There was a diagnosis by GI symptom interaction for self-injurious behaviors ($p = .04$) on the RBS-R; GI symptoms were associated with elevated scores in ASD, but not in TD. The presence of GI symptoms was not associated with differences in MSEL or VABS composite scores in either diagnostic group or with ADOS-CSS scores in the ASD group.

Conclusions: Over half of preschool-aged children with ASD had significant GI problems, as reported by parents, which were associated with increased internalizing and externalizing symptoms and self-injurious behaviors. Our investigation reinforces the importance of assessing for GI symptoms in children with ASD as GI problems may contribute to behavioral issues. Additional planned analyses include longitudinal evaluation of symptoms across early and middle childhood as well as investigations of associations between GI symptoms and maternal and child immune-related conditions.

201 **115.201** A Molecular Biomarker for Prediction of Clinical Outcome in Children with ASD, Constipation, and Intestinal Inflammation

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Background: In children with autism spectrum disorder (ASD) who present to the gastroenterologist with chronic constipation, on a background of enterocolonic inflammation, we have identified two distinct clinical subtypes: (1) patients who experience a sustained state of GI symptomatic remission while on maintenance anti-inflammatory therapy (*fast responders*) and, (2) those with recurrent right-sided fecal loading requiring regular colon cleanouts during treatment for enterocolitis (*slow responders*). We hypothesized that a detailed molecular analysis of mucosal biopsy tissue from the affected region of the colon would provide mechanistic insights regarding the fast versus slow response to anti-inflammatory therapy.

Objectives: The goal of this study was to compare gene expression in the right (ascending) colon from two groups of GI-symptomatic children with ASD and constipation (acute versus chronic fecal loading). We hypothesize that molecular examination of mucosal biopsy tissue from affected regions of the colon can provide mechanistic insights regarding transient versus chronic right-sided colonic hypomotility in the setting of enterocolitis in children with ASD.

Methods: Patients were identified by: (1) a confirmed ASD diagnosis, (2) enterocolitis noted upon biopsy and/or capsule endoscopy and, (3) constipation with right sided fecal loading as seen on abdominal radiographs. RNA sequencing was performed on mucosal biopsies from the ascending colon. Hierarchical cluster analysis was performed to assign samples to clusters and gene expression analysis was performed to identify differentially expressed transcripts (DETs) between samples within the clusters. A penalized regression analysis method (LASSO) was used to identify genes whose expression levels were most predictive of cluster assignment.

Results: Hierarchical clustering of colonic gene expression profiles resulted in two clusters. Gene ontology and canonical pathway analysis revealed significant differences between the two clusters with the *fast responder*-predominant cluster showing an up-regulation of transcripts involved in the activation of immune and inflammatory response and the *slow responder*-predominant cluster showing significant over-expression of genes involved in tryptophan and serotonin degradation and mitochondrial dysfunction. Regression analysis identified a single long non-coding RNA that could predict cluster assignment with a high specificity (0.88), sensitivity (0.89) and accuracy (0.89).

Conclusions: This initial comparison of gene expression profiles in the ascending colon from a subset of patients with ASD, chronic right-sided fecal loading constipation, and a slow versus fast response to therapy has identified molecular mechanisms that likely contribute to this differential response. Importantly, we have identified a transcript that, if validated, may provide a biomarker that can predict from the outset which patients will be slow responders who would benefit from an alternate therapeutic strategy in treating their constipation.

202 **115.202** A Multi-Omic Analysis of Peripheral Blood from Children with ASD and Ileocolonic Inflammation

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Background: Gastrointestinal (GI) symptoms are a common co-occurring medical issue in children with autism spectrum disorder (ASD). We have previously described unique GI mucosal biomarkers specific for ASD-associated ileocolitis in children. It is not yet known whether unique biomarkers are also present in the blood of these individuals. Identification of a validated blood-based biomarker of ASD-associated ileocolitis

would allow for earlier identification of co-morbid GI disease and earlier GI intervention in affected patients. Moreover, it would provide insight into the relevant genes and metabolic pathways in ASD-associated ileocolitis.

Objectives: In an effort to enable a more complete understanding of the biology that underlies GI inflammation in children with ASD, the goal of these studies was to use an integrated omics approach to evaluate blood-based gene expression and serum metabolite relative abundance in GI-symptomatic children with ASD that have a demonstrated histologic ileocolitis.

Methods: The study cohort was comprised of whole blood and serum from 22 children with ASD who were undergoing clinically-indicated ileocolonoscopy for chronic GI symptoms, and 24 non-ASD (typically developing, TD) children undergoing ileocolonoscopy for a variety of GI symptoms. All children with ASD had histologic inflammation of the ileum, colon, or both. The TD controls used for this study were selected based on absence of histologic inflammation anywhere in the GI tract and absence of a neurodevelopmental disorder. Molecular profiling in peripheral blood (transcriptome) and serum (metabolome) from children with ASD (and ileocolitis) and TD children (without ileocolitis) was performed to identify differentially expressed transcripts and metabolite abundance levels that may serve as a proxy for GI inflammation.

Results: Differential gene expression analysis (using whole genome microarray) identified a large number of both up- and downregulated transcripts. The significantly upregulated transcripts in ASD were enriched for pathways including ECM-receptor interaction, intestinal immune network, fatty acid biosynthesis, hematopoiesis, serotonin transporter activity, platelet degranulation, platelet activation, signaling and aggregation, and cytokine signaling. The significantly downregulated transcripts in ASD were enriched for pathways such as arachidonic acid metabolism, linoleic acid metabolism, extracellular vesicle-mediated signaling, NOD pathway, aryl hydrocarbon receptor pathways, and oxidative ethanol degradation. From the metabolomics data, fatty acid metabolism (acyl carnitines), phenylalanine and tyrosine metabolism were uniquely associated with ASD, whereas steroidal metabolism and xanthine metabolism were uniquely associated with TD controls. Integration of transcript and metabolite data revealed enrichment of caffeine metabolism, purine nucleotide metabolism, and glucose alanine cycle.

Conclusions: On one hand, the gene-expression signatures revealed molecular signaling pathways, while on the other hand the metabolomics data revealed the metabolic biosynthetic and catabolic routes of ASD. Both datasets point to dysregulation of fatty acid and lipid metabolism spanning the two omics layers. Such complementary multi-omics efforts have proven useful to understand the disease mechanisms in greater detail and to facilitate rapid hypothesis generation in the context of ASD.

203 **115.203** Cytotoxic T Lymphocytes Are Significantly Higher in Colonic Tissue from GI-Symptomatic Children with Autism Compared to Controls

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Background: Gastrointestinal (GI) problems are more common in children with autism spectrum disorder (ASD) than in typically developing (TD) children. Moreover, many children with ASD present with GI symptoms suggestive of an inflammatory bowel disease-like (IBD-like) condition however, following investigative ileocolonoscopy with biopsy, conventional histology with hematoxylin and eosin (H&E) staining often does not reveal any marked abnormalities. Using immunohistochemistry, an earlier study reported an increase in cytotoxic T lymphocyte (CD8+) cell density and intraepithelial lymphocyte numbers in children with ASD and GI symptoms that was disproportionate to the inflammation seen on routine histologic evaluation, indicating a distinct lymphocytic colitis.

Objectives: The goal of this study was to investigate this finding further by comparing levels of CD8, a cytotoxic T cell and gut inflammation marker, in colonic biopsy samples from GI-symptomatic children with ASD compared to TD children in a completely separate and unrelated case/control cohort.

Methods: Biopsies from the right colon were obtained via colonoscopy from children with ASD and TD children who presented with GI symptoms suggestive of an IBD-like disease. These tissues were embedded in paraffin blocks, and we first prepared slides and performed conventional H&E staining. This was followed by immunohistochemistry with a primary CD8 antibody from a mouse host (dilution 1:750) and a secondary goat anti-mouse antibody (1:1000) with an emission wavelength of 594 nm. Tissues were permeabilized with 0.2% Triton-X100 in PBS and antigen retrieval was performed with 0.01 M citrate buffer at pH 6. Dako protein block and TrueBlack Autofluorescence Quencher were used to reduce nonspecific staining and auto fluorescence. Tissues stained with *secondary antibody only* served as the negative control and the positive control was a human spleen sample (rich in CD8+ cells). Density of cells with CD8, average intensity of CD8 fluorescence per area, and total intensity of CD8 fluorescence per area was assessed semi-quantitatively following a one second exposure with fluorescent microscopy.

Results: As predicted, H&E staining showed unremarkable colonic mucosa with no diagnostic abnormalities in both the ASD and TD group. Immunohistochemical analysis using a CD8-specific antibody resulted in a mean total intensity of fluorescence (cells expressing CD8) that was significantly greater in ASD than in TD samples ($p=0.003$), and the total intensity per area was also significantly greater in samples from ASD versus TD children ($p=0.0007$).

Conclusions: These findings revealed that, compared to GI-symptomatic TD children, children with ASD and GI symptoms displayed a marked increase in CD8 fluorescence intensity, suggesting a cytotoxic T lymphocyte infiltration that was not apparent on routine histologic examination. Further analysis of CD8 reactivity is required to determine the significance of the observed CD8 infiltration. Other inflammatory markers such as CD3 and CD4 should also be examined via immunohistochemical analysis.

204 **115.204** Characterization of GI Barrier Integrity and Gut Microbiome-Derived Metabolites in BTBR, Shank3 and Cntnap2 Mouse Models of ASD, and Demonstration of AB-2004 As a Potential Mitigating Therapeutic

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Background: Autism spectrum disorder (ASD) is a complex developmental disability that affects an already large and still increasing proportion of the world population. ASD is predominantly characterized by behavioral abnormalities; however, there is growing evidence that patients also suffer from comorbid symptoms including gastrointestinal dysfunction (Chaidez et al., 2014). Microbiome dysbiosis could play a role in increased

intestinal permeability (leaky gut) which is a common condition found in ASD. Dysregulation of bacterial metabolites, such as those generated from metabolism of tyrosine and tryptophan, has been implicated as a pathological driver contributing to the disease symptomology. Specifically, 4-ethylphenylsulfate (4-EPS), a gut microbiota-derived metabolite, is elevated in a pediatric ASD population (Needham, et al., 2018 INSAR #28205). Objectives: The purpose of the present study was to characterize intestinal permeability as well as microbiota-derived metabolites in three relevant and commonly used animal models of ASD: BTBR, Shank3 and Cntnap2-/- mice.

Methods: Serum FITC-dextran amounts were measured via fluorescence intensity in samples from BTBR, Shank3 and Cntnap2-/- mice. 4-EPS was extracted from urine from Cntnap2-/- mice and measured using LC-MS/MS. To determine the effects of AB-2004, this compound was formulated into chow to a final concentration of either 0, 1 or 5 % and was available *ad libitum* for the duration of 4 weeks. The same methods were used to evaluate the impact on leaky gut and 4-EPS in Cntnap2-/- mice.

Results: Based on the results, intestinal permeability, as measured by serum FITC-dextran intensity, was significantly increased in Shank3 and Cntnap2-/- mice but not in the BTBR cohort. Similarly, the levels of urinary 4-EPS were significantly elevated in Cntnap2-/- mice compared to control animals. This data aligns with previously published work in the maternal immune activation (MIA) mouse paradigm of ASD in which elevated 4-EPS levels and increased intestinal permeability were observed (Hsiao, et al., 2013). To further investigate whether intestinal permeability and increased 4-EPS levels could be ameliorated, the effects of AB-2004, an oral gut-restricted experimental therapeutic, were assessed in the Cntnap2-/- model. AB-2004 treatment effectively restored GI barrier integrity and reduced 4-EPS levels in a gut-restrictive manner.

Conclusions: In conclusion, the Cntnap2-/- mouse model recapitulated the leaky gut phenotype and elevated levels of the gut microbiome-derived metabolite 4-EPS that have been reported in ASD patients. Interestingly, treatment with AB-2004 restored GI integrity and normalized elevated 4-EPS. Taken together, these findings identify the Cntnap2-/- model as a promising platform for the development of microbiome-inspired therapies for the effective treatment of GI and behavioral dysfunctions in ASD.

205 **115.205** Colonic and Anorectal Manometry Evaluation in Children with Autism Spectrum Disorder with Intractable Constipation

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Background: Functional constipation is common in children with autism spectrum disorder (ASD). Increased behavioral and sensory issues are often blamed for failure of children with ASD to respond to standard medical therapies for constipation. Whether failures to respond to standard medical therapies for constipation in children with ASD are due primarily to functional issues or physiological issues is unknown.
Objectives: Evaluate colonic and anorectal manometry findings in a cohort of children with ASD who failed conventional medical treatment in order to determine whether constipation in these children is associated with impaired intestinal motility.

Methods: A retrospective review of children ages 0-21 years with a diagnosis of ASD who met Rome IV criteria for functional constipation and who completed either colonic or anorectal manometry testing at Nationwide Children's Hospital was performed. Colonic and anorectal manometry studies were independently reviewed by two blinded pediatric gastroenterologists with formal training in manometry interpretation. Children were excluded if studies were incomplete or unable to be interpreted.

Results: Twenty-eight children with ASD had undergone colonic manometry testing. Three studies were excluded because they were unable to be interpreted. Studies from 25 children (80% male, median age 11 years, range 3-18 years) with ASD and functional constipation were analyzed. Fifteen of 25 studies (60%) were normal. Five studies (20%) showed dysmotility in the sigmoid colon with premature termination of high-amplitude propagating contractions in the descending colon. Five studies (20%) showed more extensive dysmotility involving the descending or more proximal colon. Of the 28 children who underwent colonic manometry testing, 24 children had anorectal manometry also performed. Of the 24 anorectal studies, 18 were performed with anesthesia and 6 were performed without anesthesia. The 18 studies under anesthesia showed that each patient had normal rectal anal inhibitory reflexes. Of the 6 studies that were done without anesthesia, 1 was excluded for an incomplete study, 1 indicated the child had abnormal sensation, and 2 suggested pelvic floor dyssynergia.

Conclusions: Colonic and anorectal manometry revealed that a proportion of children with ASD who have failed standard medical therapy for constipation possess signs of impaired motility. Colonic dysmotility was detected in 40% of the colonic manometry studies. Half of these children had impaired motility of the distal colon that is commonly found in children with chronic constipation due to pelvic floor dysfunction. The other half were found to have more extensive dysmotility of the colon that may have resulted in their constipation and failure to medical therapy. Half of children who were able to complete anorectal manometry without anesthesia displayed findings that impair response to standard laxative therapies. Our findings demonstrate that colonic and anorectal manometry can identify children with ASD who have failed medical therapy for constipation with underlying physiological changes and/or impaired motility. Identifying those with impaired motility helps direct decision making for further medical and/or surgical treatments for constipation in this patient population.

206 **115.206** Antibiotic Overuse, Implications on the Human Gastrointestinal Tract, and Links to Autism Spectrum Disorder: A Clinical Survey

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Background: The autism spectrum disorder (ASD) diagnosis has been on a steady rise over the past few decades, and yet the mechanisms behind its pathology are still largely unknown. In individuals with an ASD diagnosis, gastrointestinal (GI) symptoms are among the most common medical co-morbidities. Studies have found that GI symptoms occur in nearly half of children with ASD, and the prevalence of GI symptoms increases as children get older. In ASD individuals, an alteration in gut microbiota has been demonstrated. This dearth of the GI microbiome in autism might also be exacerbated by the over-prescription of antibiotics.
Objectives: There is currently a literature gap in the link between antibiotic overuse, related GI dysfunction, and the development of ASD. Our pilot study aims to investigate whether there is antibiotic overuse in ASD subjects that can lead to GI distress.

Methods: The frequency of antibiotic use in twenty children with an autism diagnosis was compared to the antibiotics use in twenty neuro-typical children. Parents of all participated children were surveyed using the same questions.

Results: Children in the ASD diagnosis group were given more than double the amount (rounds) of antibiotics as the children in the neuro-typical

group; the ASD group had 94 rounds of antibiotics prescribed, while the neuro-typical group had 41 . The median for the number of rounds of antibiotics in the ASD group was 4 rounds with an IQR = 2-6 rounds, while the median in the control group was 2 rounds with an IQR=1-3 rounds. There was also a different in the length of time that the ASD group took antibiotics vs. the neuro-typical controls. In the neuro-typical cases, the typical duration was between 7 to 10 days while parents from the ASD group reported antibiotic durations ranging from weeks to months of use at one stretch of time. The median length of time for the ASD group was 10 days with an IQR = 7-10 days, while the median for the control group was 7 days with an IQR = 7-8.5 days. Out of the 20 children in the ASD group, 17 (85%) reported incidence of GI distress, versus 3 out of 20 (15%) in the neuro-typical group. A Fischer Exact Test yielded a p value of <0.001. These results indicate that the increase in the incidence of GI distress is statistically significant in children with ASD as compared with neuro-typical children.

Conclusions: The results of this work suggests that the overuse of antibiotics in early childhood can be a risk factor for the development of ASD. This is a significant finding, as this tremendous amount of antibiotic use likely drives GI inflammation and reduces local flora. Understanding the risk factors involved in predisposition to ASD will provide novel insights into the pathophysiology of this neurological disorder and will pave the way for developing novel treatment modalities in pursuit of improving quality of life of ASD individuals and their families.

207 **115.207** Dysbiosis of the Gut Microbiome in Individuals with ASD

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Background: The gut microbiome, consisting of bacteria and their gene products, is an integral component of human health by contributing to host metabolism, immunity, and development and function of the nervous system. While a healthy microbiotic ecosystem promotes human health and prevents many chronic illnesses, dysbiosis has been implicated in a wide range of diseases including irritable bowel syndrome, anxiety depressive behaviors, autism spectrum disorder (ASD), mood disorders, obesity, and cancer.
Objectives: The purpose of this study was to identify disorder related dysbiosis in individuals diagnosed with ASD.

Methods: Participants with ASD and their undiagnosed, co-habiting siblings were recruited for the study. Participants were asked to complete a diet and lifestyle survey which helps identify environmental influences of their gut microbiome, as well as provide a stool sample. Bacterial DNA isolated from stool was used as a template for library construction using the Ion 16S Metagenomics Kit and sequencing on the Ion Gene Studio S5 Plus System. Data was analyzed with the Ion Reporter software Ion 16S Metagenomics Kit analyses module and the DESeq2 package in R.

Results: In this pilot study of 15 sibling pairs, we observed several differences in the composition of gut bacteria of individuals with ASD compared to their siblings. The relative ratio of the two main phyla, Firmicutes to Bacteroidetes, is ~3:1 in the sibling participants and ~8.5:1 in participants with ASD, respectively. There were four bacterial genus that were present in higher quantities in the ASD group ($\log_2$ FC > 5, adj pvalue <0.05) and six bacterial genus that were present in lower quantities in the ASD group ($\log_2$ FC < -5, adj pvalue <0.05). Finally, we observed an increase of the opportunistic pathogen, *Citrobacter freundii,* in participants with ASD when compared to their siblings.

Conclusions: Bacterial profiles are extremely variable (80-90%) between healthy adults, making it difficult to identify dysbiosis conditions that are relevant to disease. Using a co-habiting, sibling matched internal control, we anticipated that our ability to resolve disorder related dysbiosis in individuals with ASD would be improved. Since bacterial composition can be relatively easily manipulated, personalized treatment of gut-bacteria-related psychiatric disorders shows tremendous potential for improving human health and reducing the economic burden of mental health disorders on the health care system.

208 **115.208** Effect of Probiotic Supplementation on Behavioral and Gastrointestinal Symptoms in Autism Spectrum Disorders: A Randomized Double Blind, Placebo-Controlled Trial

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Background:
Recent open studies have shown some promising results of probiotic supplementation in ASD on gastrointestinal (GI) symptoms, reporting also significant changes in behavioural symptoms. To date only one study was carried out as a randomized placebo controlled trial but it was affected by a high drop-out rate and other methodological limitations.

Therefore, efficacy of probiotics in patients with ASD remains undefined.

Objectives:

The main aim of this study is to determine the effects of a 6 months supplementation with a probiotic preparation in preschoolers with ASD on behavioral and GI symptoms.

Methods:

Eighty-five children with ASD (age-range: 2.18-6.11 years; mean ± DS: 4.15 ± 1.08 years) diagnosed according to DSM-5 criteria, were included in this randomized double-blind randomized controlled trial (funded by the Italian Ministry of Health, grant GR-2011-02348280). Methodology was reported in Santocchi et al. 2016 (DOI 10.1186/s12888-016-0887-5) and in ClinicalTrials.gov (NCT02708901).

At baseline each subject was classified as belonging to the Gastro-Intestinal (GI) group or to the Non-GI (NGI) group on the basis of the presence of significant GI symptoms measured through the Gastrointestinal Severity Index (GI Severity Index) (cut-off = 4.0).

ASD participants belonging to the two groups (30 subjects for GI group and 55 for NGI group) were blindly randomized 1:1 to regular diet with probiotics or with placebo for 6 months-treatment. The probiotic preparation selected for this study is Vivomixx®, a multicomponent product containing 450 billions of lyophilized bacterial cells belonging to eight probiotic strains: one strain of Streptococcus thermophilus, three strains of Bifidobacterium and four strains of Lactobacillus. Vivomixx® is a patented and marketed product and it has been approved for the use in children. The primary end point of the trial was the reduction in ADOS total composite score (TCS).

Results:

Sixty-three subjects (74%; 17 subjects for GI group and 46 for NGI group) completed the treatment follow-up; no significant difference between the

dropout rates was observed in the two treatment groups. The placebo and probiotic groups resulted to be homogeneous at baseline with regard to all prognostic variables.

The two treatments showed a very good tolerability profile, with negligible and similar adverse event rates.

The mean difference between ADOS at baseline and post treatment TCS values resulted to be +0.03 in placebo group and -0.65 in probiotic group (p= 0.91 vs P= 0.02 respectively). The ADOS mean change in the probiotic group was not affected by the presence of GI symptoms. In fact, this value resulted -0.81 in subgroup without GI symptoms in comparison with -0.22 in subgroup with GI symptoms. The mean improvement in GI Severity Index in probiotic group (-0.83) was significant (p= 0.04) at variance with the same in placebo group (mean improvement = -0.08; P= 0.90).

Conclusions:

Six-month treatment with probiotics at variance with placebo is significantly effective in reducing the severity of ASD. The response is not related to the presence of GI symptoms, which, incidentally, improve significantly in the probiotic group.

209 **115.209** Gastrointestinal Problems Are Associated with Increased Repetitive Behaviors but Not Social Communication Difficulties in Young Children with Autism

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Background: Gastrointestinal (GI) symptoms have a well-established relationship with psychosocial problems and mood disorders in the general population, with GI symptoms demonstrating connections to difficulties with internalizing behaviors, depression, phobias, social skills, and adaptive behaviors. Some of these features are present in individuals with autism spectrum disorder (ASD). Individuals with ASD are more likely to experience a range of GI problems than typically developing (TD) individuals, including chronic diarrhea, constipation, food allergies, and abdominal pain. These symptoms have been associated with higher levels of irritability and aggressive behavior, but less is known about their relationship with core autism symptoms.

Objectives: To explore the relationship between GI symptom severity and core ASD symptoms while accounting for associated symptoms in a sample of children with ASD.

Methods: Participants were 176 children (140 males and 36 females) with ASD based on DSM-5 diagnosis, informed by the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) and ADI-R. Participants were 2 to 7 years old (M=64.9 months, SD=19.5). Mean Full Scale IQ (FSIQ) was 69.0 (SD=20.9). Autism symptom severity was measured with ADOS-2, Pervasive Developmental Disorder-Behavior Inventory (PDDBI), Vineland Adaptive Behavior Scales, Third Edition (VABS-3), and Clinical Global Impression Scale-Severity (CGI-S). Associated symptoms, including irritability, aggressiveness, and specific fears, were measured with Aberrant Behavior Checklist-Community (ABC) and PDDBI. Severity of GI problems was measured using PedsQL-Gastrointestinal Symptoms Inventory (PedsQL-GI). First, we examined zero-order correlations using univariate models for each ASD symptom, associated symptom domain, and overall GI symptoms. Second, we ran multivariable models exploring the relationship between GI problems and ASD symptoms while accounting for each associated symptom domain individually.

Results: A large majority (93.2%) of the sample had at least one reported GI problem, and 88.1% of participants had more than one GI problem. Various types of GI symptoms were experienced in the sample. Constipation, food limits, gas/bloating, and stomach pain were the most commonly reported symptoms. In the univariate regression models, Irritability; Aggressiveness; Specific Fears; Repetitive, Ritualistic, and Pragmatic Problems; Autism Composite Score; Stereotypy; and Inappropriate Speech were associated with PedsQL-GI Composite Score. In the multivariable models, after accounting for associated symptoms (i.e., Irritability, Aggressiveness, or Specific Fears), Repetitive, Ritualistic, and Pragmatic Problems (*p*-values ranged from 0.028 to 0.056) and Stereotypies (*p*-values ranged from 0.014 to 0.040) were significantly associated with GI symptom severity. Increased severity of associated symptoms was associated with increased GI symptom severity. Social and communication measures from the PDDBI and VABS-3 were not significantly associated with GI symptom severity after accounting for associated symptoms.

Conclusions: Our findings replicate a previously described association between irritability and aggression with GI symptoms. Building upon this, we sought to explore whether GI problems are correlated with core ASD symptoms after accounting for their relationship with associated symptoms, such as aggression, irritability, and fears. We found that repetitive behaviors, but not social or communication symptoms, are associated with GI symptom severity, even when accounting for emotional symptoms. This suggests that GI symptoms may exacerbate repetitive behaviors, or vice versa, independent from emotional symptoms.

210 **115.210** Investigating the Association between Gastro-Intestinal Symptoms and ASD Core Symptoms and Somatic and Psychiatric Comorbidities in a Large Cohort of High-Functioning ASD Adult Patients

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Background:

While gastro-intestinal (GI) symptoms, including diarrhea, constipation, abdominal bloating or pain, and gastro-esophageal reflux (GOPR) are frequently reported in ASD (Horvath et al., 2002) the nature, frequency and severity of these symptoms vary from one patient to another. Several authors have suggested that there could be a causal relationship between GI and ASD core symptoms in at least a subset of ASD patients (Adams et al., 2011). Others have suggested that GI symptoms could be associated with low-grade inflammation. Along the same lines, it was suggested that clustering analysis of phenotypic traits in ASD patients could allow for identifying underlying pathogenic mechanisms in ASD (Sacco et al., 2012).

Objectives:

We have sought to investigate the association between GI symptoms and ASD core symptoms, ASD somatic and psychiatric comorbidities and

peripheral biomarkers in high-functioning ASD adult patients.

Methods: Adult patients (n = 126) diagnosed with high-functioning ASD were assessed for GI symptoms (constipation, diarrhea, abnormal stool aspect, bloating, abdominal pain and GOPR), ASD core symptoms, somatic and psychiatric comorbidities, using both validated and in-house auto and hetero-questionnaires. We then used an unsupervised clustering method, K-sparse, to stratify patients in several subtypes based of the nature and severity of their GI symptoms. We then compared these subsets for ASD core symptoms and comorbidities as well as for the level of peripheral biomarkers.

Results:

We have identified two subtypes of patients: those with no or mild/rare GI symptoms, and those with severe/frequent GI symptoms. Patients from the second subtype accounted for 47,6% of all patients and were more likely to have been diagnosed with GI functional disorders or thyroid dysfunctions. In addition, patients from the two subtypes differed in the nature/severity of specific ASD core symptoms related to repetitive behaviors. While patients with high GI symptoms displayed less psychotic symptoms, comorbidities with anxiety, depression and mood disorders were similar in both groups. The two subsets of patients did not differ in the serum level of 30 immune/inflammation related biomarkers including C-reactive protein (CRP), calprotectin, and the pro-inflammatory cytokines Tumor Necrosis Factor (TNF)-alpha, interleukin (IL)-1-alpha, IL-1-beta, IL-6 and IL-17A.

Conclusions:

Our preliminary analysis of clinical data and biological samples from 126 high-functioning ASD adult patients revealed that ASD patients with frequent/severe GI symptoms were more likely to have been diagnosed with GI functional disorders and thyroid disorders. In contrast, they did not exhibit low-grade peripheral inflammation as assessed by serum levels of CRP and pro-inflammatory cytokines. Finally, our study revealed relationships between the severity of GI symptoms and ASD core symptoms related to repetitive behaviors.

211 **115.211** Prevalence of Autism Spectrum Disorder, Developmental Delay and Intellectual Disability in Children with Eosinophilic Esophagitis

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Background: In the general population, the prevalence of autism spectrum disorder (ASD) is about 2%, developmental delay (DD) is about 3 to 7% and intellectual disability (ID) is about 1.3%. Children with ASD may frequently have feeding difficulties and gastrointestinal (GI) symptoms such as regurgitation. Differentiating whether these symptoms are associated with ASD alone or represent a symptom of another GI disease is challenging without further investigation. Eosinophilic Esophagitis (EoE), a GI allergic disorder, represents 1 in 2,000 in the general population. Recent cohort data identified a significant association between EoE and ASD. ID and DD may also present with similar co-morbid diagnoses as ASD. We hypothesized that children with EoE may present with a higher prevalence of ASD, ID, and DD than the general population.
Objectives: The objective of this study was to measure the prevalence of ASD, ID, and DD among children with EoE in two large pediatric multi-disciplinary EoE programs (A and B).

Methods: Retrospective chart reviews of electronic medical records from children seen at two academic children's hospitals from 2007 to 2018 were performed. Common ICD9 and 10 codes were used to identify patients with EoE, ASD, DD, and ID. The prevalence of DD, ID, and ASD (with and without DD or ID) was measured to identify prevalence rates within children with EoE at each center.

Results: A total of 3,546 EoE patients were identified (1,702 and 2,844 patients from A and B respectively) with a male sex distribution of 69% and 73% respectively. Of EoE patients, the prevalence of ASD was 5.7% and 5.4% respectively. The prevalence of ID in those with EoE was 2.5% and 1.2% respectively. The prevalence of DD in those with EoE was 21.2% and 12.9% respectively. Of children with EoE under the age of 2 (Institution A, n = 7; Institution B, n = 525) 28.5% at Institution A and 12.9% at Institution B were also diagnosed with DD.

Table 1: Prevalence of autism spectrum disorder, intellectual disability, and developmental delay in children with EoE compared to general population.

Diagnosis	**Institution A N (%)**	**Institution B N (%)**	**General Population %‡**
Autism Spectrum Disorder	97 (5.7)	153 (5.4)	2.3 - 2.8
Intellectual Disability	42 (2.5)	34 (1.2)	1.1 - 1.3
Developmental Delay	361 (21.2)	367 (12.9)	3.6 - 7.0

‡Data obtained from Centers for Disease Control and Prevention, NCHS, National Health Interview Survey, 2014-2016.

Conclusions: Children with EoE have high prevalence rates of ASD, ID, and DD in comparison to established rates in the general population. Providers that care for patients with EoE should be aware of the prevalence of these co-occurring conditions and consider making referrals for further evaluation when appropriate. These findings emphasize the need to better understand how EoE may present in children with ASD, DD, and ID, which can have important implications in screening and early recognition in these populations. Further study is warranted to identify potential molecular etiologies of the association between EoE, allergy, and feeding, and ASD, ID, and DD.

212 **115.212** Prevalence of Gastrointestinal Problems in Individuals with Autism Compared to Those with Other Developmental Disorders and Typically-Developing Controls

H. Bohr[1], *T. Challman*[1], *S. M. Myers*[1], *V. Troiani*[1], *A. Young*[2], *C. L. Martin*[1] *and D. H. Ledbetter*[1], *(1)Geisinger Autism & Developmental Medicine Institute, Lewisburg, PA, (2)Geisinger, Danville, PA*

Background:
Gastrointestinal (GI) problems such as chronic constipation, abdominal pain, diarrhea, and gastroesophageal reflux disease are commonly reported in children with autism spectrum disorder (ASD). Prevalence estimates of GI disorders in children with ASD vary widely, from 9% to over 90%. These disparate findings may result from differences in methodology across studies.

Objectives:

This study describes the prevalence of GI problems in children with ASD and other developmental disorders compared to typically-developing children using electronic health record (EHR) data from a large health system.

Methods:

This is a retrospective study using data extracted from the Geisinger EHR. Participants included children (ages 3-18 years) with one or more of the following diagnoses: ASD, Global developmental delay/Intellectual disability (DD/ID), Language disorder (LD), Cerebral palsy (CP). The following data elements were extracted from the EHR, using information previously collected from clinical care: aggregated GI diagnoses (ICD-9 codes 530-579, 787), GI studies/procedures, GI medication prescriptions, and GI consultations.

Participants were divided into five independent diagnostic groups (ASD [without DD/ID]; ASD [with DD/ID]; DD/ID [without ASD]; LD [without ASD or DD/ID]; and CP [without ASD, DD/ID, or LD]), two summary groups (any ASD; non-ASD diagnosis), along with age and gender-matched controls. Through chi-squared analysis, the prevalence of any GI diagnosis, procedure, medication, and consultation was compared between: participants in each diagnostic group compared to controls; and any ASD compared to any non-ASD diagnosis.

Results:

Data was available from 46,996 children: ASD without DD/ID (5,429); ASD with ID/DD (1,709); DD/ID (5,928); LD (9,392); CP (1,040); Controls (23,498). Children in all of the diagnostic groups were significantly more likely ($p<0.05$) to have a GI diagnosis, undergo a GI procedure, be prescribed a GI medication, or be referred for GI consultation compared to controls. Children with one of the non-ASD conditions (DD/ID, LD, or CP) were significantly more likely ($p<0.05$) than children with ASD (with or without DD/ID) to have a GI diagnosis, undergo a GI procedure, be prescribed a GI medication, or be referred for GI consultation.

Conclusions:

Previous studies have suggested that GI problems are more common in children with ASD than in unaffected siblings, typically-developing children, and children with other developmental disorders. However, many of these studies were based on parental report, which could introduce recall bias. This study expands and refines the understanding of the prevalence of GI disorders in ASD compared to other developmental disorders using EHR data from a large health system. Overall, children with ASD (with and without DD/ID) and other developmental disorders were more likely than controls to have evidence of a GI disorder. However, the increase in GI disorders was not unique to ASD; children with other developmental diagnoses had an even higher rate of GI disorders. In addition to informing future research methodology, these findings provide important information that will allow healthcare providers to better anticipate the medical needs of children with ASD or other developmental disorders.

Poster Session
116 - International and Cross-Cultural Perspectives
11:30 AM - 1:30 PM - Room: 710

213 **116.213** Disparities in Diagnostic Categories Among Latinx Children within the Fragile Families and Child Wellbeing Study

K. Lopez *and H. Oh, Arizona State University, Phoenix, AZ*

Background:
Latinx child has vastly grown in the US population. Recent data from the CDC indicates that the gap in rate of autism spectrum diagnosis between Latinx and non-Latinx white children has decreased over time. However, disparities in the types of developmental diagnoses that Latinx children receive have persisted over time and across sociodemographics.

Objectives:

To explore racial/ethnic differences in diagnoses of developmental disabilities among a sample of primarily unmarried mothers. Present data that indicates disparities in autism diagnoses between Latinx and non-Latinx white children.

Methods:

This study analyzed used data collected from multiple waves of the Fragile Families and Child Wellbeing study, in order to take into account important demographic factors as well as socio-economic factors associated with likelihood to have developmental disorder. The key predictor, race of mother, was gather in wave 1 (birth). In addition, from the same time point, mother's age, mother's marital status at baby birth, country of origin, and child gender were collected. From wave 4 (5 years old), parent's report on child's social problems, withdrawn symptoms, and internal behavioral symptoms were collected. Data in wave 5 (9 years old) provided diagnosis of developmental disorders that we focus on. Wave 5 also provided data regarding whether parents were married or cohabiting, maternal education, five-categories of Federal Poverty Line, child's age in months, number of children under 18 years old living in mother's household. By using baseline and follow-up surveys, we created a binary variable indicating whether a child had a disruption of insurance coverage over 9 years since their birth. First, multivariate logistic regression was used to assess racial disparities in likelihood of diagnosis of four developmental illnesses of focus and any diagnosis. In addition, we conducted multivariate multinomial regression to assess relative likelihood of diagnosis of ADD/ADHD, ID/DD, and language disorders over Autism to assess a question whether Latinx mothers are particularly subject to misdiagnosis of autism.

Results:

A series of multivariate logistic regression provided evidence for racial disparities in diagnosis of developmental disabilities even after controlling for key covariates. Compared to non-Latino mom, Latinx mothers were 0.58 times less likely to have their kids to diagnosed with ADD/ADHD ($p<.01$). Regarding Autism, Latinx mom were 0.08 times less likely to have their kids to diagnosed when compared to non-Latinx mothers ($p<.01$).

Findings from multivariate multinomial regression showed racial disparities on likelihood to be diagnosed with ASD was most conspicuous, in particular for Latinx mothers of children with any developmental disorder. Compared to non-Latinx mothers, Latinx mothers were 6.12 times more likely to have their kids diagnosed with ADD/ADHD over Autism (p<.05). Latinx mothers were 16.98 times (p<.01) and 10.41 (p<.01) times more likely to have their kids diagnosed with ID/DD and language disorder, respectively, over autism.

Conclusions:

The results indicate that Latinx children are less likely to be diagnosed with ASD. These results suggest disparities in the diagnostic process among Latinx children, particularly when there is a healthcare disruption. Implications for reducing disparities are discussed.

214 **116.214** Adaptation and Evaluation of the Program Parents Taking Action for Latino Parents of Pre-Adolescents with Autism Spectrum Disorder (ASD)

M. Garcia[1] *and S. Magaña*[2]*, (1)UIC, Chicago, IL, (2)University of Texas, Austin, Austin, TX*

Background:

In the last decade, an increase in research related to Autism Spectrum Disorder (ASD) in the Latino community has emerged. This research has primarily focused on early childhood and intervention, but little is known about the experiences of Latino adolescents and their families. Parent education has been found to provide knowledge, skills and support for families. A culturally tailored, evidence-based intervention called Parents Taking Action (PTA) develop by Sandra Magaña, provides support to Latino families of children with ASD in early development. The purpose of this research study is to expand the PTA program and adapt it for the next developmental stage to equip families to support their children through adolescence.

Objectives:

In this research project, I aim to develop and test a curriculum for Latino parents of adolescents with ASD, which will include topics of puberty, sexuality and adolescence. The project is divided in three phases in which the first phase included a pilot study of the content of the program in Austin, TX. In phase two, I will incorporate feedback obtained from the first pilot and will conduct a new study with parents in Chicago. Finally, in phase three, I will test the effectiveness of the intervention in Bogota, Colombia. This study reports on the results from phase I.

Methods:

In phase one, a pilot study was conducted with 13 Latino mothers of children with ASD in Austin, TX. The program was delivered in group format and included three sessions in which topics related to puberty, private vs public situations, relationships, internet risk, mental health, and mood changes were covered. After the completion of the program, mothers completed a social validity and satisfaction questionnaire about the program. To complement, a focus group was conducted to understand how and why the program was found helpful and what changes the program required. After reviewing feedback from first pilot, the same procedure will be conducted with Latino parents in Chicago as phase two.

Results:

Results from social validity and satisfaction survey showed that parents were highly satisfied with the program, and that they plan to apply many of the strategies. The results of the focus group suggested that the program provided parents with helpful information. It allowed them to realize that adolescence is a new stage, and that despite the short intervention, the strategies provided were helpful to address some situations. Parents also suggested that the program needed to be longer as just three sessions were not enough to cover a complicated stage of development, especially for children with ASD.

Conclusions:

Sexuality in the Latino community is often considered taboo, presenting cultural barriers that need to be addressed to improve the lives of youth with ASD. Addressing this barrier through educational programs tailored for Latino families is a feasible approach to provide tools, strategies and knowledge to parents who are the primary caretakers and educators of these youth. Through the development of this program, parents will have access to important information and practical approaches to support their adolescents with ASD

215 **116.215** A Community-Based Advocacy Mentorship Program for Low-Resourced Latinx Parents of Children with ASD in the U.S

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Background:

Research suggests that Latinx children get a diagnosis of ASD 2.5 years later than White children. Likewise, Latinx children are more likely to be misidentified with other disabilities instead of ASD. Moreover, in California, Latinx children receive about only 50% of State-sponsored resources and services when compared to White children. Disparities for Latinx children with ASD are a persistent issue in care and education systems in the U.S. Research suggests that Latinx parents are in dire need of advocacy training in order to address this disparity in diagnosis and services. This study was designed to rigorously test, using randomization, a parent-to-parent IEP advocacy program for parents of children with ASD within a low-resourced, mostly Latinx population in Southern California. The study design includes randomization to a parent advocacy mentorship about the Individualized Education Program for their child or to a control group (program materials).

Objectives:

RQ1-Does a parent-to-parent advocacy mentorship program for parents of young children with ASD increase their advocacy knowledge (i.e. their rights under the Individuals with Disabilities Education Act (IDEA))? RQ2: Does a parent-to-parent advocacy mentorship program for parents of children with ASD increase their family empowerment and family advocacy outcomes (i.e. their likelihood to exercise their rights under IDEA)?

Methods:

This study examines the effects of a PARENT INTERVENTION- a parent-to-parent advocacy IEP mentorship program for low-resourced parents of children with ASD—on parent empowerment and IEP advocacy skills. Recruitment of parents and parent mentors, development and delivery of the intervention, and data collection was conducted employing Community-Partnered Participatory Research. The intervention was developed in English and Spanish and employing culturally sensitive materials. A total of 21 parents participated in the study. Parents were randomly assigned

to receive the PARENT INTERVENTION or to a CONTROL group. Parents in the PARENT INTERVENTION group (n=10) participated in 3 one-on-one meetings with a community Parent Advocate at the parent's home or a public space. Parents in the CONTROL (n=11) group received intervention materials after the conclusion of the study.

Results:

There was a significant increase in parents' IEP advocacy skills (i.e. Knowledge of their rights under IDEA) for parents in the PARENT group when compared to the CONTROL group. There were no statistically significant differences between the PARENT group and the CONTROL group for family empowerment or family advocacy outcomes.

Conclusions:

A low-intensity, low-cost community-based intervention may improve Latinx parents advocacy skills in the IEP process which can ultimately lead to better services for their children. The intervention did not yield positive gains in measures of family empowerment and family outcomes, which were already at high levels prior to intervention.

216 **116.216** The Puente Project: Use of Parents Taking Action to Promote Service Utilization Among Latinx Families

ABSTRACT WITHDRAWN

Background: Access to effective, evidence-based services for youth with developmental disabilities in the community is limited, especially for ethnic minorities populations where significant disparities in identification, service entry and utilization are documented (Mandell et al., 2002, 2005, 2007). There are a growing number of system-driven efforts to address service disparities. In 2016, the State of California Department of Developmental Services launched an initiative to address disparities in care for Latinx clients. To best inform this effort, the San Diego Regional Center (SDRC) prioritized the identification and tracking of disparities in current service expenditures and authorizations by ethnicity and race. This examination informed the design of a targeted intervention effort to promote service utilization among Latinx families through the use of a Promotora (lay health worker) home-visiting model, entitled the PUENTE Project. The goal of the intervention is to promote psychoeducation and empowerment for parents of Latinx children with developmental disabilities.

Objectives: The aim of the current study is to examine the development, implementation and outcomes for the PUENTE Project.

Methods: Service utilization data from 27.343 SDRC clients were examined to identify the appropriate target population for intervention. Five parents/family members of individuals with developmental disabilities were hired as Promotoras. After receiving 25 hours of training on the content and delivery of *Parents Taking Action,* Promotoras began home visits with families of children with autism spectrum disorders (ASD) and/or intellectual disability (ID). Case managers at SDRC identified Latinx families who were underutilizing services for referral to the program. Promotoras visited families weekly for 12 weeks to discuss *Parents Taking Action* content and share personal experiences. An independent assessor visited families prior to intervention and immediately following the end of sessions to gather relevant evaluation measures.

Results: Analyses indicated significantly lower SDRC spending for Latinx clients that first emerges between the ages of 14-16 for individuals with ID and ASD. To date, families of 24 children from this group have been referred to PUENTE. Promotoras have conducted over 85 home visits with families. Participating children have a mean age of 13.04 years (SD=1.87, range – 10-16) and 52% (n=12) are male. Diagnoses include ID (n=8; 38%) or ASD (n=5, 24%), ASD+ID (n=4, 19%), and ID+ CP/EP (n=4, 19%). Preliminary data indicate that parents demonstrate moderate levels of strain (M=61.81, score range = 21-105) as well as intermediate disability knowledge (M=31.78, score range = 14-56) and use of effective strategies (M=40.22, score range = 14-56) for addressing children's needs. A total of 55.5% of families received scores in the clinical range on the CES-D. Families were utilizing an average of 1.79 services (SD=1.36, range = 1-4) within schools and 3.35 services (SD=2.9, range = 0-10) outside the school context. Formal and informal feedback from Promotoras, Regional Center case managers, and families is positive regarding the intervention and service model.

Conclusions: These results demonstrate the feasibility and appropriateness of the PUENTE Project to reach Latinx families with children with developmental disabilities. Effectiveness and impact of the intervention will be discussed.

217 **116.217** 100 Years from Now: Advocacy and Concerns of Parents of Adults with Autism in China and the United States

H. McCabe[1]*, D. B. Baker*[2]*, M. Kelly*[3] *and T. Jiang*[4]*, (1)The Five Project for International Autism and Disability Support, Randolph, MA, (2)Hobart and William Smith Colleges, Ithaca, NY, (3)Education, Hobart and William Smith Colleges, Geneva, NY, (4)Human Development, University of Rochester, Rochester, NY*

Background: While the experience of aging for individuals with autism – including caregiver perspectives and concerns – has been studied in the United States (US) (e.g., Roberts, 2010; Shogren & Plotner, 2012; Taylor & Seltzer, 2011), much of it focuses on the years immediately surrounding the school to adulthood transition, with fewer studies investigating the experiences of middle-aged and older adults (e.g., Perkins & Berkman, 2012). In China, where autism was diagnosed four decades later than in the United States (Tao, 1987), autism services are still emerging and research focuses on services for and experiences of young children and their families (e.g., McCabe, 2007; Qian, Reichle, & Bogenschutz, 2012). Like in the US, adult services in China are limited, and parents face significant uncertainty as their children with autism age.

Objectives: The purpose of this cross-cultural qualitative study was to examine the experiences of American and Chinese parents of adult sons and daughters with autism, and specifically to understand: In what ways are the experiences of these families similar and different in US and Chinese contexts? and What relationships exist between the nature and availability of adult services and the experiences of families as their children age? Analyzing the experiences of American and Chinese parents of adults with autism brings into focus not only similarities and differences across the two countries but also reveals themes that might be absent from analysis of a single cultural context.

Methods: Eighteen families participated in the study—seven in the US and eleven in China. Data were collected using a semi-structured interview protocol with seven open-ended prompts. Once all of the interviews were completed, the researchers independently coded one interview from each country using a combination of a priori and emerging codes (Weston et al., 2001). The researchers met multiple times during the pilot coding process to reconcile any coding differences (Saldaña, 2015) and to update the code list.

Results: Regarding issues of growing up and aging, three overarching themes emerged from the data: (1) transition to adult services plays out differently in the two nations, (2) parent advocacy and efforts in supporting and securing services for their children are similar in the two countries but also defined by the nature of available services, and (3) due to the scarcity of adult services in their country, Chinese parents

express significantly more worries about their own aging and mortality as compared with US parents.

Conclusions: The results of this study indicate that while parents across both countries strive to act in their children's best interests, the availability of resources informs the nature of their advocacy as well as how they view aging and the future. The results of this study make visible, in both countries, practices that are useful and should be expanded, as well as gaps and areas where more services are needed.

218 **116.218** A CROSS-Cultural Comparison of Stress and Resilience Among the Parents of Children with Autism Spectrum Disorder in India and the UK.

F. M. Kodakkadan[1], *E. M. Lee*[2] *and S. D. Stagg*[3], *(1)Anglia Ruskin University, Cambridge, United Kingdom of Great Britain and Northern Ireland, (2)School of Psychology and Sport Science, Anglia Ruskin University, Cambridge, United Kingdom, (3)Anglia Ruskin University, Cambridge, United Kingdom*

Background: The causes of stress for parents with children with autism and improving resilience are key research areas concerned with well-being and quality of life. Raising a child with Autism Spectrum Disorder (ASD) involves unique challenges, and specific cultural challenges are often not considered in research (Freeth et al., 2014). Cultural factors may influence how autism is experienced, recognised and explained in diverse communities. For example, information that might be helpful for one parent may be too difficult or even unclear for another parent due to cultural differences including beliefs and values, socioeconomic status, religion and stigma. Factors such as perceived emotional support and parental attitude toward their child with ASD are also seen as contributors to stress and resilience and have yet to be studies cross-culturally. Objectives: To compare parental responses to stress and resilience, and contributing factors, in a sample of parents with children with ASD drawn from the UK and India. We also tested two new factors relating to stress and resilience: perceived emotional support and parental attitude towards the child.

Methods: An online survey was conducted with 120 parents from the UK (Age M=38; SD= 5.9) and 120 parents from India (Age M= 40; SD=6.7) who have children with ASD aged between 3-16 years. Parents completed a set of online questionnaires about their experiences of caring for their child with ASD, their own perceptions of stress and resilience and their child's current adaptive level of functioning. Measures included: The Vineland Adaptive Behaviour Scale (VABS), the Parenting Stress Index (PSI-SF), the Brief Resilience Scale (BRS), the Multidimensional Scale of Perceived Social Support (MSPSS), the Perceived Emotional Support Scale (PES), the Family Impact Questionnaire (FIQ), and the Affiliate Stigma Scale (ASS).

Results: Parents in India reported higher levels of stress and lower levels of resilience than their UK counterparts even when matched on parental age, gender, socioeconomic status and occupation level. Indian parents also reported lower levels of perceived social support, higher level of negative parental attitude toward their child and higher levels of stigma. Of particular interest was the finding that Indian parents rated their child as having lower adaptive levels than their UK equivalents. In contrast Indian parents reported higher levels of perceived emotional support than the UK parents.

Conclusions: The findings indicate that the reported level of parental stress is higher in the Indian sample in our study. Factors that contribute to elevated stress and lower resilience among Indian parents included their child's adaptive level, lower level of perceived social support, higher level of negative parental attitude toward the child and higher affiliate stigma. The data collected will be used to further develop a culturally specific model of stress and resilience. This research will help to develop new culturally specific strategies to provide interventions that will help parents overcome stress and enhance resilience. This research may also help to increase clinicians' awareness and cultural responsiveness in order to support UK and Indian parents.

219 **116.219** A Comparative Feasibility Study of Two Parent Education & Training (PET) Programmes in a Low-Resource South African Setting

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Background:

In spite of the need for post-diagnostic parent/carer education and training (PET) in ASD, the research evidence-base is relatively small, particularly in Low-and-Middle-Income Countries (LMIC). A wide range of programmes exist, but with no consensus on criteria to evaluate such programmes for implementation in culturally diverse settings.

Objectives:

Here we performed a comparative feasibility study of two PET programmes in a low-resource setting. EarlyBird/EarlyBird Plus (EB/EBP), a UK-developed, widely used and highly manualised 12-week programme was compared to Autism Cares, a locally-developed 5-day programme. Our two aims were first, to examine acceptability, adaptation and perform limited efficacy testing of the programmes; second, to use a newly-generated multi-stakeholder ASD PET Evaluation Framework to compare them.

Methods:

A mixed-method, quasi-experimental design was used to collect pre, post and 3-month follow-up data. Measures included standardised and custom-designed quantitative outcome measures (e.g. Parenting Stress Index, Autism Treatment Evaluation Checklist, Parent Involvement Questionnaire, and Parent programme satisfaction measure) and qualitative semi-structured interview data.

Results:

Eighteen parents participated in the EarlyBird/EarlyBird Plus programmes, and eleven in the Autism Cares programme. Parent/carer and child characteristics were very similar. In particular, at least 30% of families earned <$300 per month. Strong parental acceptability for both programmes was found along with the need for some adaptations to the local context. Limited efficacy testing showed positive changes for parental stress, knowledge of ASD and changes in child, more so for EB/EBP than AC. The multi-stakeholder panel acknowledged strengths and weaknesses of both programmes, but judged EB/EBP as most suitable for next-step research citing factors relating to implementation including scalability and sustainability.

Conclusions:

Our findings contributed to the limited evidence-base for ASD PET in low-resource environments but highlighted the need for global collaboration to identify consensus measures to include in future research. The ASD PET Evaluation Framework provided a useful structure for comparison of the two programmes, but emphasised the need to align measures with the evaluation criteria. Overall, the study underlined the need for the evidence-base of ASD PET programmes to include processes & procedures, and examination of the implementation landscape, in addition to outcomes.

220 **116.220** A Cross-Cultural Study: The Comparison of Autism-Spectrum Quotient (AQ) Among UK, Japan, and Korea

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Background: Due to the increasing prevalence in Autism over the world since 2000s, the demanding of that cross-cultural studies with ASD is increasing. The Autism-Spectrum Quotient (AQ) questionnaire (Baron-Cohen et al., 2001), a self-administered questionnaire, developed for screening for possibly affected individuals to assist in making referrals for a full diagnostic assessment, it is one of the questionnaires, which can be used in the cross-cultural study in ASD.

Objectives: This study is aimed to examine the cultural differences in Autism-Spectrum Quotient among UK, Japan and Korea with HFASD and control population.

Methods: The result of Korean AQ results was compared with UK (Baron-Cohen et al., 2001) and Japanese (Wakabayashi et al., 2006) study. The studies of three countries included three groups, including adults with HFASD, control population at random, and University students. The results of three countries analyzed in every respect; (1) Cut-off score, (2) Mean AQ in each group, (3) Mean score of subscales in each group.

Results: The HFASD group scored at a similarly high level among three countries; the cut-off score was 33 in Japan, 32 in UK, and 31 in Korean data.

As a result of HFASD group comparison, there were no significant country differences between the three countries. The mean AQ score for each country was 37.9 (SD:5.31) in Japan, 35.8 (SD:6.5) in the UK, and 26.85 (SD:5.91) in Korea. In the results of subscales, the score of Local details (t=13.588, p=.047) in Japan was significantly higher than Korean.

As the result of General group comparison, the mean AQ had a significant country difference in both Korea-UK comparison (t=21.247, p=.030) and Korea-Japan comparison (t =76.083, p = .008). In the subscale results, the Korean communication score (t=121.000, p=.005) was significantly higher than UK score. As well, the results of Korea-Japan comparison displayed the country differences in three subscales; Communication, Social skills, and Imagination (one-sample t-test, all p<.05). The Korean scores were significantly lower than Japanese scores in three subscales.

In the result of mean AQ in Student group comparison, there was a significant country difference in both Korea-UK (t=27.269, p=.023) and Korea-Japan comparison (t=22.523, p=.028). The score of Communication (t=144.000, p=.004) and Imagination in Korea (t=18.857, p=.034) were significantly higher than those of UK's. In addition, the Japanese scores of Imagination and Local details (t=14.238, p=.045; t=20.818, p=.031) were significantly higher than those of Koreans, while the Korean score was significantly higher at the Attention switching (t=15.648, p=.041).

Conclusions: The present study explored the cross-cultural differences of AQ among three countries in adults with HFASD, control population, and students. The cut-off scores in three countries were similar level, and there was no country difference of mean AQ and subscales in HFASD group comparison, except Local details. It implies that, although there are cultural differences in general population, AQ questionnaire can be used to distinguish autism traits of individuals with HFASD from the controls, regardless of cultural differences.

221 **116.221** A Validation Study of Korean-Version Autism-Spectrum Quotient (K-AQ)

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Background: Autism is a developmental disorder characterized by difficulties in social interaction and communication, and by restricted and repetitive behaviors (DSM-5,2013). There are some diagnostic instruments for autism, such as the ADI-R, the ADOS-2, that are time-consuming to manage. People who are at risk or diagnosed with autism have been increased in Korea; however, there is no brief self-administered and time-saving scale for measuring the degree to which any individual adult with normal IQ may have the 'autistic traits' or 'the broader phenotype'(Bailey et al.,1995).

Objectives: This study is aimed to test the validation of a Korean-version AQ with Korean HFASD, general adults and university students.

Methods: Totally 957 volunteers participated and were divided into three groups. Group1 comprised 20 males who had been diagnosed with HFASD and their mean age was 22.4 (SD:3.69). Group2 comprised 200 adults selected at random (Male:68, Female:132) from general adults whose mean age was 37.5 (SD:10.57). Group3 was made up of 737 students (Male:336, Female:401) who are attending university in Korea and the mean age was 21.4 (SD: 2.63). The procedure was exactly replicated as the UK (Baron-Cohen et al., 2001) and Japanese (Wakabayashi et al., 2006) studies.

Results: The cut-off score was determined as an AQ score of 31+, based on the results that 80% of HFASD group scored at this level, while only 2.4% of controls did so. The mean AQ scores of three groups were compared using independent t-test. In the results of comparing HFASD group and General group, the HFASD group showed its mean as 26.85(SD:5.91) and the General group presented its score as 18.01(SD:6.57). There was a significant difference between two groups (p<.001). In the comparison between HFASD and Student group, Student group displayed its mean as 18.94 (SD:5.92), and there was a significant difference between two groups (p<.001).

In the subscale results, the HFASD group showed higher scores than both General and Student groups in all subscales. The HFASD group showed their lowest score in Imagination and highest score in Attention switching. Comparing the HFASD and General group, there was a significant difference in all subscales; Communication (p<.001), Social skills (p<.01), Imagination (p<.001), Local details (p<.01), and Attention switching (p<.05). In the result between the HFASD and Student groups, there was a significant group difference in four subscales; Communication (p<.001), Social skills (p=.001), Imagination (p<.001), and Local details (p<.05). In addition, males showed the higher mean score in General group, while females in Student group demonstrated higher mean AQ. There was a significant gender difference within some subscales in both General and Student

groups.

Conclusions: This study investigated the validation of Korean-version AQ in adults with HFASD, control, and students. These results emphasize the significant group differences in mean AQ and scores of subscales between HFASD and control groups (both general and student groups). It suggests that the Korean-version AQ can be used to validate the autistic traits in individuals with HFASD from controls, although the limited numbers of participants with HFASD were involved in this study.

222 **116.222** Adapting Caregiver-Delivered Interventions to Low-Resource Settings: Caregiver Descriptions of Joint Activity Routines with Young Children with Autism Spectrum Disorder in South Africa

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Background: Coaching caregivers to deliver naturalistic developmental behavioral intervention (NDBI) (Schreibman et al., 2015) strategies to their young child with autism spectrum disorder (ASD) may help address the provider capacity barrier in sub-Saharan Africa (SSA) (Franz et al., 2017; WHO, 2015). Caregiver use of NDBI strategies can promote child joint attention, affective engagement, and language acquisition (Bottema-Beutel, 2016; Siller & Sigman, 2008). However, behavioral and developmental research that forms the theoretical underpinning of NDBIs is overwhelmingly drawn from Western cultural contexts (Nielsen et al., 2017). Therefore our understanding of joint activity routines (JAR), including play and family routines (Bruner, 1974) in which NDBI strategies are embedded, (Mohammadzaheri et al., 2014; Rogers et al., 2012) may have limited applicability outside of Western cultural contexts (Nielsen et al., 2017). Thus, important questions remain on how to adapt NDBIs to be relevant to diverse cultural groups.

Objectives: This study aimed to elicit descriptions of JAR from caregivers of young children with ASD in South Africa, in order to understand whether an NDBI-informed early ASD intervention approach would 'fit' within the multicultural, multilingual South African context.

Methods: Participants were recruited from the Western Cape Education Department autism waiting list through convenience sampling. Four focus group discussions were conducted with 22 racially/ethnically diverse caregivers (e.g. mothers, fathers, and grandmothers) of young children with ASD. While the focus group guide covered a range of topics, this study draws data from questions on caregiver-child play, acceptability of caregiver coaching, and South African contextual factors. Data were analyzed through directed content analysis (Hsieh & Shannon, 2005), which used inductive methods to determine salient themes and subthemes.

Results: Caregivers reported engaging in a variety of turn-taking games, teaching cognitive, language, and fine motor skills, and participating in child-directed activities during object-based play. They described active, physical play and an awareness of their child's emotional state during sensory social play. Caregivers also noted that their children showed increased expressive language and willingness to engage with different play partners during social routines. Caregivers detailed family routines such as child participation in mealtime routines and caregiver-child interactions during bath time. Throughout these interactions (e.g. prayer before meals) they taught their child expressive language, worked to enhance their child's attention to themselves and other family members, and practiced turn-taking. Caregivers also described limitations related to lack of financial resources, access to specialist services, and social support.

Conclusions: These results suggest that South African caregivers of young children with ASD use JAR to engage and teach their children. This suggests that there exists a degree of 'fit' between South African caregiver-child interactions and NDBI caregiver coaching approaches. However, as most of the caregiver-child interaction questions in the focus groups concentrated on play, more information is needed on other family routines which use NDBI strategies (e.g., feeding), both in terms of which family routines occur, and who interacts with the young child with ASD during these routines. These descriptions will help tailor the implementation of caregiver coaching NDBI approaches for low-resource African settings.

223 **116.223** Adapting a Caregiver Skills Training Intervention for Families of Children with Developmental Disabilities in South Africa

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Background: Working towards the goal of closing the gap in access to care for children with developmental disabilities (including children with autism spectrum disorder) in low- and middle-income countries, the World Health Organisation developed a novel, open-access Caregiver Skills Training (WHO CST) programme that can be implemented in low-resource settings by non-specialists. However, it is essential to maximise the contextual fit of this intervention with the particular families that are being served, the providers who deliver the intervention, and the diversity of service settings. Without considering adaptations, the WHO-CST programme may lack acceptability, relevance, and sustainability in the local context.

Objectives:

Our objectives are (1) to consider adaptations of the WHO-CST intervention (i.e. a complex intervention) and its implementation using a participatory multiple-stakeholder approach; (2) to develop and test replicable, easy-to-use, and cost-effective documentation methods for recording adaptations and/or modifications (i.e., pragmatic measures); (3) to provide contextual process data to interpret outcomes (i.e., how adaptations contributed to outcomes); and (4) to create an organised list of adaptations that future implementers can consider.

Methods: A comprehensive and integrated assessment of the WHO-CST intervention (that takes stakeholders, the socio-cultural context and setting into account) informs the dynamic adaptation process. Adaptations are considered throughout a four-phase implementation and evaluation process, namely: (1) exploration, (2) preparation, (3) implementation, and (4) sustainment. A mixed methods research approach using multiple data sources are considered (i.e., stakeholder workshops, focused interviews, questionnaires, checklists, and logs, and expert reviews) to systematically capture data on the nature of the adaptation and the characteristics of the population and settings.

Results: The presentation will discuss the adaptation process and outcomes during the exploration and preparation phases of the study. Our findings describe how an academic-community partnership consisting of a multidisciplinary team of researchers, practitioners, implementers, and end users identified ways to integrate research evidence, local knowledge, and stakeholders' preferences in adapting the WHO-CST intervention in

South Africa.

Conclusions:

There are no gold standard procedures for the adaptation of complex interventions in low- and middle-income countries. Yet, considering adaptations in a planned and considered manner, rather than ad hoc way, is especially important to maintain intervention fidelity and to ensure acceptability, appropriateness, and sustainability of the intervention. This study describes the real-world implications of adapting a caregiver skills training intervention to be implemented in a low-resourced South African context.

224 **116.224** Association of Child Autistic Characteristics with Parenting Stress in Mothers of Children with Autism Spectrum Disorder: A Comparison between the United States and Japan

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Background:

Research in various industrialized countries indicates mothers of children with Autism Spectrum Disorder (ASD) experience severe stress. Factors influencing stress in mothers of children with ASD are complex and reflect the sociocultural contexts of parenting. Child ASD characteristics may be strongly related to parenting stress in collectivistic cultures such as Japan. The atypicality of the child may be perceived more negatively compared to individualistic cultures such as the U.S. There is a need to understand how parenting stress is related to child ASD characteristics across cultures.

Objectives:

To investigate potential interactions between child ASD characteristics and the country of residence (US vs. Japan) in relation to parental stress in mothers.

Methods:

We used data from our ongoing cross-cultural research on mothers of children with ASD that included 52 mothers from the US and 51 Japanese mothers of children ages 2-12 years old with confirmed diagnosis of ASD. Each mother completed three questionnaires to measure characteristics of mothers (Parenting Stress Index (PSI)) and children (Social Communication Questionnaire (SCQ), Social Responsiveness Scale (SRS-2)), and one background questionnaire. The Japanese versions of the PSI, SCQ, SRS-2, and the background questionnaire were used for the Japanese participants. We used logistic regression to compare the association of child ASD characteristics with parental stress between the US and Japan.

Results:

Mean age of children from the US and Japan were 7.0 and 7.4 years respectively; 78.9 % and 76.5% of the children from the US and Japan were male, respectively. About 63% of the US mothers and 70% of the Japanese mothers showed clinically significant levels of parenting stress. There were no cross-cultural differences (p = .257) on the level of parenting stress measured by the PSI after controlling the child age and the parent's socioeconomic status (SES) score. Comparison of child ASD characteristics measured by the SCQ and SRS scores indicated that Japanese children had significantly lower scores than those of the US (p = .004 and <.001, respectively). SCQ scores were associated (p = .047) with maternal stress related to child characteristics (Child Domain). However, there were no significant interactions between the SCQ and country in relation to maternal stress. For both countries the SRS score had a statistically significant association with maternal stress (US p = .004, Japan p = .034). After adjusting for children's age and SES, one unit increase in SRS score was expected to increase the odds of clinically significant maternal stress by 6 % and 3 % in the US and Japan, respectively. However, the country difference was not statistically significant.

Conclusions:

This is the first study to examine cultural differences in the association of child ASD characteristics in maternal parenting stress. There were not differences by country in the level of parenting stress influenced by the level of child ASD characteristics (SCQ and SRS). Nevertheless, our study revealed that child ASD characteristics are associated with the level of parenting stress across the nationalities.

225 **116.225** Autism Awareness in China: Preliminary Data on the Autism Stigma and Knowledge Questionnaire (ASK-Q)

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Background: The estimated global prevalence of autism spectrum disorder (ASD) is 1 in 160 children (WHO, 2017). In the United States, it is 1 in 59 children (CDC, 2018). However, the number in China has been consistently lower, ranging from 1 in 255 (Wang et al., 2018) to 1 in 1205 (Jin et al., 2018). Given research suggesting that prevalence should not differ dramatically across geographical regions (Elsabbagh et al., 2012), this may suggest significant under-diagnosis in a country hosting nearly 20% of world population. It has been shown that low knowledge and stigma perception contribute to low diagnosis rate and increased diagnosis age in under-represented population (Magaña et al. 2013; Mandell et al. 2009). To date there has been no study examining ASD knowledge among the general public in China. One suitable instrument for addressing this issue is the Autism Stigma and Knowledge Questionnaire (ASK-Q; Harrison et al., 2017), which was developed to systematically evaluate ASD knowledge in cross-cultural contexts.

Objectives: This study aimed to 1) translate and adapt ASK-Q into Chinese and evaluate the psychometric properties; 2) gather information about public knowledge of ASD in China using the ASK-Q Chinese.

Methods: ASK-Q translation followed a rigorous translation-back-translation procedure (Guillemin et al., 1993). To examine the cross-cultural

validity of the ASK-Q in China, a group of Chinese-English bilinguals with ASD expertise reviewed the questionnaire and made an adaptation to only one item to better describe Chinese stigma perception of disease. Responses were collected using an online survey tool, Wenjuanxing and distributed via social media platforms (i.e., Wechat and Weibo). ASK-Q evaluates three ASD knowledge categories: Diagnosis/symptoms, etiology, and treatment, as well as stigma endorsement. The responses were scored as correct or incorrect. Item discrimination of high vs. low knowledge was obtained by comparing the number of correct responses in the high group (highest 25% on total score) and that in the low group (lowest 25%).

Results: 1,244 valid responses were collected from mainland, Hong Kong, and Macau. In the sample, 76% were females and 89% were urban residents. Based on the cutoffs provided in Harrison et al. (2017), 92.7% participants demonstrated adequate knowledge for diagnosis, 78.7% for etiology, 85.2% for treatment, and 98.6% for not endorsing ASD stigma. Chi-squared analysis indicated significantly higher scores in the high knowledge group than the low knowledge group on all four categories. The five items that best discriminated high vs. low knowledge were: 11. Autism is preventable (Etiology, Stigma). 41. Traumatic experiences very early in life can cause autism (Etiology). 40. There is currently no cure for autism (Treatment). 5. We now have treatments that can cure autism (Treatment). 28. Many children with autism repeatedly spin objects or flap their arms (Diagnosis/Symptoms).

Conclusions: Etiology appeared to be the knowledge gap of the surveyed participants. The results have important implications for improving public awareness of ASD in China. Training can be implemented directly addressing the identified misconceptions. Further study should be pursued to include under-represented groups such as males and rural citizens.

226 **116.226** Autism Research Capacity Building in Northern Mexico: Preliminary Evaluation of an Ongoing Process

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Background: Research Capacity Building (RCB) is an integral component for the production of sound evidence to inform clinical practice and policy decision-making. However, research capacity is often measured with longer-term outcomes of high-quality research, such as peer-reviewed publications or successful grant applications. This framework may not address relevant issues contributing to progress, particularly amongst the initial stages of development or when RCB occurs in Low-Middle Income Countries (LIMCs). A six-principle framework to guide and evaluate four levels of development of RCB in health care was proposed by Cooke (2005). The Autism Global Panel (AGP) is a trans-sectorial network of publicly- and privately-funded organizations in the northern state of Nuevo Leon, Mexico founded in 2013. AGP's first multi-collaborative research project is geared toward early detection and intervention of autism in toddlers, set to launch in December 2018.
Objectives: To evaluate the ongoing process of autism RCB set by AGP in Northern Mexico, utilizing Cooke's framework.

Methods: Six principles of RCB were evaluated along four levels of development activity (individuals, teams, care giving organizations, and networks and support units): 1. Skills and confidence building; 2. Support of research 'close to practice'; 3. Linkages, Partnerships, and Collaborations; 4. Appropriate dissemination; 5. Continuity and sustainability; 6. Appropriate infrastructures. A matrix of criteria for each principle x level was defined by two founding members of AGP and rated according to the development stage as of November 2018 (Not started; In process; Achieved). A summary including the accomplishments expected in the initial five-year period of RCB, and the identification of priorities for the next five years was produced.

Results: From the list of 64 criteria identified guided by the model, 31 (48.4%) were rated as *Achieved* or *In Progress*. The remaining criteria (51.5%) were rated as *Not Started*. Overall, principles 1 and 2 (Building skills and confidence, and Close to practice) were rated as having a percentage of criteria within the *Not started* status of 50 and 54.5, respectively, whereas principle 3 (Linkages, collaborations, and partnerships) was rated as having all of its criteria within the *In Progress* or *Achieved* status. Principles 4, 5, and 6 (Appropriate dissemination and impact, Continuity and sustainability, and Infrastructure) obtained a status rating of *Not Started* for 77.7, 70, and 63.4% of their criteria, respectively.

Conclusions: Cooke's framework allows preliminary evaluation of the process of autism RCB in Northern Mexico by the collaborative AGP during its first five years of existence (2013-2018). Three of the six principles evaluated had most of the criteria rated within the *Not started* status. Distinctively, principle 3 (Linkages, collaborations, and partnerships) was rated as the relative strength of this initiative, receiving 100% of its criteria as *In process or Achieved*. Secondary strengths were identified in principles 1 and 2 (Building skills and confidence, and Close to practice) where half the criteria were rated as *In Process* or *Achieved*. The progress documented in this preliminary evaluation of the RBC process is promising and will contribute to inform the efforts prioritized for the next five years.

227 **116.227** Barriers and Facilitators to Implementing a Caregiver-Coaching Early Autism Spectrum Disorder Intervention in South Africa

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Background: Early detection and early intervention for autism spectrum disorder (ASD) can improve child outcomes and reduce long-term costs. In Sub-Saharan Africa, access to early ASD intervention is however extremely limited. The United Nations Sustainable Development Goals include an overt shift in health system focus from "surviving" to "thriving" in an effort to address morbidity associated with developmental disabilities, including ASD. Efforts to adapt and implement evidence-based early ASD interventions are therefore increasing on the African continent. To date, no implementation studies have been conducted for caregiver-coaching early ASD interventions in Sub-Saharan Africa, and little is known about barriers and facilitators to implement and sustain such interventions.
Objectives: The objective of this study was to explore barriers and facilitators to implement and sustain 12 sessions of an Early Start Denver Model (ESDM) informed caregiver-coaching intervention, delivered by non-specialists, and tailored for the South African context.

Methods: Key informant interviews were conducted with nine South African stakeholders involved in the implementation of the caregiver-

coaching intervention during the pre-pilot phase of a study (3 certified ESDM therapists, 2 Non-specialists, 2 Non-specialist school supervisors, 2 caregivers of young children with ASD). Individual in-depth interviews were semi-structured and conducted in person. Interview questions were informed by a similar multi-stakeholder qualitative process evaluation (Curran et al., 2012). Data were transcribed verbatim and thematically analysed, with line-by-line analyses leading to the development and refinement of themes and subthemes.

Results: Consistent themes emerged from key informants. *Implementation facilitators* included non-specialist baseline knowledge of ASD, and the skills gained over time from ongoing supervision. In addition, *implementation facilitators* related to the coaching experiences included the in-session coaching structure, strong team relationships, clear illustration of intervention skills from video-based materials, and intervention skill mastery by both the non-specialists and caregivers. *Implementation barriers* included the complexity of intervention concepts, and misalignment of non-specialist training with a caregiver-coaching approach. *Implementation* logistical *barriers* included time constraints, and limited access to physical resources such as coaching space, computers and internet connectivity, and mismatch of intervention video material content with the South African context. *Structural barriers to sustain* the intervention included poverty, unreliable transportation, and unemployment. *Facilitators to sustain* the intervention included significant improvement in child symptoms, caregiver buy-in to the coaching approach, and increased caregiver competence. *Structural factors that will sustain* the intervention include ongoing supervision as well as time and financial investment from the school system where non-specialists delivering the intervention are employed.

Conclusions: This data provides preliminary information on barriers and facilitators to implement and sustain a caregiver-coaching early ASD intervention in South Africa. The results will inform tailoring of the intervention training and supervision approach for a larger pilot study. Positive child and caregiver outcomes could be offset by larger contextual and system-level issues, such as poverty and a need for ongoing support and supervision.

228 **116.228** Barriers to Screening for Autism Spectrum Disorders (ASD) in Pediatric and Community Health Practices in Ecuador

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Background:

An essential issue for early diagnosis of autism is the extent to which health professionals can be engaged in the screening process. Universal routine screening of autism and developmental delays is recommended by the American Academy of Pediatrics in the effort to enhance early identification of children needing services. Pediatricians and family physicians are among the first professionals able to identify developmental difficulties and provide effective recommendations. However, several barriers to screening in those settings have been identified in different countries. Among them, lack of knowledge about ASD, lack of confidence in identifying signs of autism, perception of autism as a condition that is not well defined, and misconceptions regarding the signs, symptoms and etiology.

Objectives:

We aim to address a critical gap regarding screening practices in Ecuador based on the hypothesis that, as in many parts of the world, children are not being routinely screened for ASD and that the absence of screening practices may result from poor acknowledgment of this condition. A better understanding of barriers to screening practices can be helpful to inform on professionals' training needs, and provide a first step in improving detection thus improving the life of children and their families. Correct case identification may also raise visibility to improve resources for families in Ecuador.

Methods:

We interviewed 46 subjects, 29 medical doctors in Pediatrics and Community Health and 17 postgraduate students in a School of Pediatrics from different regions of Ecuador. Participants responded to an original questionnaire developed to assess (1) current barriers to ASD screening in pediatric and family physician settings, (2) auto-perceived knowledge and auto-perceived self-efficacy and (3) to inform on training needs among those professionals as well as on the preferred ways to receive it.

Results:

Preliminary results indicate that most endorsed barriers to screening for autism are *lack of time to perform a screening*, *lack of resources to offer to autistic people, not knowing where to find adapted instruments and the feeling to be able to recognize symptoms without the need for a tool*. A small proportion of participants consider they have enough training in detection and monitoring, and more than 90% of participants feel they could benefit from receiving training in the area of autism, especially in the identification of early signs. Around one third of participants report between 1 and 4 children identified with ASD during their professional practice, and 70% report not having identified children with ASD during their professional life, suggesting that children are not being routinely screened for ASD, which may result from poor acknowledgment of this condition.

Conclusions:

Those results suggest the presence of several barriers to screening in pediatric settings, such as lack of time and resources, lack of feeling of self-efficiency to discuss symptoms with parents or to refer a child for further evaluation, that are consistent with previous findings in High- and Low-Income countries. These findings highlight the importance of continuous education among health care professionals and inform about their needs in training and education in Ecuador.

229 **116.229** Barriers to an Information Effect on Diagnostic Disparities of Autism Spectrum Disorder in Young Children

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Background:

Autism spectrum disorder (ASD) is underdiagnosed in children from minority and low socioeconomic status families, and various reports allege that parental "lack of awareness" of symptoms is a factor. If these reports are true, then the implication is that simply exposing parents to information about ASD may alleviate diagnostic disparities as the use of the category increases around the world. Yet in the first sample of parents of young children with ASD living within spatial clusters of low severity cases—the very cases that may be explained by an information

effect—exposure to information had little effect on diagnostic disparities.

Objectives:

The objective of the present research was to explore factors that inhibit an information effect among parents of symptomatic children who are exposed to information and/or other cases of ASD.

Methods:

Interviews were conducted with the parents of 54 children with ASD in Costa Rica, including many cases within spatial clusters that appeared after a genetic study conducted an information campaign for case recruitment. The interviews focused on factors influencing parents' symptom recognition and help-seeking behaviors, including clinical encounters prior to diagnosis and contact with parents of children with neurodevelopmental disorders both before (incoming information) and after diagnosis (outgoing information). Parents were recruited at the diagnosing hospital either at the time of diagnosis or during follow-up appointments, and interviews were conducted by two authors who both took detailed notes and resolved differences immediately afterwards. The analysis was influenced by grounded theory and ethnomethodology, with the aim of providing "thick description" of any role of information on parents' help-seeking behaviors.

Results:

Information about ASD failed to spur parents to pursue a diagnosis for their symptomatic children, in part because early symptoms in their children gave parents no reason to suspect ASD. As their children aged beyond 2-3 years and developed additional symptoms, parents' understanding of ASD became relevant, but it depended on unique, idiosyncratic features of other children's behaviors that were not often present in their own children. Parents often received unsolicited advice from strangers, although rarely from family, and it was always seen as critical of their parenting; furthermore, the advice was too late to influence the referral process, which was well underway by the time classical symptoms of ASD appeared, if they did at all. Post-diagnosis, the interviewees occasionally gave advice to other parents, mostly strangers, but none had apparently been diagnosed.

Conclusions:

These results challenge narratives about the role of information in the context of an increasing international prevalence of ASD diagnosis. In spite of efforts to disseminate ASD information through a population with low levels of ASD knowledge, there are significant barriers to an information effect on parents' health behaviors, including the symptomatology of ASD. To reduce diagnostic disparities as ASD continues to be adopted globally, efforts to educate parents should focus on the heterogeneity of symptoms, as well as generic developmental delays that can indicate neurodevelopmental disorders in general.

230 **116.230** Community-Based Participatory Research and Training on the Identification and Treatment of Children with Autism Spectrum Disorder (ASD) in Ukraine

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Background: In Ukraine, the diagnosis of autism in young children is often significantly delayed. Professionals have had limited education on autism, limited access to formal diagnostic assessments such as the ADOS 2, and neither general developmental or autism specific screens are routinely used in primary care or other common service settings.

Objectives: Describe the process for improving identification and treatment of young children with ASD in Ukraine and determine factors that support successful implementation of workshop methods and materials.

Methods: Our group has conducted workshops in Ukraine for the past 3 years. Local priorities have been identified through Skype sessions and post-workshop evaluations of participants. In September/October 2018, we conducted workshops in 3 cities and offered formal training in the STAT (Screening Tool for Autism in Toddlers) a brief hands-on assessment to help identify young children with or at-risk for ASD; Reciprocal Imitation Training (RIT), a naturalistic developmental behavioral intervention for young children with ASD; workshops for Speech Pathologists on treatment of children who have limited verbal skills including children with ASD; and workshops for parents of children with ASD. The parent workshops addressed themes identified as high priority by parents and focused on building parent advocacy skills. Two STAT kits were left in each of the 3 cities for participants in the STAT workshops. After the workshops, STAT trainees follow established procedures for on-going coaching and certification while RIT and speech trainees engage in supervision and case discussions by Skype every 2-3 months.

Results: A total of 55 professionals attended STAT and RIT trainings, 25 participated in Speech workshops and 68 participated in the parent workshops. Participants included psychologists, child psychiatrists, pediatricians, speech pathologists, teachers and parents. The professionals' years in practice ranged from 1 to 30, and the parent-reported age of their children with ASD ranged from 2 years to 18 years. Participants rated the workshops highly. For example, 76% of participants "strongly agreed" they would pursue STAT certification and use it in their practice. We will report on number of STAT workshop participants who complete STAT certification procedures and RIT participants and speech pathologists who engage in remote supervision. We also will report data from 3 and 6 month email follow-up with workshop participants regarding use of tools, strategies and information, and will discuss barriers to and factors supporting successful implementation.

Conclusions: Tools and treatment strategies developed in USA were enthusiastically embraced by local professionals and can be successfully implemented in Ukraine. Barriers to and factors that support successful implementation will be discussed.

231 **116.231** Developmental Profiles of Preschool Children Diagnosed with Co-Occurring Autism and Epilepsy Using the Communication Deall Developmental Checklist

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Background: Epilepsy co-occurs frequently in autism spectrum disorder (ASD). Language deficits are common in both ASD and epilepsy. Understanding if there is a different phenotype in developmental domains, including motor and cognitive-linguistic domains, in children with Autism with and without epilepsy will help further research efforts towards targeted intervention.

Objectives: (1)To compare developmental profiles of preschool children diagnosed with ASD only (ASD) to those with ASD and Epilepsy (ASD+Epi) (2)To evaluate predictors of motor, language and cognitive abilities in the two groups

Methods: A total of 89 (63-ASD, 26-ASD+Epi) 3-6-year-old pre-school children were assessed on The Communication DEALL Developmental Checklist (CDDC; Karanth et al., 2010). CDDC is a well validated developmental tool that is sensitive to the socio-cultural-linguistic needs of India. CDDC assesses child's development in eight domains: Gross Motor(GM), Fine Motor(FM), Activities of Daily Living(ADL), Receptive Language(RL), Expressive Language(EL), Cognition, Social and Emotional skills - for children between 0-6 years. Each subject received a total ratio score of observed skills/expected skills per domain. Whenever possible clinicians corroborate CDDC scores via direct observation during a 1-hour play session. The study subjects were also assessed for autism severity on the Childhood Autism Rating Scale and for a proxy for cognitive abilities via the social quotient (SQ) on the Vineland Social Maturity Scale. Subjects received a clinical best estimate diagnosis for Epilepsy, ASD and for associated comorbidities.

Analysis: (1) To determine if domain scores differed between groups, an ANCOVA testing for main effects of subject diagnostic group were employed, adjusting for age, sex and SQ. (2) Robust linear regression was used to predict motor, language and cognitive scores from other domain scores, autism severity score, age, sex, SQ, socio-economic status(SES), comorbidity and presence/absence of regression, by groups.

Results: Across groups, subjects did not differ by age, sex, SES, SQ scores, regression and co-morbidities (Table-1). ASD+Epi had significantly higher autism severity (t=3.42,p=0.001)

Only FM, RL, EL, Cognitive and Emotional skills were significantly different between groups (F = 12.17,9.22,7.4,4.10,6.58 and p=<0.001,0.037,0.036,0.001,0.041 respectively). Further, comparing different developmental domains within a group, EL and Social were most affected in comparison to e.g. motor domains (Fig-1A, 1B-for varying autism severity). Mean total ratio scores were lower than optimal of 1 indicating clear developmental nature of the disorder (Fig-1A). All domain scores were significantly negatively correlated with Autism severity scores but not for group*severity interaction - ranging from: EL-F=18.68,p<0.001 to GM-F=5.83,p< 0.007 (Fig-1C).

Cognitive scores predicted GM and FM skills in both groups (GM-ASD:b=0.594,p=<0.0001; GM-ASD+Epi:b=0.979,p=0.004; FM-ASD:b=0.667,p=0.001; FM-ASD+Epi:b=1.236,p=0.043). Age, autism severity, Social, RL-EL differences, Motor (b=0.002,-0.008,0.459,0.643,0.490; p=0.0285,0.001,0.001,<0.0001, <0.0001 respectively) predicted RL skills in the ASD group. RL-EL differences (b=0.467,p=0.03) and motor (b=0.452,p=0.006) predicted RL in the ASD+Epi group. Model convergence was not achieved for Cognitive Scores.

Conclusions: All developmental domains were affected in both groups on the CDDC, with poorer scores in the ASD+Epilepsy group. The profiles obtained using this checklist and domain specific predictors, help streamline current practices in India of providing intervention within the developmental model as it is eminently suitable to monitor progress in intervention/therapy.

232 **116.232** Early Intervention: Spanish-Speaking Mothers' Experiences with Esdm

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Background: After young children receive a diagnosis of Autism Spectrum Disorder (ASD), providers recommend that parents seek intervention services to support their child's language, social, and play skills. Often parent-mediated intervention programs utilizing evidence-based developmental and behavioral strategies, such as the Early Start Denver Model (ESDM), are provided. Currently, little is known about the experiences of non-English speaking families who participate in parent-mediated intervention. Given that Spanish-speaking Latino families represent 38 percent of families living in the United States (Krogstad & Gonzalez-Barrera, 2015), understanding their perceptions, views, and beliefs about early intervention services can ultimately help improve the delivery of this intervention and increase the relevance to their needs.
Objectives: To learn about Spanish-speaking mothers' views, perceptions, and beliefs about the impact of parent coaching in the strategies of ESDM on parents, their child, and their family.

Methods: Nine Spanish-speaking families were invited to participate in a semi-structured interview about their experiences being coached to use the strategies of ESDM (Rogers & Dawson, 2010) over 12 sessions. Notably, these intervention sessions were completed with English-speaking ESDM certified therapists with the assistance of a Spanish language interpreter. The semi-structured interview in Spanish included questions to obtain information about the impact of this ESDM on parents, their child, and their family. For this sample, 6 mothers with a child with ASD and 1 family with a child with Rett Syndrome agreed to participate (two families declined to participate because they did not have time or were not interested). Whereas children's average chronological age was 45 months (range: 24-65) when they started ESDM, children's average chronological age was 62 months (range: 45-71 months) at the time of the parent interview.

Results: Using a coding, consensus, and comparison methodology (Wills et.al., 1990) to analyze the interviews, three general themes emerged. First, mothers reported learning a great deal about ASD in general through their participation in the intervention. Second, mothers indicated seeing positive effects of ESDM on their child's development, including better social, play, and language skills. Finally, mothers reported positive effects on themselves, such as increased patience and emotional regulation during child interactions because they understood their child's development and ASD better.

Conclusions: These themes suggest that Spanish-speaking families' experiences were generally positive. They perceived improvement in their child's development and their own understanding of ASD, which in turn helped them to better cope with raising a child with ASD. Clinically, although it is encouraging that families perceived benefits from this intervention provided by English-speaking providers, it is not known whether there would be greater perceived benefits with a Spanish-speaking provider. Also, given that families from diverse backgrounds tend to receive fewer intervention services than English-Speaking families, future research is needed to improve access to early interventions.

233 **116.233** Evaluating a Training to Improve Autism Knowledge and Stigma in Kenya

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Background: Autism resources remain scarce in Kenya (Riccio, 2011). In one of the only prior studies about autism in Kenya, parents and educators reported experiencing stigma and misconceptions about autism (e.g., caused by witchcraft) and pronounced challenges accessing care (Gona et al., 2015). Although autism affects people at similar rates globally (Elsabbagh et al., 2012), services are far from equally distributed (Hahler & Elsabbagh, 2015). Inequalities in access to care are sustained by financial and geographical barriers, such as lack of governmental support and a paucity of information and trained professionals, and cultural differences, including stigma. A central strategy recommended by the WHO (2013) to address inequalities is training "non-specialists" to provide care and promote understanding. In regions with insufficient infrastructure, family members often bear the full responsibility for educating autistic individuals and lead the way in developing infrastructure (Feinstein, 2010). Trainings have the potential to begin to address global disparities in access to care by empowering the people who are already caring for autistic individuals in low-resource areas (Brezis et al., 2015; Harrison et al., 2016; Tilahun et al., 2017).
Objectives: We evaluated if participation in an autism training was associated with increased autism knowledge and decreased stigma among parents, professionals, and students in Kenya.

Methods: In collaboration with the Kenya Autism Alliance and autistic college students, we adapted a training, previous iterations of which have been associated with improved knowledge and/or stigma among internationally (Gillespie-Lynch et al., 2015; Obeid et al., 2015; Someki et al., 2018). We delivered two half-day long trainings in Nairobi and Mombasa. Ninety-eight people attended the trainings, 89 answered optional pre- and post-tests for gift cards, 74 (34% parents, 37% educators) provided complete data. We adapted two knowledge measures, Stone's Autism Survey and Harrison's ASK-Q, to address strengths and challenges and align with the cultural context. We measured stigma with a social distance scale. Nine open-ended questions assessed access to care and personal/community conceptions of autism.

Results: Parents and educators demonstrated higher pre-test knowledge than others (*p*s < .03). Pre-test knowledge was high for both measures (*M* = 45.14, Range 13-65; *M* = 18.85, Range 0-22). Knowledge improved with training across measures (*p*s < .003). No group differences or changes in stigma were observed (*p*s > .56). Pre-test stigma was lower (M = 9.12; Range = 6-24) than stigma reported by college students in the US (*M* = 11.41), Lebanon (*M* = 12.94) and Japan (*M* = 15.65) who completed assessments online.

Conclusions: Participation in training was associated with improved autism knowledge among participants in two cities in Kenya who entered the training unexpectedly (given limited local resources) well-informed. In open-ended responses/discussions, parents described experiencing isolation, stigma, and lack of support and described some community members selling their farms to send children to India for STEM cell treatment, which is not evidence-based (Knoepfler, 2018). Findings highlight the potential of training while demonstrating that parents and educators in Kenya entered training well-informed. Autism trainings for low-resource regions should build on local knowledge and networks.

234 **116.234** Exploring the Acceptability and Feasibility of a Mobile Assessment Platform: START (Screening Tools for Autism Risk Using Technology)

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Background: Paucities of trained specialists and low community awareness mean that most children with autism spectrum disorders (ASD) in low- and middle-income countries (LMIC) do not receive timely diagnosis. Simultaneously, expensive proprietary diagnostic measures obstruct the dissemination of gold-standard tools in LMIC. In such settings, a digital application administered by non-specialist workers (NSW) to screen for ASD could facilitate early identification, enabling timely intervention.
Objectives: To explore acceptability to families, and feasibility in the hands of NSWs of START (Screening Tools for Autism Risk using Technology), a mobile platform for assessing multiple domains of neurodevelopment which could eventually be used to screen for autism and other neurodevelopmental disorders in in household settings.

Methods: START, an Android application, incorporates six tasks adapted from those used in laboratory settings. Four gamified tasks have been designed to capture metrics of social motivation, sensory interest and fine motor ability. Tablet-based eye tracking captures low-resolution gaze data for measures of preferential looking and attentional disengagement. The app also includes questionnaires and video recording of parent-child interaction. NSWs were provided a two-day classroom training and practice on START administration. Following this they conducted assessments in Delhi, India with children aged 2-7 years; typically developing (TD) N=40, clinically diagnosed ASD N=40 and intellectual disability (ID) N=40. A researcher accompanying each worker documented details of assessment process and household environment using observational checklists. Acceptability and feasibility of household assessments were explored by interviews with parents of children assessed, NSWs and the researcher.

Results: With minimal training, NSWs having no prior experience with tablet computers or child mental health were comfortable using the START app and able to independently carry out assessments. Lighting conditions for capture of eye tracking data were adequate in 98% of households. A table-chair arrangement was available in only 6%. Other settings included tablet placement on bed (56%), floor (22%) and other objects, e.g., stairs, stool (16%). Although there were some distractions during the assessment (e.g., 10% interruptions from other siblings/family members), these did not interfere with the assessment process. None of the families had tablet computers but majority owned smartphones with which children were familiar. When shown the tablet, all children were interested and rapport typically was established within ten minutes (99% of sample). Compared to 94% of children who completed all START tasks in the TD group, completion rates were lower in the atypical groups (40% ASD and 50% ID). Child factors such as loss of interest were the main reason for varying task completion rates; this observation was corroborated by experience of NSWs who felt typically developing children engaged more readily throughout the assessment. Parents were at ease with the use of tablet-based technology and duration of the household visit, and supportive of assessments' being conducted at home where their child was comfortable.

Conclusions: The ability of NSWs to deliver START in LMIC household settings and START's acceptability to families offer potential for scaling up as part of regular community health assessments.

235 **116.235** Extending the Reach of Behavior Analytic Intervention to India: A Preliminary Investigation of a Training Manual for Teaching Behavioral Skills to Parents and Service Providers

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Background:

For decades, addressing the challenging behavior of individuals with developmental disabilities has involved a functional approach. Interventions such as functional analyses, differential reinforcement and non-contingent reinforcement have been replicated, extended and discussed across hundreds of studies. However, most research on these procedures, their efficacy, and their adoption has been developed and conducted in North American settings. To maximize the outcomes and generality of these practices across populations research must be conducted cross-culturally and cross-linguistically.

Objectives: The present study sought to replicate and extend functional assessment training procedures in a few key ways. First, we assessed our training procedures with an Indian population of parents and professionals including lower-resourced families that often experience barriers to participation in research. Second, we included clear descriptions of the cultural adaptations made to the training program including those involving language, the trainer, the structure, and content of delivery. Specifically, the purpose of the present study was to examine the effects of face-to-face training and the function based behavioral assessment and interventions (FBAI) manual on teaching behavior analytic perspectives and skills used to assess and treat problem behavior.

Methods:

We employed a waitlist control group using a quasi-experimental cross-over design to establish repeated measures and replicate the effect of the intervention across two groups. Forty-six individuals (including parents of children with disabilities and professionals involved with such children) participated in the study and were allocated either to an immediate treatment (n=22) or a waitlist control (n=24) group. We evaluated the outcomes directly targeted by the content of the manual (knowledge test), surveyed the participants' self-reported use of specific evidence-based strategies (Participant Approach to Function based Intervention – Survey; PAFIS), and assessed the social validity of the training procedure.

Results: No significant differences ($p = 0.29$) were found between the groups in the pre-training knowledge test and PAFIS administration using an independent samples t-test. A significant difference in the increase in scores obtained in the pre-training and post-training knowledge test ($p<0.0001$) and PAFIS ($p<0.0001$) was found in both groups. In the social validity survey conducted after the training, all participants either agreed or strongly agreed that the training was an acceptable way to acquire the skills necessary to address problem behavior.

Conclusions:

The results obtained replicated those of prior studies that have shown that the education of parents and service providers is an effective way to support the management of problem behavior in children with a developmental disability. In regions such as India, where unsubstantiated treatments are often practiced, and several barriers exist to accessing behavior analytic intervention, the present study produced successful outcomes in the education and training of parents and service providers. Although the training produced positive outcomes, more support is likely needed to maintain impactful outcomes at high integrity, over time. An outreach strategy for international dissemination will likely be most successful in collaboration with a culturally-responsive training program like the one described herein.

236 **116.236** Familial History, Pre- and Post-Natal Conditions and Observed Phenotype - Case Studies of Some Individuals with ASD

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Background:

The African autism population is one of the most understudied and often underrepresented globally. The unavailability of sufficient data on this population has impaired much progress in autism research in Africa. This is partly due to the little awareness of the disorder among the general public as well as public stigmatization/discrimination and non-inclusion of with autism and special needs as a whole. Also, partly due to the limited participation of affected families/families of interest in research studies and surveys.

Objectives:

The present study aimed to acquire background data of individuals with ASD directly form affected parent/guardian.

Methods:

The study utilized a direct one-on-one interview of consented participants using a researcher designed structured questionnaire. The interview questionnaire consists of 84 semi-structured questions divided into seven sections highlighting data on Sociodemographic, Diagnosis, Family history, Pre-natal and Post-natal, Few months and above, and Treatment. The previously designed, Autism Phenotype Questionnaire (APQ) was also administered to consented participants. All participants were requited from the Neuro-paediatric clinic of University of Lagos Teaching Hospital (LUTH) and the Child and Adolescent Unit of the Federal Neuro-psychiatric clinic, Oshodi Annex Lagos. Statistical analyses were done using IBM SPSS version 20.

Results:

A total of twenty-seven (27) parents (mothers) and guardian consented to the study. Observed mean age was 7.96±4.33 years with an age range of 2-19 years and male: female ratio of 1.7:1. A total of 92.59% (25/27) of the cases had other unaffected siblings, three of whom were unaffected twins. Also, 25 0f the 27 cases (92.59%) had been appropriately diagnosed with 76% (19) having other co-morbid diagnosis. Seizure disorder was the most observed co-morbid disorder (12; 63.16%), followed by ADHD (6; 31.58%), others include developmental delay and Cerebral Palsy (CP). All pregnancies were carried to term and uneventful with the exception of a case where the gestation period was for over 10 months and two cases where the mothers had malaria during pregnancy. The overall mean birth weight was 3.33±0.61 years. About 80% of cases could respond to their names and perform simple tasks such as turning on and off the TV. In over 80% of the cases, loss of speech and hyperactivity/aggression was the main concern, others include lack of responsiveness to environment and tantrums. In 74.07% (20) of the cases combined intervention of pharmacological and non-pharmacological (therapies) was employed in the management of affected individuals. Medications such as, Carbamizine, Tagretol, Neurovites, Omega 3 were the most commonly prescribed alongside, speech, occupational therapies and physiotherapy.

Conclusions:

More could still be learned through participation of families in research studies. Public sensitization and inclusion of stakeholders in future

research studies will go a long way in bridging the gap of the African autism population data.

237 **116.237** Prevalence of Epilepsy in a Large Cohort of Children Diagnosed with Autistic Spectrum Disorder (ASD) in Tripoli, Libya Hospital-Based Study

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Background: The knowledge about possible relationships between ASD and epilepsy is well known.There is insufficient information about the clinical characteristics of epilepsy among children diagnosed with ASD. The term 'seizure' is used to describe paroxysmal, stereotyped, relatively brief interruptions of ongoing behavior, associated with electrographic seizure patterns. 'Electrographic' means when seizures are evident on an EEG monitor.

Objectives: The aim of this study was to investigate the prevalence and characteristics of epilepsy in a large, unselected cohort of children with ASD in Tripoli, Libya.

Methods: We conducted a retrospective review of 442 children with ASD who were evaluated in our neurodevelopment clinic between the years 2012 and 2016 for epilepsy. We compared the history of epileptic activity in these children with the results of EEG. We compared our data with data from other studies in a large general pediatric population.

Results: Of children with ASD (age 4–14 years; 80% males); 10 (2.3%) had active epilepsy. This is a lower occurrence than expected in the general pediatric population. The majority of our patients had responded easily to AED's and they were more likely to be seizure free (79%) compared to the patients with epilepsy in general pediatric population. The ASD patients with and without epilepsy did not differ regarding age, gender. The patients had been diagnosed with epilepsy on average 1.5 years before the ASD assessment. All patients with epilepsy were treated with sodium valproate (SVP) and initial response to SVP was achieved in 85%.

Conclusions: The epilepsy diagnosis preceded the ASD diagnosis, and was found in a significantly lower rate than would be expected in the general pediatric population. The majority of patients had mild epilepsy. All cases with epilepsy and ASD were treated with SVP, with initial response achieved in 86%.

238 **116.238** Satisfaction with the Diagnostic Process of Autism Spectrum Disorder: Experiences of Parents in India

ABSTRACT WITHDRAWN

Background:

There is a paucity of research regarding the experiences of parents receiving diagnostic evaluations for autism spectrum disorders (ASD) from developing countries, and even fewer studies examining parental satisfaction with the diagnostic process. Parental satisfaction with the diagnostic process may determine how families accept the diagnosis, proceed with the treatment for their child, and develop relationships with service providers.

Objectives:

To examine the barriers to early identification of autism and the factors influencing parental satisfaction with the diagnostic process.

Methods:

85 children with a diagnosis of ASD, as per the DSM 5 criteria, aged 2 to 12 years were recruited from the Department of Pediatrics of a tertiary care hospital in North India. The exclusion criterion was presence of a comorbid medical diagnosis. An open ended parent questionnaire was used to elicit information regarding parental concerns about child's behavior and development, details of professionals consulted, investigations requested, diagnosis given, treatments suggested, and the time taken to get a formal diagnosis. Parents were asked to report their level of satisfaction, on a 3-point scale, with the diagnostic evaluation process. Previous medical records were used to corroborate parental reports. The study was approved by the ethics committee of the Institute.

Results: Parents usually waited 7 months from the time when they first had concerns about their child's development and seeking professional help. On average, parents consulted a professional when their child was 2.72 years (SD=1.47). Parents consulted 3.60 professionals before getting an ASD diagnosis and the most frequent professional consulted was a pediatrician (69%) followed by a speech and language therapist (11%). The delay between initial parental concern and the child receiving a formal diagnosis of ASD was 2.68 years (SD=2.02). A significant time lapse of 1.96 years (SD=1.34) between age at first consultation and final diagnosis was also found. Surprisingly, no decrease in the time taken to get a diagnosis of ASD from a previously published study in India was found (Daley, 2004). The most common misdiagnosis was attention deficit hyperactivity disorder (ADHD) followed by developmental delay. Majority (55%) of the parents reported dissatisfaction with the process of getting a diagnosis of ASD and were much less likely to be satisfied if they had been prescribed medications (χ^2= 5.28, p=.022), consulted multiple professionals (χ^2= 25.7, p=.0001), and had been advised several investigations (χ^2= 4.10, p=043). Multiple regression analysis revealed that consulting multiple professionals emerged as the only significant predictor (F= 35.80, P=.0001) and it explained 30% of the variance in overall satisfaction level of parents.

Conclusions:

Obtaining a diagnosis of ASD in India continues to be fraught with delays, multiple visits to health professionals, medical investigations, prescriptions, and therapies. The prolonged diagnostic process not only delays initiation of appropriate interventions but is also associated with feelings of frustration and dissatisfaction among the caregivers.

239 **116.239** Show Me the Money! a Portfolio Analysis of Autism Research Funding in Australia from 2008 - 2017

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Background:

Recent work by Pellicano, Dinsmore, and Charman (2014) examined the allocation of autism research funding across research topics in the United Kingdom (UK), and found that the distribution of investment did not align with community priorities for research. Similar projects (Daniels et al.,

2018) have examined autism research funding in the UK, United States, and Canada, and have consistently found disproportionate investment in biological discovery, while topics of priority to the autistic community (such as services and lifespan issues) receive comparatively little funding. In Australia, autism research has historically received funding primarily from the Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC). However, in 2013, the Cooperative Research Centre for Living with Autism (Autism CRC) was founded as the world's first national, cooperative research effort focused on autism. With a stated aim to empower autistic people through collaborative and inclusive research, the Autism CRC has the potential to change the landscape of autism research funding in Australia.

Objectives:

This study aimed to examine the distribution of autism research funding in Australia across research topics, using the questions and corresponding research areas outlined in the Interagency Autism Coordinating Committee (IACC) *Strategic Plan*. Specifically, we aimed to determine whether the pattern of research funding in Australia is similar to (or different from) the pattern of funding found in other countries, and to identify whether the establishment of the Autism CRC is associated with a change in the pattern of autism research funding in Australia.

Methods:

Data were gathered on research grants relevant to autism awarded from 2008 to 2017. A total of 128 relevant grants were identified. Each grant was coded independently by both authors, using the IACC *Strategic Plan* questions and research areas, with high agreement (89%). In cases where authors disagreed, consensus was reached through discussion. Funding patterns were then examined for the five years prior to the establishment of the Autism CRC (2008 – 2012) and the first five years of Autism CRC operation (2013 – 2017).

Results:

Preliminary findings indicate that, in the period 2008 – 2012, more than $22 million was invested in autism research in Australia. As shown in Figure 1, approximately 65% of funding was directed towards biological discovery, with no funding invested in autism research infrastructure or lifespan issues. In the period 2013 – 2017, more than $40 million was invested in autism research. As shown in Figure 2, research funding was more evenly distributed during this period.

Conclusions:

The distribution of autism research funding in Australia is similar to the US, the UK, and Canada, with a large proportion of funding directed to biological discovery. With the establishment of the Autism CRC in 2013, there has been a significant shift both in the extent and nature of funding for autism research. Further work is needed in order to bring research funding more into line with community priorities, to ensure that funds are directed to areas where they are most needed and can make the most impact.

240 **116.240** Social Communicative and Motor Competence in an Epidemiological Sample of Rural Ugandan Children.

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Background: Social communicative skills in early childhood have been shown to be influenced by multiple genetic and socio-cultural factors. Cultural factors such as childrearing practices have been cited in the literature as plausible explanations for the differences in developmental trajectories (e.g. motor, language, social and emotional skills etc.) observed among infants from diverse cultural backgrounds. Thus, environmental variations and differences in children's abilities may affect social emotional, language abilities, learning and health outcomes. It has been observed that school-aged children with movement coordination difficulties experience social interaction challenges and vice versa. However, less is understood regarding the co-occurrence of social communication and motor delays among epidemiological samples of preschool-age children , particularly in low-and middle-income countries. Few studies have examined social communicative skills and motor ability among preschool age children in resource-limited settings. Determining whether deficits in social communication and motor development co-occur during early childhood may help to classify behavioural phenotypes and to identify appropriate interventions to address specific problems.

Objectives: The purpose of this study was to determine the proportion of children with delayed motor abilities who demonstrate co-occurring social communication delays among an epidemiological sample of rural preschool age Ugandan children.

Methods: We conducted a population-representative survey of adults aged 18 years and older who lived in the Iganga-Mayuge Health and Demographic Surveillance Site. Respondents who identified as being a caregiver of a child aged 36-59 months were eligible for the study. Participants children were assessed using UNICEF's Early Childhood Development (ECD) questionnaire. Descriptive statistics were used to determine the base rate of children with potential motor and social communication delays.

Results: From November 6, 2017 to June 20, 2018, we enrolled 720 (360 boys, 360 girls) Ugandan children with an average age of [46.9±6.7 months], Out of the 720 children who were screened, 4.2% [n=30, mean age 45.4 months SD (7.7)] had social interaction challenges, 6.4% [n=46, mean age 46.7 months SD (6.9)] demonstrated receptive language difficulties and 7.4% [n=53, mean age 46.6 months SD (6.7)] were identified as having motor delays. Of those judged to have impaired social skills, 16.7% demonstrated receptive language difficulties and 6.7% also exhibited motor problems.

Conclusions: Findings indicate socio-emotional, receptive language and motor problems tend to co-occur among children during the early stages of development. Integrated screening and surveillance infrastructure need to be developed within the Ugandan low-income context to facilitate early identification, subtyping and intervention.

241 **116.241** Students with Autism in the First Person. Points of VIEW of Students with ASD and Their Families on the Inclusive Educational Experience in Mainstream Schools in the Province of Misiones, Argentina.

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Background: Misiones is a province in the northeast of the Argentine. Its population is diverse and with great cultural contributions has descendants of local Guarani aboriginal communities and European immigration. At present there are no epidemiological studies of ASD in the region or data on health and education services for people with ASD and their families.Our research focuses on the perception of students with ASD about the support devices they have during the inclusion process in mainstream schools and how parents of students with ASD perceive the supports their children receive, their scope and limitations.
Objectives: Inquire about the factors that favor/ hinder learning in students with ASD. Explore what type of adjustments may be necessary to promote the learning of students with ASD in mainstream school.Explore the level of involvement and participation of parents and your knowledge about support needs of children.

Methods: It is an exploratory investigation, with a descriptive framework.Participants:30 students (8 females, 22 males) with ASD, with verbal language, between 6 and 13 years old (from first grade of primary school to first year of secondary school) 30 parents of students with ASD. (22 mothers and 8 fathers).Two types of surveys were designed, one for parents and another for students, with accessible language.The surveys were administered in a personal way to each student who attends school with a support teacher (ST).

Results: Only 25% of the students attend public school. 75% attend private schools. This may be showing the challenges of public policies to address inclusive education as set out in the UN CRPD. Taking into account the economic difficulties of families in the region, it is very difficult to find public schools that provide the necessary support for inclusion.The students themselves say that they need ST to carry out school activities, to help them pay attention and to make the contents easier. Some state that they also help them regulate their behavior problems.70% of students consider that they need a lot of help from ST.In the present survey, very few students (9%) are included in secondary school. What happens when children grow up?40% of parent consider the role of ST favors the student's relationship with his peers, provides help and guidance to teachers and intervenes with specific support in learning.

Conclusions: This research aims to bring relevant information about the perception of students with ASD in mainstream schools about their support needs. It is necessary to accompany this process of transformation in the region with concrete data, given that the support devices need training of human resources and budgets adjusted to the needs of the education system.On the other hand, the province of Misiones as an Argentine border with Latin American countries such as Brazil and Paraguay, with common socio-cultural patterns, can exchange experiences with them and contribute to the construction of inclusive public policies in the region.Our challenge is to minimize barriers and increase opportunities for inclusion in the community for people with ASD in low and middle income countries.

242 **116.242** Teacher Training on Autism Spectrum Disorders in Tanzania. Results from a Three Day Workshop

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Background: Autism Spectrum Disorder (ASD) is a worldwide phenomenon. There are large disparities in provision of service for children with ASD around the world. In Africa, many countries have small number of professionals dedicated to working with children with ASD. Recommendations to address this include increased engagement with community stakeholders, increase in access to information about ASD, and specific trainings on ASD in community settings.
Objectives: Participants will learn about the successful delivery of a training to increase teachers' basic knowledge about ASD in an urban setting in Tanzania.

Methods: Participants included special education teachers from schools in Mwanza, Tanzania. They completed a three-day ASD training workshop in July 2018. The training was hosted by the Organization for Medical and Psychological Assistance for Children Overseas (OMPACO), a United States based social benefit organization who has conducted trainings in Tanzania since 2011. Of the 39 participants recruited, 35 (17 males and 17 females; M_{age} = 40.29, SD_{age} = 8.50) successfully completed the study. Training materials were developed by OMPACO clinicians who used PowerPoint presentations and hands-on teaching activities. All information was translated into Swahili for participants. To establish baseline autism knowledge, participants received a pre-test measure, a translated version of the 49-item Autism Stigma and Knowledge questionnaire (Harrison et al., 2017). At the end of the training, participants were re-administered the measure. Total knowledge scores on the pre- and post-test measures were analyzed to examine whether the training led to gains in autism knowledge.

Results: A paired *t*-test revealed a significant increase in knowledge scores from the pre- (M = 36.09, SD = 3.80) to post-test (M = 39.63, SD = 2.52), $t(34) = 5.12$, $p < .001$. Cohen's effect size value indicated that this was a large effect, $d = .86$, indicating that the training was effective at improving autism knowledge in the participants. An exploratory mixed ANOVA with gender as a between-subjects factor did not reveal any effects of gender on knowledge scores (Fs < 1). In addition, pre-test scores, post-test scores, and difference scores were not significantly correlated with participant age or with the number of students (with ASD, with an intellectual disability, or combined) that the participants were currently teaching.

Conclusions: The current findings demonstrate a significant gain in autism knowledge, as measured by the questionnaire, at the end of the training workshop for the teachers who attended. This improvement in knowledge did not appear to be related to participant gender or age, nor the number of students with ASD or intellectual disability the teachers were currently instructing. Importantly, these findings support the development of a professional development program on the topic of autism for teachers can be provided in an urban center in Tanzania, and highlights the need for implementing additional training or retention methods to improve overall basic knowledge of ASD.

Harrison, A.J., Bradshaw, L.P., Naqvi, N.C., Paff, M.L.,& Campbell, J.M (2017). Development and Psychometric Evaluation of the Autism Stigma and Knowledge Questionnaire (ASK-Q). *Journal of Autism and Development Disabilities.* doi: 10.1007/s10803-017-3242-x

243 **116.243** The Current Situation and Outlook of Autism in Mainland China

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Background: In China, there are more than ten million (10,000,000) people on the autism spectrum as estimated by the prevalence of 1% in the whole population of one point three billion people. It is an extremely large population but little is known about their living conditions.
Objectives: The present study provides a systematic review of 8 perspectives of the current situations related to autism spectrum disorders (ASD) in mainland China, including prevalence, diagnosis, intervention, education, employment, family issues, research, and law.

Methods: Literature review

Results: Results from a review of 26 epidemiological studies from 2000 to 2016 showed that the average prevalence rate was 0.30% (*SD* = 0.32). Diagnosis were mainly made by pediatricians using translated tools, such as DSM-5. However, there were very few of them certified to use ADOS, ADI-R or other established diagnosing and assessment instruments. With regard to intervention, there were around 2000 service providers in mainland. Among the 47 interviewed organizations, only 37% of intervention approaches they used were established and evidence-based. According to a survey of 1202 organizations, 92% of them provided rehabilitation and education service while only 8% of them provided employment service and adult care service. School-aged children with ASD had five options of education placements, including autism schools, special schools for children with mental retardation, and other three types of placements in mainstream schools. Our review also analyzed the financial burden of families with a child having ASD. Besides, number of publications in the field of autism were analyzed by year from 2000 to 2015. We found a consistent growing tendency which implied that autism is also becoming a more and more popular research topic in China. Lastly, we have reviewed the development of laws related to individuals with ASD and its limitations.

Conclusions: Based on the systematic review of the current state of ASD in China, suggestions of the future development in diagnosis, vocational education and support, and training professionals were proposed.

244 **116.244** The Development of a Comprehensive Autism Spectrum Disorder Support Model (A-Support Model)

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Background: More than 10 million people are diagnosed with Autism Spectrum Disorder (ASD) in mainland China as estimated. However, no current medical interventions demonstrate clear benefit for core symptoms in ASDs. It is a life-long disorder that requires training and support throughout the whole life. However, there is no comprehensive support model for ASD in mainland China. Teachers and therapists lack guidance on systematic assessments, interventions, and supports to children with ASD.

Objectives: The current study aims at conceiving a comprehensive Autism Spectrum Disorder Support Model (A-Support Model) from theory to practice in five perspectives: theoretical framework, teamwork, assessment, intervention, and support.

Methods: Literature Review

Results: The theoretical framework provides a comprehensive understanding of the underlying mechanism of ASD. It was developed based on the neurological and behavioral research findings from multiple domains, including sensation and perception, thinking and learning style, memory, multiple intelligence and exceptional abilities, emotion and personality development, and influence of comorbidities. To provide comprehensive assessment, intervention, and support, transdisciplinary collaboration was recommended and the primary service providers (PSP) approach was discussed in the context of providing training and support. The rationale of developing a set of ecological assessment was discussed. It guides the selection of appropriate assessment tools of different domains across ages and levels, and the procedure of transferring the result of assessment to the development of individual support plan. As for intervention, technical and theoretical eclecticism were reviewed to serve as the theoretical guidance for the selection of evidence-based approaches according to the goals and individual's characteristics. Ecological support and longitudinal support were both introduced. The model demonstrates a focus on longitudinal support, especially on identifying, developing and transforming individual's strength to vocational skills.

Conclusions: The A-support Model was developed as a framework for guiding the assessment, intervention, and support for individuals with ASD.

245 **116.245** The Implementation Challenges of EARLY and Intensive Therapy in the Brazilian Context

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Background: Early intervention can be deeply beneficial for autism spectrum disorder (ASD). According to literature, good prognosis is related to early, specialized and intensive intervention. However, response to programs is variable. Besides that, it is important to understand the impacts of interventions models across and within cultures. We intend to present a case study discussing Brazilian social and cultural aspects, which has appeared during the implementation of an Intervention program based on the principles of Early Start Denver Model (ESDM). For this process, culture adaptation were needed in many aspects. For exemple: it was impossible for the team to offer therapy sessions at the family residence. The therapy took place at a school clinic, situated within a Pshycology Departament of an important Brazilian university (Universidade Federal de Minas Gerais); another point was that we didn't have all the needed professionals within the interdisciplinary team, so the children had to do occupacional therapy and speech therapy by side.

Objectives: Evaluate Brazilian social and cultural aspects that interfered in implementation of an early Intervention program.The most important aspect, which we aim to discuss here, is the difficulty to implement the recommended intensity of the therapy proposed, and the consequences of failing to do so.

Methods: The child started the intervention at the age of 28 months old and continued the treatment for 9 months long. We provided access to 9 to 12 hours of therapy weekly plus parental coaching (one hour per week). We evaluated the daily progress data and ESDM checklists curricullum.

By evaluating the data collected, in a daily progress record, it was possible to identify variables that interfered in the better progress of the intervention. In the beginning of the treatment, the child attended 90% of the sessions . During this period, 94% of the objectives were reached (11 of 13 objectives). However, subsequently, with a slight reduction in the attendance rate, the objectives achievement dropped down to 34%. In the last quarter, with the lowest attendance throughout the intervention (only 58% in the sessions), the child acquired less than 1% of the objectives (1 out of 19 objetives).

Results: Therefore, there is a direct relationship between the number of objectives reached and the intensity of the intervention . The low attendance was due to an increase of family vulnerability, as they are socialeconomically underprivilleged. In Brazilian's public health system, there is an omission on therapeutic support benefits. Besides that, due to the child's parent divorce, plus an ASD diagnosis of their second child, parental stress got higher. Macrossocial aspects (high vulnerability) that can affect the micro-social context of the family (divorce).We suggest the relevance of intervention intensity, which can only be achieved through public policies that could guarantee the necessary support to families.

Conclusions: More extensive studies on the importance of the support network for families are needed, especially considering the role of the

state in this scenario. New studies, with better analyses of macro-microssocial variables and considering parental needs, will be needed to figure out the issue.

246 **116.246** Training Promotores De SALUD to Increase Awareness of Autism Spectrum Disorder in Latino Communities in Cincinnati, OH

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Background: Research indicates that Latino children: 1) receive an Autism Spectrum Disorder (ASD) diagnosis less often and 2-2.5 years later than non-Hispanic Whites, 2) are more likely to be diagnosed with severe ASD, and 3) have more unmet service needs. Thus, there is a need for effective, affordable, and culturally appropriate interventions for Latino children and their families to increase ASD knowledge. *Promotores de salud* have been found to be critical participants in prevention, health promotion, and the delivery of care in the Latino community. A *promotores* model used in ASD awareness education has the potential for enhancing healthcare access and earlier ASD identification among Latino children resulting in improved long-term outcomes.

Objectives: To pilot a *promotores de salud* intervention to increase ASD awareness in Latino communities.

Methods: We recruited 8 *promotores* who met the inclusion criteria of being Latino(a), having Spanish as primary language, at least 3rd grade reading level, and possessing leadership qualities identified by their community leaders. The **first aim** of the study was to conduct a *promotores* training on early signs of ASD and resources founded on a curriculum-based manual that was adapted from the *Autism Promotor Manual* (Spanish version/UCLA and Autism Speaks). The investigators tailored it to Cincinnati/Northern Kentucky developmental and community resources. The focus of the 15-hour training was to prepare *promotores* to conduct community outreach and education on developmental milestones, ASD and Developmental Disabilities (DD), parental advocacy, and system navigation. We also used the "Learn the Signs. Act Early" booklet as a reference for the developmental milestones training. The key outcomes of this aim included increased ASD knowledge and acceptability (satisfaction) with the training by *promotores*. The **second aim** was to pilot test an approach to disseminate ASD awareness education by *promotores* teaching other Latino community members. The key outcomes included feasibility (spread of awareness training) and acceptability (satisfaction) with the *promotores* approach, and increase in ASD knowledge by community participants.

Results: For the **first aim**, acceptability of the *promotores* training survey (n=8) indicated high satisfaction with the training and curriculum. Using a 5-point Likert Scale, the majority of the promotores *strongly agreed* with the four survey statements: "the presentation helped me learn better ways to help my children learn and grow"; "the new things I learned were helpful to me"; "after hearing the presentation I want my child to be regularly screened for his/her learning and growing"; and "I would recommend this presentation to others". We used the paired samples t-test and found no significant changes in pre-post ASD knowledge among the 8 *promotores*. For the **second aim**, 120 Latino community members participated in the ASD awareness education and they rated the *promotores* model with high satisfaction (e.g., 100% would recommend this presentation to others) and demonstrated significantly increased pre-post ASD knowledge (p < .01).

Conclusions: Since the *promotores* model was highly acceptable and demonstrated significant increased knowledge in ASD among the Latino community, our next step is to develop a *promotores* "train the trainer" approach to disseminate the ASD knowledge exponentially.

247 **116.247** Transforming the System of Care for Children with Autism in Post-Soviet Kazakhstan

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Background:

Over the past thirty years since the collapse of the Soviet Union,the system of care for children with ASD in Kazakhstan, a post-Soviet state in Central Asia, has been undergoing major restructuring. Autism was not included in the Soviet classification of psychiatric disorders; instead cases of ASD were registered and treated under other names (e.g., oligophrenia, schizophrenia, mental retardation). The Soviet system of care for children with autism was characterized by the dominance of a medical model of disability, in which the institutionalization of children with special needs was the main mode of care provision. The post-Soviet child welfare reforms include the development of community-based care and inclusive education for children with autism.

Objectives:

This study has three main objectives: (a) to map out the transforming system of healthcare, educational, and social services for children with ASD in Kazakhstan; (b) to examine gaps in the provision of healthcare, educational, and social services for children with ASD from the perspectives of family caregivers of different ethnicities; and (c) to identify provincial commonalities and differences in the provision of care for children with ASD.

Methods:

We employ an exploratory qualitative research design using purposive sampling procedures and utilizing two sources of data: (1) 8 focus groups with family caregivers of children with ASD (56 participants in total); (2) 16 in-depth interviews with professional service providers for children with ASD (doctors, psychologists, educators, etc). The study geography includes 6 urban locations in different provinces of Kazakhstan, including two major cities of Astana and Almaty and 4 smaller towns. Focus group data were transcribed and analysed using open coding and axial coding procedures (Charmaz, 2000). Interviews with service providers were analyzed using a framework analysis method (Ritchie & Lewis, 2003).

Results:

This analysis points to the evolving and fragmentary system of governmental and private services for children with ASD. Recently introduced services are often inaccessible or unaffordable, from parents' perspectives. The development of services in small towns is lagging behind the big cities. The lack of agreed upon diagnostic criteria of ASD leads to multiple diagnoses and the delayed detection of ASD. Once a child is diagnosed with ASD, parents are rarely offered professional guidance regarding the planning of care for the child and services available in the community. Furthermore, parents face barriers to accessing special education, while inclusive education programs for children with ASD are insufficient. There

are also barriers to accessing limited public benefits and social programs for families. Better-off families seek private services and pay out of pocket, whereas poor families can only rely on limited public services. Finally, parents with autistic children face stigma and isolation in the community.

Conclusions:

The study points to the gaps in the provision of healthcare, social and educational services for children with ASD and develops policy recommendations. The study also offers important insights into the challenges to the development of care for children with ASD in a post-Soviet context.

248 **116.248** Un Camino Hacia Delante (A "way" forward): A Productive Path for Spanish-Speaking Families

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Background:

One of the fastest growing ASD populations in the United States is the Latino population (Baio et al, 2018), yet several studies have documented that Latino children have less access, lower levels of utilization and worse quality of health care services when compared with White children (Liptak *et al*. 2008; Parish *et al*. 2012). In a study that examined Latino parents' perspectives to barriers to diagnosis, parents listed 3 categories as barriers-community knowledge and perception of ASD, parent and family factors and health care system barriers (Zuckerman et al. 2013b. Magaña et al (2013) along with other studies of Latino families of children with ASD also found that a lack of information in the community was an important factor that created a barrier to service use.

Objectives:

The objective is to provide an exemplar pathway for Spanish-speaking families' to support the learning needs of young children with autism, looking at the quantitative and qualitative impact the pathway.

Methods:

Caregivers who speak Spanish as their primary language and/or identify themselves as Hispanic were offered several options to help support the needs of their children.

As part of a funded research study, primary care practices who serve Spanish-speaking families were asked to screen their patients ages 9 to 20 months with an online screening tool available in both Spanish and English. After completing the screening, families were encouraged to enroll in a web-based portal giving them access to online resources in their primary language. Children with a positive result for autism on the screening were invited to participate in a no-cost diagnostic evaluation.

In addition, a support group for families conducted in Spanish was offered at the center where the evaluations are conducted. This led to a funded study to provide a monthly training program for Latino families led in Spanish by a bilingual SLP on social communication strategies for children with ASD.

Results:

Data will be provided to show the number of families who completed the screening in Spanish, number who accessed the web-based resources, and those who participated in the support group and in the training.

To date 333 families have completed the online screening in Spanish, 132 enrolled in the resource portal. Thirty of the children screened received a positive outcome for autism. We also had an average of 8 to 14 Spanish speaking caregivers attend a monthly parent support group. In addition, 6 Spanish-speaking families enrolled in a study on social communication strategies for their children with ASD. Of the 6 families, 4 of them came in through a community based screener.

Conclusions:

Offering screening, evaluation and support services in the primary language leads to possibly narrowing the diagnostic gap for Latino children with ASD, increasing Latino parental engagement, improving better understanding of ASD, and more focus on seeking EI services. We will examine whether there is an increase in caregiver ability to support and advocate for their child's needs, a decrease in parental stress, and an increase in the confidence to mentor other families.

249 **116.249** Understanding the Stigma Associated with Autism in Older Filipino Communities: A Case Study

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Background: A major disparity currently exists between White and ethnic minority families regarding the identification and diagnosis of ASD. Potential barriers to the identification of autism within these generally underrepresented ethnic communities may include stigma that is associated with ASD and is especially prevalent within the older generations of these communities. Understanding the conceptualizations held by the older generations about ASD may offer additional insight into the unique challenges that ethnic minority families who have children with ASD experience.

Objectives: To understand the experiences of an individual with stigma that she and her son encountered from the older Filipino community.

Methods: The study is a descriptive case study that thematically analyzed qualitative data from a 40-year-old Filipino mother of an 8-year-old boy with an ASD diagnosis. The principal investigator and the interviewee engaged in a video-recorded semi-structured interview that was then transcribed and thematically analyzed using an inductive approach. The interview was coded twice in order to establish interrater reliability, and a member check with the participant was performed for interpretation accuracy.

Results: Three main themes emerged from the interview: stigma, cultural differences, and generational differences. The results indicated that the stigma experienced by the interviewee was related to themes of cultural and generational differences, signifying that stigma may be both a culturally-specific and a generationally-specific phenomenon. Particularly, the interviewee cited a lack of awareness and heightened stigma regarding ASD within older generations and her inability to educate and refute those negative perceptions as a result of the cultural practice of respecting elders. The participant further shared that in order to decrease public stigma regarding ASD in the older Filipino generations, parents must first confront their own perceived stigma about ASD. The results highlight that stigma acts as a prevalent barrier in preventing parents from

seeking services for their children.

Conclusions: The present study offers insight into the experiences of ethnic minority families with stigma in the context of cultural and generational differences. Future studies should include multiple participants to increase the generalizability of the results.

250 **116.250** Visual Attention during Narration in Autism: A Cross-Cultural Study

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Background: Differences in visual attention have been documented in ASD, and are thought to importantly relate to clinical-behavioral features (Frazier et al., 2017). However, most of this work has been conducted in Western countries, where attentional bias toward salient information (particularly social stimuli) has been observed. Cross-cultural investigation is important to evaluate potential environmental/cultural influence on visual attention in ASD. In East Asian cultures, attentional biases toward contextual or less focal information (e.g., making judgements about a character based on the contextual setting) is commonly observed (Nisbett et al., 2001; Kitayama et al., 2003; Blais et al., 2008), similar to the attentional biases reported in ASD in Western cultures. This study investigated cross-cultural differences in visual attentional during narration in ASD across Western (US) and East Asian (Hong Kong; HK) cultures, with the prediction that the ASD-HK group would exhibit similar social attention patterns to Control-HK and ASD-US groups, but both ASD groups would differ significantly from control-US individuals.
Objectives: To characterize the cultural influence on visual attention patterns in ASD.

Methods: US participants included 27 individuals with ASD and 82 controls. Age- and IQ-comparable samples were included from HK (n=37 ASD, n=61 control). Gaze was tracked while participants completed two narrative tasks differing in structure and content (a structured wordless picture-book (PB), and a less structured more emotionally evocative task involving six images selected from the Thematic Apperception Test (TAT) (Murray, 1943)). Proportions of fixations to face, bodies, and setting were recorded, and in the TAT, analyzed across scenes differing in dominance of animate (i.e., face-dominant or body-dominant) vs. contextual scene (i.e., setting) information.

Results: The HK ASD and control groups made more setting fixations compared to both US groups in the structured PB task (*p*s<.01). In the TAT, during setting-dominant images, a hierarchical pattern emerged with the control-US group making the fewest setting fixations compared to control-HK, followed by ASD-US, followed by ASD-HK, who made the greatest number of fixations towards the setting (*p*s<.05). During face-dominant images, the ASD-HK group made fewer face fixations than the ASD-US group (*p*<.05). Finally, in a body-dominant image depicting interacting characters, both control groups made more body fixations than the ASD-HK group (*p*s<.05), and both US groups made more face fixations than the ASD-HK group (*p*s<.05).

Conclusions: Cultural differences in gaze emerged and varied by context. During the more structured task, both HK groups differed in setting fixations from the US groups, but only individuals with ASD (regardless of culture) fixated more towards the setting during the less structured, more emotionally evocative TAT task. The hierarchical pattern that emerged in fixation to setting across cultures by groups suggests an interplay between cultural influence and ASD-status on visual attention that is impacted by narrative structure and emotional content. Further, attention towards faces was reduced across both HK groups, suggests a cultural influence observed particularly in images depicting human interactions characters.

251 **116.251** Vitamin D Deficiency Among Paediatric Patients with Autism in Malaysia

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Background: There is a paucity of studies evaluating vitamin D deficiency and severity of autism. This pilot study determined the prevalence of vitamin D deficiency and insufficiency in paediatric outpatients with autism, under follow up at University of Malaya Medical Centre (UMMC), Kuala Lumpur. This is the first study of its kind involving paediatric patients with autism in South-East Asia.
Objectives: (1) Determine the prevalence of vitamin D deficiency and insufficiency among patients, aged 3 - 16 years, with autism, (2) Compare the severity of autism, as measured via Childhood Autism Rating Scale, 2nd Edition (CARS-2) scores, in the vitamin D deficient, insufficient and sufficient groups, (3) Compare the severity of behavioural symptoms, as determined by Aberrant Behaviour Checklist, 2nd Edition (ABC-2) scores according to vitamin D status.

Methods: All patients diagnosed with autism, who presented to the Developmental Paediatrics Clinic, UMMC, during a 2-month period, commencing in September 2018, were included. Socio-demographic data and information regarding risk factors for vitamin D deficiency were obtained. Risk factors that were assessed included age, sex, skin pigmentation, pubertal status, dietary recall, sunlight exposure, physical activity and past history of non-traumatic fractures. The severity of autism was determined via the CARS-2. The ABC-2 was used to assess behavioural symptoms. Serum levels of 25-hydroxy vitamin D, intact parathyroid hormone, phosphate, calcium and alkaline phosphatase were taken. Renal impairment and liver impairment were excluded. The cut-off for vitamin D deficiency was ≤ 35 nmol/L, insufficiency: 36–49 nmol/L and vitamin D sufficiency: ≥ 50 nmol/L. Patients with vitamin D deficiency were commenced on a 3-month course of cholecalciferol, 1200 IU, daily. Patients in this pilot study have been recruited as part of a larger study (n = 100), whereby CARS-2 and ABC-2 scores pre- and post-treatment will be performed to determine whether treatment of vitamin D deficiency reduces the behavioural symptoms of autism.

Results: There were 25 participants (92% male, 8% female). The mean age of participants was 6 years (71.8 months). The prevalence of vitamin D deficiency was 12%, and 32% had vitamin D insufficiency. The mean CARS-2 score was 37.5 (range: 26 - 46.5). The majority (64%) had moderate-to-severe symptoms of autism. Four (16%) had mild-to-moderate symptoms. Table 1 shows the distribution of patients according to CARS-2 severity and vitamin D status. No significant correlation was found between CARS-2 total raw scores or T-scores and vitamin D status. Negative correlations were found between vitamin D levels and the ABC-2 Irritability subscale score (R = -0.24, p = 0.26) and the ABC-2 Hyperactivity/Noncompliance subscale score (R = -0.19, p = 0.36). However, these did not reach a level of statistical significance.

Conclusions: Despite the availability of year-long sunlight in Malaysia, a significant proportion (44%) of patients with autism in the study were either vitamin D insufficient or deficient. CARS-2 and ABC-2 scores were not significantly correlated with vitamin D levels. A larger sample size will be required, as in the follow up study.

Poster Session
117 - Interventions - Non-pharmacologic - School-Age, Adolescent, Adult
11:30 AM - 1:30 PM - Room: 710

252 **117.252** Adapting Virtual Reality Job-Interview Training for Transition-Age Youth on the Autism Spectrum

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Background: Virtual Reality Job-Interview Training (VR-JIT) is an efficacious Internet-based intervention for adults with severe mental illness (SMI). Evaluations of VR-JIT have shown improved interview skill and access to employment in several cohorts of adults with SMI and with autism spectrum disorders (ASD). VR-JIT trains participants how to fill out job applications and handle job interviews. Trainees receive feedback through in-the-moment nonverbal cues, critiques, and recommendations for improving performance.
Objectives: Our study sought to adapt VR-JIT for transition-age youth with ASD (TAY-ASD) by recruiting TAY-ASD and adult stakeholders to review VR-JIT and provide their feedback on how to optimize its accessibility and acceptability.

Methods: We recruited n=24 TAY-ASD and n=21 adult stakeholders from public and charter schools, transition programs, and community service providers. Participants provided feedback on VR-JIT to enhance its applicability to TAY-ASD. We analyzed data from TAY-ASD and stakeholders, presented their quantitative and qualitative responses to community and scientific advisory boards for review and recommendations, and adapted the intervention design and content.

Results: Our adaptations included adding diversity (gender; race/ethnicity) to the virtual hiring manager; shortening the interview by reducing response options; increasing social storytelling to enhance engagement with VR-JIT core components; adding employment opportunities more relevant to younger workers; reducing the reading level; adding bullet points, voiceover, and imagery/video; and adding new learning goals.

Conclusions: This study presents a rigorous and innovative methodology for adapting VR-JIT to meet the needs of TAY-ASD. We review our engagement with TAY-ASD and stakeholders, and discuss the standardized coding scheme we used to adapt VR-JIT and the usefulness and limitations of employing this methodology in adapting other behavioral interventions.

253 **117.253** Pilot RCT of the Employment Success Intervention: Increasing Vocational Soft Skills in Adults with ASD

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Background:
Longitudinal studies of intellectually able adults with autism have shown consistent and persistent deficits across cognitive, social, and vocational domains, indicating a significant need for effective treatments for these functional disabilities (Howlin, 2000). The cognitive and social skill deficits, "Soft Skills" which predict vocational outcomes, have been identified as major challenges to employment success for these adults (Kautz et al, 2014).

Objectives:

This study tested through a pilot randomized clinical trial a novel, community-based intervention teaching vocational soft skills through the manualized **Su**pported employment, **C**omprehensive **C**ognitive **E**nhancement & **S**ocial **S**kills (SUCCESS) program within public vocational agencies. Multiple outcomes were assessed including cognitive skills, social skills, functioning, employment and satisfaction

Methods:

A total of 39 adults (μ= 25.5 SD=6.01 yrs) participated. The participants were male (80.5%), race/ethnically diverse (44%), average IQ ((μ= 64.6 SD=15.6), 61% receiving Disability Services and 39% on SSI. A total of 16 adults were randomized to the SUCCESS intervention group. The SUCCESS curriculum was delivered weekly for 90minutes via active group participation during a work meeting. Skills taught include executive functioning: attention, learning, memory, prospective memory, cognitive flexibility, problem solving, goal oriented thinking and contextual awareness and social cognition: social conversation (giving and receiving compliments, feedback and help), social relationships, initiations, social media and social networking. Adults in the usual care control group (n=23) received similar level of supportive contacts. Pre and post assessments include a full battery of assessments including 1) cognitive skills: Behavior Rating Inventory of Executive Function- Adult Version (BRIEF-A), DKEFS; 2) social skills: Social Responsiveness Scale-2 (SRS-2), Social Skills Performance Assessment (SSPA); 3) functioning skills Waisman-Adaptive Daily Living (W-ADL) and 4) vocational outcomes of employment: pay rate, hrs worked, type of job. Data was gathered from standardized measures (participant and parent report) and program staff ratings.

Results:

Analyses consisted of calculating Intent-to-treat ANCOVAs (Group) by (Time) Controlling for IQ. Findings reveal significant differences by group on cognitive, social, employment and efficacy measures with medium to large effects on executive functioning (ES=.23- .86) and social functioning (.75-1.31) for the intervention group but no to small improvements for control group (ES=.01-.25) (Refer to Table 1 & Figures 1 & 2). Intervention group had greater improvement with 38% (n=6) participants obtaining employment and 69% (n=11) increasing wages overtime while 0% of control group obtained employment while 3 adults loss jobs. Only 13% (3 adults) increased wages.

Conclusions:

This study demonstrates that a vocational soft skills intervention positively impacts adults with ASD. Adults receiving the intervention were substantially more prepared for the workforce and were employed at higher rates. This job-training program revealed high satisfaction and promise towards vocational success for adults with ASD.

254 **117.254** Identifying and Targeting Priority Skills in Transition Programming for Students on the Autism Spectrum through Multi-Informant Assessment

***K. Hume**, Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, Chapel Hill, NC*

Background: Post-high school outcomes are particularly bleak for students with autism spectrum disorder (ASD). One malleable contributor to post-school outcomes is the quality of the transition plans developed as part of the Individualized Education Plan (IEP). The Secondary School Success Checklist (SSSC) is a new measure developed to allow students across the spectrum to describe their current skill level in transition-related domains as well as rank their priorities for goal setting, thus actively contributing to the transition planning process.
Objectives: This study examines (a) the transition-related skill level of adolescents with ASD as reported by each respondent group, (b) the perceived importance of each skill across respondent group, and (c) the relationships between the rankings of each respondent group. This will provide unique insight into the experiences and self-identified priorities of high school students with ASD, provide guidance for staff and families during the transition planning process, as well as inform intervention development/ implementation to ensure priorities are addressed.

Methods: Data were drawn from a larger ongoing RCT of high school students with ASD. The sample includes 547 adolescents and their parents (mean age= 16.4; mean nonverbal IQ=85.8; mean Vineland=75.8) from 3 states. The student version of the SSSC has 20 items, each which is linked to key items on the teacher and parent versions (105 items). Both sets of items were representative of four key domains: independent behavior, transition, social, and academic.Mean levels of skill performance and importance are reported across domain and informant, and differences between groups and domains were examined. Next, the inter-rater reliability across respondents for skill level and priority scores were conducted, and finally we ran paired sample t-tests to determine which domains were rated as most important by informant group.

Results: The study findings indicate that adolescents rated themselves as higher skilled on SSSC items than did parents or teachers. There were significant differences across the informant groups, with differences on up to 18 of 20 items (adolescent- parent), with low agreement across raters (weighted Cohens kappa= adolescents had very low agreement with both parents,.10 and teachers .11; parents and teachers had slightly higher agreement .20. Although the ratings varied, there was some agreement in the ranking of the highest and lowest rated skills across all three groups. Adolescents consistently had lower percentages on items marked as a priority across skills and informant group; however, even the lowest percentage on the priority ratings from adolescents was close to 70%. Again, though variable, there was agreement across all three groups on the rankings of several of the highest and lowest priority skills.

Conclusions: This is the first study to examine the perceived skill level and importance of transition-related skills among adolescents with ASD, their parents, and teachers. This is the largest current sample of adolescents with ASD (i.e. most recent NLTS2 sample was followed until 2009) and this data provides an important snapshot into student performance of key transition-related skills, providing a profile of both student strengths and needs as reported by multiple informants.

255 **117.255** Self-Determination in Transition-Aged Individuals with Autism Spectrum Disorder

***B. Tomaszewski**[1], L. G. Klinger[2], M. R. Klinger[3], A. F. Berman[4] and C. E. Pugliese[5], (1)Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, Chapel Hill, NC, (2)TEACCH Autism Program; Psychiatry, University of North Carolina, Chapel Hill, NC, (3)UNC TEACCH Autism Program, Chapel Hill, NC, (4)Psychology and Neuroscience, University of North Carolina at Chapel Hill, Chapel Hill, NC, (5)Children's National Health System, Washington, DC*

Background: Self-determination refers to an individual's causal agency in their own lives and is associated with positive post-secondary outcomes in individuals with disabilities and young adults with ASD. Few studies focus on examining self-determination in this population. Identifying predictors of self-determination from multiple perspectives may inform important intervention targets for transition-aged individuals with ASD.
Objectives: The purpose of the current study was to examine associations between autism symptoms, executive function, depression symptoms, and self-determination using parent-report and self-report in transition-aged individuals with ASD.

Methods: Participants included 124 transition-aged individuals with ASD without intellectual disability ages 14-21 (Mean= 17.6 years) drawn from two sites, North Carolina and Washington, D.C. Parents completed questionnaires of autism symptoms using the Social Responsiveness Scale, executive function using the Behavior Rating Inventory of Executive Function (BRIEF) and self-determination using the AIR Self-Determination Scale (AIR-SDS; Wolman et al., 1994). The AIR-SDS parent-report assesses three domains: Ability, Opportunities at Home, and Opportunities at School. The *ability* domain assesses whether an individual has the knowledge to make choices and decisions, plan and set goals, and the skills to reach their goals. The *opportunity* domain assesses whether an individual has opportunities in their environment to use their abilities. Individuals with ASD completed the AIR-SDS self-report and a questionnaire on depressive symptoms using the Center for Epidemiologic Studies Depression Scale (CESD). The AIR-SDS self-report assesses two domains: Capacity and Opportunity. The *capacity* domain includes ability, knowledge, and perceptions of self-determination.

Results: The AIR-SDS demonstrated internal consistency for both parent report (Cronbach's α=.88) and self-report (Cronbach's α=.91). Parent and self-report total scores were not significantly correlated (r=.16, p=.12). Parents (M=69.1) reported significantly higher levels of total self-determination than students (M=54.1, t[94]=11.89, p<.001). Multivariate multiple regressions were performed to examine the extent to which the General Executive Composite on the BRIEF T-score, SRS Total T-score, and CESD sum predicted domains of parent-reported and self-reported self-determination. Executive function accounted for 31% of the variance in overall parent-reported self-determination. Specifically, decreased executive function difficulties were significantly associated with parent-reported increased *ability* (B=-.03, p< .001,η^2=.19) and increased *opportunities* at home (B=-.03,η^2=.16,p<.001) controlling for age, autism symptoms, and depression. Decreases in age were significantly associated with parent-reported increased *opportunities* at home (B=-.06,η^2=.07,p=.03). Depression accounted for 8% of the variance in overall self-reported self-determination. Specifically, decreased depression symptoms were significantly associated with self-reported increased *capacity* (B=-.02, p< .001,η^2=.06) and increased self-reported increased *opportunity* (B=-.02, p=.03,η^2=.06) controlling for age, executive function, and autism symptoms.

Conclusions: Overall, parent and self-report AIR-SDS appear to be internally reliable measures, although are not related to each other. The lack of association between these measures suggests the importance of incorporating multiple perspectives when measuring outcomes. Parents of younger adolescents with increased every day executive function skills reported higher levels of self-determination. Adolescents with less symptoms of depression reported higher levels of self-determination. Thus, self-determination may be a meaningful outcome measure for interventions targeting executive function and emotion regulation.

256 **117.256** Comparative Randomized Control Trial for Infants at-Risk of Autism Spectrum Disorder: Outcomes from a Standard Measure of Play

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Background: There is increasing interest in interventions targeting the infant and early toddler years, when it is believed that the developmental course of ASDs can be substantially altered. Parent-mediated interventions are important at this age as they provide an opportunity to begin treatment early and at a high dose. Interventions that target joint attention, engagement and play are also important for this age.
Objectives: The goal of this study was to rigorously test parent-mediated Joint Attention, Symbolic Play, Engagement and Regulation (JASPER) for infants at-risk for ASD. JASPER augmented one of two early intervention classrooms that used a global infant curriculum, Assessment, Evaluation, and Programming System for Infants and Children (AEPS; Bricker, 2002). AEPS-only (referred to as Standard Baby) was compared to AEPS+ Baby JASPER (referred to as Baby JASPER). In addition, parents randomized to Baby JASPER received hands-on, individualized training in JASPER and parents in the Standard Baby condition received parent education classes.

Methods: In total, 105 at-risk toddlers, 12 to 22 months old, were referred and screened for study entry. Eighty qualified for the trial by scoring with at least mild to moderate concern on the ADOS-2 Toddler module. The children were predominately male (80%) and ethnically diverse (54%) with an average age of 17.66 months (*SD* = 3.08). Once enrolled, the children were randomized to Baby JASPER or Standard Baby, twice-weekly for two months. Assessments were completed at baseline and immediately following the 8-week treatment period, which included the Structured Play Assessment (SPA; Ungerer & Sigman, 1981), a standardized play assessment delivered by a clinician blind to treatment status and unfamiliar to the child. The SPA was coded for overall play level, play diversity, and frequency of play acts.

Results: A zero-inflated Poisson regression with a random intercept was used to model the change in symbolic play due to excessive zero counts. A majority of children, 88% in the Baby JASPER group and 83% in the Standard Baby group, had no acts of symbolic play at baseline. Both groups saw improvement in the percentage of children with at least some symbolic play at Week 8 Exit (80% versus 62%, respectively), however, children in the Baby JASPER group had a greater increase in the frequency of symbolic play compared to the Standard Baby group. On average, children in the Baby JASPER group had 4.2 times more symbolic play from baseline to Exit compared to the Standard Baby group, controlling for expressive language, receptive language, visual reception, severity, and chronological age with 95% CI (1.2, 15.2) and ANOVA Type III p-value = 0.03.

Conclusions: Both treatment groups noted improvement in play skills over the course of intervention. Of the children with at least some symbolic play, the children in the Baby JASPER treatment showed greater increases compared to the Standard Baby treatment group. Of note, play outcomes were assessed using a standard measure of play conducted by a novel administrator, blind to treatment status, suggesting that the treatment effect generalized outside of the parent-child dyad.

257 **117.257** Using Mobile Robots to Facilitate Academic Skills in Children with ASD

S. Srinivasan[1,2], *M. Kaur*[3], *C. M. Wanamaker*[4], *T. Gifford*[4], *K. L. Marsh*[5] *and A. Bhat*[6,7], *(1)IDC School of Design, Indian Institute of Technology Bombay, Powai, Mumbai, India, (2)Department of Kinesiology, University of Connecticut, Storrs, CT, (3)Psychology and Human Development, Vanderbilt University, Nashville, TN, (4)University of Connecticut, Storrs, CT, (5)Psychological Sciences, University of Connecticut, Storrs, CT, (6)Department of Physical Therapy, University of Delaware, Newark, DE, (7)Department of Psychological & Brain Sciences, University of Delaware, Newark, DE*

Background: In the last few decades there has been growing research on the use of robots to facilitate social communication, motor, and behavioural skills in children with Autism Spectrum Disorder (ASD). Robot-child interactions are motivating for children with ASD and robots can in fact serve as models to teach children and help them practise critical social communication skills such as turn taking and joint attention as well as motor skills such as imitation, praxis, and interpersonal synchrony.
Objectives: The data reported here are part of a larger project aimed at examining the efficacy of novel, robotic interventions for school-age children with ASD. Our talk will focus on assessing the effectiveness of an 8-week intervention using mobile robots to promote academic/cognitive skills in 8 children with ASD.

Methods: 8 children diagnosed with ASD between 5 and 12 years of age participated in the study. Children received 2 expert-delivered and 2 parent-delivered sessions each week. The expert-delivered sessions involved interactions with a mobile robot, Rovio™ (WowWee®), and an adult partner. The Rovio robot was controlled by a second adult in the room. Children engaged with Rovio in the context of a 'walking' game where children and their adult partners were asked to follow the Rovio robot as it traced alphabets/shapes in a 9-point square grid drawn on the floor. Children were thereafter asked to guess the traced shape and complete 8 worksheets associated with the traced alphabet. Worksheet activities included tracing the alphabet on paper, sounding the alphabet, finding upper and lower case versions of the alphabet in letter mazes, matching spelling and pictures of objects, and fill in the blank activities using the traced alphabet. We scored and compared worksheets completed by children during an early (Session 1), mid (session 9), and late (session 15) training session. Specifically, we coded for the total number of attempts per task, total number of prompts (verbal, gestural, visual, or manual) required to complete each worksheet task, overall accuracy of performance (0 incorrect, 1 – correct performance), and total time taken to complete each task. For each variable, a final score was obtained by summing across all 8 worksheets completed per session.

Results: Children significantly reduced the time taken to complete tasks and the amount of prompts required to complete worksheets in the late sessions compared to the early and mid-sessions with 7 out of 8 children following the group trends. In terms of accuracy of responses, although there were no statistically significant results, 5 out of 8 children improved their accuracy of performance in worksheets from early to late sessions.

Conclusions: Our preliminary results suggest that games involving mobile robots can serve as promising contexts to promote academic and literacy-related skills in school-age children with ASD.

258 **117.258** Practitioner Perceptions of the Benefits and Barriers to Robot-Mediated Interventions

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Background: Over a decade of research has demonstrated robots' potential as an intervention tool for children with ASD(Begum et al., 2016; Diehl et al., 2012). Over 400 commercially available robots (Softbank Robotics's NAO, Robokind's Milo) are estimated to be in current use in school/therapy-based intervention for children with ASD (personal communication with ROBOTTECA.com and Robokind). Despite advances, gaps exist in the understanding among robotics researchers, robotics companies, and stakeholders (children with ASD, families, practitioners) about the clinical utility of robot-mediated interventions (RMI), best practices in RMI, and hardware/software requirements to establish RMI as an evidence-based practice for children with ASD.

Objectives: To identify practitioner perceptions of supports and barriers to RMI implementation.

Methods: Eight practitioners who used RMI with children with ASD (three with programming expertise[PE], five with no programming expertise[NPE]) were recruited with assistance from Mike Radice(ChartaCloud Robotics). They completed a survey with six demographic(e.g., specialization, caseload size), 12 yes/no(e.g., "is the program interface easy to use?"), and 10 open-ended questions(e.g., "What is your opinion about robots as an intervention tool?"). Mixed methods analyses were conducted: thematic analyses(Attride-Sterling, 2001) identified Basic, Organizing, and Global themes for open-ended questions; descriptive analyses examined quantitative data for PE and NPE practitioners.

Results: Three Organizing Themes (benefits of robot instruction/learning, usefulness of robots, and individualized response to robots) emerged from the question about robots as an intervention tool. Practitioners reported that robots can facilitate social behaviors and promote generalization through predictable, motivating activities. Robots' usefulness was limited by reduced functionality, ease of use, and number/variety of programs, and increased costs. Robots were perceived to be more or less useful than other technologies, based on users' experiences. Students' responses, motivation, and engagement with the robot were reportedly individualized. The Organizing Themes converged around one Global Theme(perceptions of robot benefits/drawbacks).

A question about limitations of apps for individualized intervention yielded two organizing themes (robot apps/interface are not user-friendly, robots' design limits practical scope/usefulness for intervention). Practitioners reported that apps were not flexible/customizable to suit users' needs. Robots' functionality was reportedly limited/inconsistent, and apps did not account for individual needs of students with ASD. Existing apps were limited in number, curriculum, target behaviors, and appropriateness. The Organizing Themes converged around one Global Theme(robot app limitations).

Quantitative data reinforced qualitative results, especially related to robots' ease of use and customizability. Three NPE practitioners indicated programming was difficult and time-consuming. One PE and two NPE reported the programming interface was not easy to use. Four NPE practitioners preferred for a programmer to help program the robot and believed RMI would be more effective if a programmer could help them design their own intervention. Six of eight practitioners agreed that a robot that could learn through demonstrations rather than programming would be beneficial.

Conclusions: Survey findings indicated robots are promising intervention tools for improving social skills in children with ASD. However, reduced functionality, high costs, limited apps, and limited knowledge/time for programming/customizing apps to meet individual needs are barriers to implementing effective RMI for children with ASD.

259 **117.259** Randomized Controlled Trial of a Gaming-Based Whole of Class Resililence Curriculum for Students on the Autism Spectrum - the Secret Agent Society-Whole of Class (SAS-WOC) Program

ABSTRACT WITHDRAWN

Background: Research shows that some programs for primary school-aged children on the Autism Spectrum hold promise in improving emotion regulation and peer socialization skills. However, these programs are typically delivered and evaluated in out-of-class or clinic contexts. This approach is at odds with an inclusive educational framework.

Objectives: This study examined the effectiveness of a novel gaming-based whole-of-class resilience curriculum in improving the emotion regulation and social skills of Grade Five students on the Autism Spectrum, and their typically developing peers.

Methods: A cluster randomized controlled trial was conducted with 613 Grade Five students across 15 mainstream schools. Schools were randomized to either the Secret Agent Society-Whole of Class Program (SAS-WOC) condition or a waitlist group. Approximately half of the student participants were male (51.5%) with an average age of 10.5 years (SD = 0.52). The majority of student participants were described by their teachers as being 'typically developing' at the outset of the study (81.6% - 500 students), with 11.1% (68 students) reported as having social-emotional difficulties without an Autism Spectrum Disorder (ASD) diagnosis and 7.3% (45 students) reported as having an ASD.

SAS-WOC was a manualized curriculum consisting of nine forty-five-minute class lessons designed to be delivered by classroom teachers. The program involved students playing the SAS computer game and other spy themed games to learn emotion regulation and peer socialization skills. Data was collected from students' classroom teachers and the students themselves at pre-intervention and post-intervention.

Data was analyzed using two-way mixed ANOVAS to examine Group, Time and Group x Time interaction effects. Outcome measures for all students included teacher-report questionnaires (the Emotion Regulation and Social Skills Questionnaire - teacher version: ERSSQ-T); the Spence (1995) Social Skills Questionnaire-Teacher version: SSQ-T) and child competency measures (James and the Maths Test – measure of children's knowledge of anxiety management strategies; Dylan is Being Teased – measure of children's knowledge of anger management strategies). Teachers also completed the Anxiety Scale for Children – Autism Spectrum Disorder (ASC-ASD) and the Behavioral Assessment Scale for Children – Third Edition (BASC-3) for students who were identified as having social-emotional learning difficulties (including those on the Autism Spectrum).

Results: Mixed-model ANOVA results indicated significant Group x Time interaction effects for the whole Grade 5 student sample only for James and the Maths Test, $F(1,552) = 21.94$, $p<.001$ and Dylan is Being Teased, $F(1, 552) = 9.92$, $p = .003$. For the subsample of students with social-emotional difficulties (including those with ASD), the Group x Time interaction effect trended towards significance for the Total Score and Uncertainty Subscale Score on the ASC-ASD, ($F(1,109) = 4.24$, $p=.042$; $F(1,109) = 4.21$, $p = .043$ respectively) and the Leadership Subscale Score of the BASC-3, $F(1,91) = 5.37$, $p=.023$.

Conclusions: In isolation, study findings suggest that a brief 'one-size fits all' stand-alone whole-of-class curriculum may not be optimal in improving the social-emotional functioning of children on the Autism Spectrum, nor of their typically developing peers. Potential explanations for the results are presented, together with recommendations for future research.

260 **117.260** Response to the Emotion Awareness and Skills Enhancement (EASE) Program: Emotion Dysregulation and Intolerance of Uncertainty As Potential Mechanisms

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Background:

Adolescents with autism spectrum disorder (ASD) often have co-occurring anxiety or depression. Recently there has been an emphasis on transdiagnostic processes that may contribute to risk for psychopathology and serve as potential modifiable treatment targets. A growing body of literature suggests that emotion dysregulation (ED) may underlie a range of psychiatric and behavioral problems in ASD. Intolerance of uncertainty (IU) has been established as a mechanism underlying anxiety in and outside of ASD, but its association with depression and other manifestations of ED has received relatively little attention. IU may decrease in response to interventions that target acceptance and awareness through techniques such as mindfulness.

Objectives:

This study aimed to: 1) Establish the association between IU, depression, and ED in adolescents with ASD; 2) Explore whether IU decreases in response to a new mindfulness-based psychosocial treatment for ED in ASD; and 3) Determine whether change in IU is associated with change in anxiety, depression, and ED in response to treatment.

Methods:

Participants included 17 12- to 17-year-olds (IQ > 80) with ADOS-confirmed ASD who participated in an open trial of the Emotion Awareness and Skills Enhancement (EASE) Program. EASE is a 16-week manualized individual therapy intervention that teaches mindfulness, distress tolerance, and emotion regulation strategies to decrease ED. Participants and their parents completed a battery of questionnaires before and after treatment including the Intolerance of Uncertainty (IUS) Scale, the Emotion Dysregulation Inventory (EDI), and PROMIS Anxiety and Depression Scales. A larger, two-site randomized controlled trial of EASE with the same battery is on-going (current completed n = 13, currently on-going n = 10, with continuous enrollment); additional analyses will explore whether IU and ED decrease more in EASE compared to individual supportive therapy.

Results:

At baseline, IU was correlated with parent-reported anxiety as expected (r = .576, p = .006), but correlations with ED (EDI Reactivity scale) and depression were not significant. After completion of EASE, there was a significant decrease in IU ($t_{(15)}$= 3.26; p= .005; effect size .69). The magnitude of change was comparable to previously reported decreases in parent-reported anxiety (effect size = .59), depression (effect size = .96), and ED (effect size = .69) following EASE (Conner et al., 2018). IU change was significantly associated with a reduction in ED (r = .502, p = .047) and parent-reported depression change (r = .756, p = .001). IU change was approaching a significant correlation with parent-reported anxiety change (r = .485, p = .057).

Conclusions:

A new ED-focused intervention produced parent-reported improvements in psychiatric symptoms (depression, anxiety) as well as IU and ED. Although previously studied in the context of anxiety predominately, change in IU was associated with a decrease in depression and ED. IU may serve as a potentially modifiable transdiagnostic treatment target in ASD.

261 **117.261** Validity for Clinical Global Impression-Improvement in Minimally Verbal Children with Autism Spectrum Disorder

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Background:

There are few valid and reliable ASD-specific assessments available for minimally verbal (MV) children (Kasari et al., 2013). Even with appropriate tests, MV children may not fully display their communicative abilities in unfamiliar contexts, complicating assessment of change over time. Observational and naturalistic measures may be informative, but coding and scoring are often time-consuming. One promising approach is the Clinical Global Impression-Improvement (CGI-I) scale (Guy, 1976), a brief, well-established tool for assessing global improvement in specific constructs of psychiatric disorders (Busner & Targum, 2007). It typically uses an observational approach, considering information from naturalistic contexts, and is completed by blinded raters. However, for quickly assessing intervention progress in real-time (e.g., in a SMART study), interventionists can also apply the CGI-I. While the CGI-I has been validated for measuring symptomatology of complex disorders (e.g., schizophrenia), it has not yet been validated as a measure of social communication change in MV children with ASD.

Objectives:

Examine validity of the CGI-I as a measure of social communication change in MV children with ASD.

Methods:

Participants included 54 MV (<20 words) school-aged children with ASD (M_{age}=6.05 years, *SD*=1.18). Children received intervention targeting social communication skills, focused on improving joint attention (JA).

Children received ratings of their severity of social communication prior to intervention and their improvement in social communication after 6 weeks of intervention. Primary interventionists rated CGI-I scores for each participant. CGI-Is were also randomly rated by blinded researchers for reliability. Children with CGI-I scores of 1 ("very much improved") and 2 ("much improved") were considered "fast responders;" children with scores of 3 ("minimally improved") or higher were considered "slow responders."

The early social communication scales (ESCS) was administered at entry and after 6 weeks of intervention. ESCS was coded by blinded coders using the Communication Complexity Scale (CCS; Brady et al., 2012), which examines communication in individuals who primarily use pre-linguistic or non-symbolic communication. The CCS is a valid and sensitive measure of social communication change (Brady et al., under review). From this we calculated ΔOptimal score, ΔBehavior Regulation (BR) score, and ΔJA score. Mann-Whitney U tests were conducted to determine differences

between fast and slow responders.

Results:

37% of children were rated as "fast responders" on the CGI-I. There was no difference between fast and slow responders in distributions of ΔOptimal or ΔBR. However, the distribution of ΔJA was significantly different across fast and slow responders (p=.039), such that fast responders improved more in their ΔJA scores.

Conclusions:

This study examines the validity of the CGI-I as a measure of social communication change after a short intervention period in a SMART study. The CGI-I significantly corresponded to changes in JA, indicating that the CGI-I validly measures change in social communication during treatment for MV children with ASD. These findings are practically significant. The CGI-I is relatively easy to administer compared to other standardized assessments. It does not require any additional materials and can be assessed in real-time. It is clinician-based, allowing children to demonstrate small but clinically meaningful changes in social communication skills.

262 **117.262** A Randomized Trial of a Modular Approach for Autism Programs in Schools (MAAPS)

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Background: A number of empirically supported interventions exist for children with ASD. However, we know little about the feasibility and effectiveness of interventions when implemented in schools; barriers (e.g., limited buy-in, resources) often temper successful implementation by educators (Kasari & Smith, 2013). Modular Approach for Autism Programs in Schools (MAAPS) is a comprehensive and modular intervention, developed to address common barriers by providing educators with a flexible framework and in-vivo coaching to implement evidence-based interventions. Through MAAPS, educators identify goals for their student and select modules to address core and associated features of ASD. A coach uses behavioral skills training for educators to implement interventions. Iadarola et al. (2017) presented results of a MAAPS pilot, which provided preliminary support for the intervention: educators viewed the intervention as socially valid, implemented interventions with high fidelity, and favorably rated student outcomes.

Objectives: Expand findings by conducting an efficacy trial of MAAPS to evaluate (1) feasibility, (2) social validity, and (3) student outcomes.

Methods: We conducted an underpowered RCT across three sites with 28 students with ASD and their educators (student-teacher dyads), randomized to MAAPS or our control, enhanced services as usual (ESAU). For ESAU (n=14 dyads), educators were offered up to 12 hours of didactic trainings on module-related topics. For MAAPS (n=14 dyads), educators were assigned a coach (research personnel) and engaged in a systematic process of (1) selecting individualized goals and modules and (2) receiving up to 12 hours of in-vivo coaching per module. An independent evaluator administered the Developmental Disabilities modified Children's Global Assessment Scale (DD-CGAS) on students at baseline, mid-intervention, and end of intervention. Social validity was assessed from the 29-item Usage Rating Profile (URP) (6=highest rating) and a 10-item scale of coaching quality (4=highest rating). Coach and teacher fidelity of implementation was also collected.

Results: Eleven dyads completed MAAPS and 13 dyads completed ESAU. Fidelity: Coach and teacher fidelity was high (above 90%), with high inter-rater reliability (97-99%). Social Validity: On the URP, teachers rated MAAPS highly for acceptability, M(SD) = 5.22(.31), usability, M(SD) = 5.61(.10), and feasibility, M(SD) = 5.47(.27). Mean coaching quality was rated 3.84(.07).Student Outcomes: Although not statistically significant, students receiving MAAPS showed gradual increases in mean DD-CGAS scores from baseline (51.5) to midpoint (54) and exit (61), with associated improvement in functioning from "moderate" to "slight" impairment. ESAU did not show change in mean functioning across timepoints (i.e., 57.5 at baseline, 58.5 at midpoint, 60 at post-treatment).

Conclusions: To our knowledge, this is the first comprehensive, modular intervention for educators of students with ASD. Educators rated MAAPS favorably; both educators and coaches implemented the intervention with high fidelity. Although we were underpowered to detect group differences on student outcomes and there were large differences in baseline scores between groups, greater within-group improvements were seen in MAAPS vs. control. Results indicate that a modular intervention approach with in-vivo coaching for educators may be more effective than providing didactic trainings for supporting students with ASD.

263 **117.263** Implementation of the Rubi Parent Training Program for Children with Autism Spectrum Disorder and Disruptive Behavior in Clinical Settings

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Background: There is a pressing need to close the chasm between demonstrated efficacy of interventions for youth with autism spectrum disorder (ASD) validated under ideal conditions and their effectiveness when implemented in community settings. The Research Unit on Behavioral Interventions (RUBI) Autism Network developed a manualized parent training program for families of children with ASD and co-occurring disruptive behaviors. RUBI utilizes techniques grounded in applied behavior analysis to teach parents how to manage their child's behavioral problems over 11 outpatient visits. With over a dozen published research studies, RUBI has been found to be acceptable to parents, reliably delivered by trained therapists, and effective in reducing disruptive behavior when evaluated under ideal conditions (i.e. efficacy trials). RUBI is emerging as an important component of short-term, effective treatment for children with ASD. This is the first large-scale examination of efforts to deliver RUBI under real-world conditions.

Objectives: This trial evaluates the feasibility and efficacy of RUBI when delivered at two independent hospital-based clinics [Marcus Autism Center (MAC); Seattle Children's Autism Center (SCAC)] serving families of children with ASD.

Methods: All children, ages 2-12 with a community diagnosis of ASD and disruptive behavior, who participated in RUBI at two clinical sites (MAC, SCAC) between June 2015 and October 2018 were included in the analyses. Demographics (e.g., age, sex, race, ethnicity, school placement) were collected through medical record and intake documentation. Children were characterized at intake using a standardized battery (Social Responsiveness Scale, Adaptive Behavior Assessment System, Stanford-Binet). Primary outcomes include treatment feasibility (e.g. attendance, attrition), which denotes evidence that the treatment is acceptable to families. Efficacy (reduction in child behavior problems) is examined

through change on the parent-rated Aberrant Behavior Checklist-Irritability subscale (ABC-I). Results from the large-scale trial of RUBI (RUBI-RCT) are used as benchmarks to compare to findings from the two clinical sites.

Results: 180 children completed intakes across the two sites, with 166 initiating RUBI. Mean age was 6.6 ± 2.2 (MAC) and 6.4 ± 2.4 (SCAC) suggesting an older population than RUBI-RCT. Compared to RUBI-RCT, the two clinical sites served a more diverse population [IQ below 70 = 26% RUBI-RCT vs. 48% MAC, 31% SCAC; Caucasian = 73% RUBI-RCT vs. 42% MAC, 72% SCAC; on medication = 13% RUBI-RCT vs. 62% MAC, 42% SCAC]. Feasibility outcomes suggest high parental engagement, with attrition rates similar between RUBI-RCT (11%), MAC (20%) and SCAC (14%). Parents reported a 46.9% (MAC) and 31.6% (SCAC) decrease in disruptive behaviors on the ABC-I from baseline to endpoint (both significant at p<0.001), which is comparable to RUBI-RCT (47.7% decrease). Findings from key secondary outcomes (e.g., Home Situations Questionnaire, Parenting Stress Index) will be reported.

Conclusions: When delivered in a community setting, RUBI appears to be acceptable to parents. Outcomes indicate notable reductions in child disruptive behaviors with a diverse population, with findings comparable to those from a large scale efficacy trial. Discussion will include a review of barriers to delivering RUBI in clinical settings, including modifications required to meet clinic and billing demands.

264 **117.264** Parents, Peers, and Musical Play: A Mixed-Methods Analysis of an Inclusive Parent-Child Music Class Program for Families of Children with and without ASD

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Background: Inclusive community experiences are important for skill development and generalization, the development of relationships, and emotional well-being for individuals with autism spectrum disorder (ASD) and their families (Askari et al., 2015; King et al., 2003). Musical activities, a natural type of parent-child and peer play, may provide a good platform for inclusion and interaction because they are motivating and provide a predictable context to scaffold engagement (Lense & Camarata, 2018). Shared musical experiences are associated with prosocial behaviors in typically developing (TD) individuals (Pearce et al., 2015; Kirschner & Tomasello, 2010), while music therapy may support social and communication development in children with ASD (Kim et at., 2008). However, less is known about the potential impact of inclusive parent-child community music programs.

Objectives: A mixed-methods pilot study to examine correlates of participation in an inclusive parent- child music class that provides parent training and peer inclusion through musical play.

Methods: 14 preschoolers with ASD (mean (SD): 38.6 (11.2) months; 11 males) and 14 TD preschoolers (34.1 (9.6) months; 11 males) participated in a 10-week music program with their parents. Children's engagement in an early and late class session were coded from video using 5-second partial interval coding. Parents completed weekly logs about their families' social music engagement and practice at home. At the start and end of the program, children with ASD completed tests of motor imitation skills (Stone et al., 1997) and parents completed an inventory of their child's communicative gestures/social play (Fenson et al., 2007) and a parenting stress questionnaire (Abidin, 2012). Interviews with all parents about their experience in the program were coded using a general inductive approach.

Results: There were no significant differences between ASD and TD children in regard to active or passive engagement in classes or time spent in practice at home though children with ASD initially spent more time unengaged in the class (p=0.018). Over the course of the program, both TD and ASD children increased in active engagement (p<.001) and ASD children significantly decreased time spent unengaged (p=0.022). Children with ASD demonstrated significant increases in imitation skills (23.4% (19.1%), p<0.001) and gestures/actions repertoire (4.5 (4.5), p=0.002) over their time in the program. Parents reported significant decreases in parenting stress (p<0.01). Interviews highlighted that important aspects of the program for parents included forming connections within and across families, increased understanding of child development and ASD, and learning specific parenting skills through musical activities.

Conclusions: This pilot study suggests that parent-child inclusion music classes may provide a potential vehicle for supporting community participation, increasing connections within and across families, and scaffolding specific social communication goals such as imitation and gestures for children with ASD. As an ecologically valid form of social play, musical experiences may provide a platform for supporting families because they are predictable, reinforcing, emotional, and scaffold shared attention to an activity. We will discuss implications and limitations of current pilot findings, as well as next steps including an ongoing waitlist-controlled study of this parent-child music program.

265 **117.265** Effects of Music Education on Social Skills and Executive Functioning of Children with Autism Spectrum Disorder

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Background: There is growing interest in studying the impact of music for children with autism spectrum disorders (ASD). Individual music therapy for ASD increases peer interactions and turn taking (Kim et al., 2009; LaGasse, 2014). However, less is know about the effects of group music making on social skills of children with ASD. Individual and group music making can improve executive functioning of children with typical development (Moreno et al., 2011) and may also have the same effect for children with ASD who show executive impairments.

Objectives: We aim to assess whether group music making will have a positive impact on social skills and executive functioning of children with ASD in a naturalistic group setting.

Methods: Six entire classes comprised of children with ASD and neurodevelopmental disorders 8 to 13 years old completed a music intervention program during music class to maintain a naturalistic intervention setting. Three of the six classes practiced percussions in a structured drum circle (experimental group, N=21) and the other three classes explored different instruments without explicit practice (comparison group, N=18). Music classes targeted by the study occurred once per week for 30 minutes over 10 weeks. Homeroom teachers completed the Social Skills Improvement System: Socio-emotional Learning (SSIS-SEL) questionnaire, as a measure of social skills, and participants completed the NIH-Toolbox Dimensional Change Card Sort task, as a measure of executive functioning, pre and post music intervention. Groups were matched on IQ (p=.18) as measured with the Wechsler Scale of Intelligence-II (FSIQ range: 46-98).

Results: For the SSIS-SEL, repeated measures ANOVA showed no main effect of change over time (p=.43) or group (p=.40) but a significant interaction of time and group (p<.01), such that pre to post intervention scores increased for the comparison group but decreased for the experimental group. For the Card Sort task, repeated measures ANOVA with a sub-sample of the study (N=15) showed a significant increase in

performance over time from pre to post intervention for both groups (p=.03), and no significant effect of group (p=.35) or interaction of group and time (p=.34). Although the interaction effect was not significant, visual inspection of graphed data shows that scores seem to have increased more for the experimental than comparison group pre to post intervention.

Conclusions: Contrary to our predictions, results suggests that social skills improved more for the comparison than experimental group, bringing into question whether longer interventions are needed to impact social behaviour outside the music class setting. Group rather than individual measures may best capture positive changes in group dynamics anecdotally reported by teachers. Our findings related to executive functioning, although not significant in a small sub-sample, were in the predicted direction suggesting that longer interventions and frequent practice (e.g. daily) may be needed for skill transfer to non-musical tasks. Our findings show that it is feasible to study the impact of music education within the context of special education while minimally altering the regular school curriculum.

266 **117.266** Measuring Change in Social Interaction during a Music-Based Intervention for Children with Autism: Behavioral Coding of Therapist-Child Joint Engagement

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Background: Standardized methods for assessing social abilities in children with autism are often insufficient to monitor dynamic social interactions (Peper et al. 2016). Current tools typically assess deficits and often rely on parent report or advanced verbal skills. Tools capturing the dynamics of social interaction through direct observation of behaviour may improve sensitivity in evaluation of treatment outcomes (Cunningham, 2012). In a randomized controlled trial (RCT), we recently showed that 8-12 weeks of music intervention can improve auditory-motor connectivity and parent-reported social communication in school-age children with autism (Sharda et al, 2018). These findings suggest that collaborative music-making can enhance communication. However, there is limited clarity on the specific aspects of music-based interventions that are beneficial. It has been proposed that joint engagement between therapist and child in treatment settings may drive social benefits (Spiro and Himberg, 2016) but its specific role is poorly understood due to lack of suitable tools (Mössler, 2017).
Objectives: Our aims were to 1) identify a behavioral coding scheme appropriate for capturing changes in levels of triadic engagement between a therapist and school-aged child with ASD around intervention activities, 2) apply this scheme to session video from one-on-one music or a control play therapy, 3) evaluate potential changes in joint engagement over the course of music versus play therapy, 4) evaluate whether initial level of joint engagement predicts response to treatment.

Methods: An engagement coding scheme, adapted from Adamson et al., (2004), was used to assess levels of engagement in video-taped sessions of 6-12 year-old children with autism undergoing music or play-based intervention (Sharda et al., 2018). Seven mutually exclusive engagement state codes were employed (Fig.2a). For each intervention activity, duration of time spent in each state was coded using BORIS software (Friard & Gamba, 2016; Fig.1). Three raters were trained using a training manual in two phases, for a total of 70 hours of training, coding and discussion on intended coding targets, until they achieved acceptable inter-rater reliability (IRR). All raters were blind to session number and were not involved in the RCT. Twelve additional participant sessions (each with 4 activities making a total of 48 clips) were coded by each rater in order to measure IRR using intraclass correlation coefficient (ICC; one-way-single unit, agreement) for subsequent independent coding of videos.

Results: The ICCs for 4 (Coordinated joint, Supported Joint, Object engagement, Non- task-relevant object engagement) out 7 of engagement codes was >.79 (p<.001; Fig.2b). The remaining three state codes (Person only, Other, Unengaged) occurred quite rarely. Following the procedure in Adamson et al (2004) , we pooled these together resulting in an IRR=0.71 (p<.001) but excluded them from further analysis.

Conclusions: Measuring joint engagement through direct observation may provide a more sensitive tool for measuring response to behavioural interventions. Our adapted coding scheme had high reliability for key codes reflecting joint engagement with therapist and intervention activities. In ongoing work, we are applying this coding scheme to longitudinal intervention data from music and play-based interventions in autism to identify mechanisms of treatment-related change.

267 **117.267** A Mixed Methods Approach to Evaluation of Student Acceptability of the School-Based Interventions Unstuck and on Target and Parents and Teachers Supporting Students

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Background:
Mixed methods research provides comprehensive information on barriers and facilitators to treatment implementation and sustainability (Brownson et al., 2018). Participant acceptability is an important implementation consideration in clinical research (Smailes et al., 2016), such that higher acceptability is correlated with greater adoption (Lewis, Weiner, Stanick & Fischer, 2015). Furthermore, in the principle of participatory processes, participant feedback allows for adaptation of interventions based on the experiences of the targeted group (Green, Glasgow, Atkins, & Stange, 2009). This has substantial potential to impact effectiveness, adoptability and implementation.

Objectives:

To evaluate acceptability of the school- and home-based interventions, Unstuck and On Target (UOT) and Parents and Teachers Supporting Students (PATSS) through quantitative and qualitative student feedback.

Methods:

In a comparative effectiveness trial, schools were randomized to either the cognitive-behavioral executive function treatment, UOT, or the contingency behavioral management program, PATSS. Upon completion of the trial, students (N=130), who had an ASD or ADHD diagnosis, were given a 5-question survey to evaluate overall enjoyment, knowledge gained, and what they liked and disliked about the intervention. Answers to three questions were indicated on a 3-point Likert-type scale. Two questions were asked in an open-ended format and responses were analyzed using the qualitative data analysis software, ATLAS.ti. These responses were separated and coded into categories based on their content, resulting in a greater number of responses than there were students.

Results:

Students in the UOT group (N= 67) rated their enjoyment of the group significantly higher than students in the PATSS group (N= 63; p=.000). Across diagnoses there were minimal differences, however, within the UOT intervention group, students with an ADHD diagnosis (N=48) reported that the skills learned in group helped them at home significantly more than students with an ASD diagnosis did (N=19; p=.026). Within the PATSS intervention group, students with an ADHD diagnosis (N=38) reported that the skills learned in group helped them in school significantly more than students with an ASD diagnosis did (N=25; p=.047). In response to the open-ended questions, students in the UOT group most commonly reported learning about "flexibility and rigidity" (47.7%). Students in the PATSS group most commonly reported learning about "passive, aggressive and assertive" behaviors (28.5%). Only 1 student in each intervention group said they did not learn anything. Seven students (10.4%) in the UOT group and eleven students (17.4%) in the PATSS group said they did not remember what they learned. For both groups, over one-third of students said there was nothing they didn't like (UOT: 55%; PATSS: 36.5%). Responses in both groups noted that there could be improvements in scheduling and frequency of group, and group size (UOT: 17.9%; PATSS: 12.7%). In the PATSS group, 15.9% of students indicated a desire for more games.

Conclusions:

Overall students in both groups liked the interventions and learned from them. Future implementation of both interventions should consider scheduling, frequency and group size, such that students are able to attend the intervention group with frequency, without missing other school activities such as recess, and in small groups.

268 **117.268** A Multidisciplinary Approach According to IEP for ASD Children at Dhaka, Bangladesh

ABSTRACT WITHDRAWN

Background:

In Bangladesh Institute of Paediatric Neurodisorder and Autism (IPNA), Bangabandhu Sheikh Mujib Medical University aims at consolidating research initiatives both at the national and international level and pledges to make all out efforts to be a beacon of hope and inspiration for families and communities in Bangladesh who are struggling to cope with autism spectrum disorders. This Institute has a school for ASD children named IPNA Autism School with Individualized Education Programme (IEP) in a multidisciplinary approach.

Objectives:

In this study it was observed that at IPNA Autism School, in a multidisciplinary approach according to IEP what were the clinical outcomes or functional changes of children with Autism Spectrum Disorder (ASD).

Methods:

With 30 ASD children of IPNA Autism School, Dhaka, Bangladesh was observed from January 2016 to December, 2017. All children were also received occupational and physio therapy, speech and sensory therapy. Parents of those children were also received counseling. Children were received sessions 30-32 hours per week according to IEP as well as received occupational, physio and speech therapy 4 hours per week, sensory and music therapy 2 hours per week. Parents counseling were given 5 times in a month. Every evaluation was taken after 6 months in a data sheet by task analysis according to child's IEP.

Results:

A large percentage improvement was observed after task analysis of the ASD children of IPNA Autism School. According to domen-wise improvement in case of speech 43% improvement achieved after 6 months but after 2 years it was 93% achieved. In case of cognition same percentages of improvement was observed. In social improvement after 6 months it was 30% achieved and after 2 years which was achieved 83%. In case of academic improvement 46% improvement were observed after 6 months and 80% were seen after 2 years.

Conclusions:

After 2 years some of ASD children of IPNA Autism School were send to mainstream inclusive school for further education with a routine follow-up. That had been done due to follow IEP in a multidisciplinary approach with limited resource settings in Bangladesh.

269 **117.269** A Randomized Controlled Study of Compass: Can School-Based Consultants be Trained to Implement a Consultation Intervention for Students with ASD?

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Background:

Consultation in schools is one way to meet the high demands of special education services for students with autism spectrum disorder (ASD). The Collaborative Model for Promoting Competence and Success (COMPASS) is an evidence-based, student-centered consultation and coaching intervention developed specifically for ASD. Three previous randomized controlled trials found that COMPASS results in better IEP quality and goal attainment progress over the course of an academic year compared to control groups (Ruble et al., 2018; Ruble, McGrew, Toland, Dalrymple, & Jung, 2012; Ruble, Dalrymple, & McGrew, 2010). COMPASS starts with a parent-teacher consultation facilitated by a COMPASS trained consultant producing individualized goals and teaching plans followed by coaching with performance feedback and IEP progress monitoring. Prior studies have been limited because COMPASS was only delivered by the original developers.

Objectives:

The primary goal of this study was to create a COMPASS training package and examine its impact on school-based consultant fidelity and student IEP outcomes. A secondary goal evaluated COMPASS effectiveness based on the frequency and type of coaching.

Methods:

Participants included 5 consultants, and 11 students, caregivers, and teachers. Students were males aged 3-10 years receiving special education services under the category of autism. Consultants were women aged 45-60 years with 11-30 years of experience as consultants (*M* = 17.2, *SD* =

7.49). Consultants received 28 hours of training provided by the researchers online and in-person on COMPASS procedures for consultation and coaching with an additional 10 hours of consultation and coaching supervision.

Participants completed the COMPASS consultation and were then randomly assigned into one of four groups that varied the type and frequency of consultant coaching: 1) 4 coaching sessions, 2) 2 coaching sessions, 3) 4 feedback emails of student's goal attainment progress and teacher teaching plan adherence, and 4) consultation only.

Consultation fidelity was measured with a 25-item Likert-type questionnaire (α = .81) by the supervisor, consultant, parent, and teacher. Teachers and parents rated satisfaction with a 25-item Likert-type questionnaire (α = .940). Consultants and supervisors evaluated consultation process skills on a 35-item Likert-type questionnaire. Consultants used a 1-4 scale (α = .77) and supervisors used a yes-no scale (α = .85).

Supervisors, consultants, and teachers will use a 16-item scale to rate coaching fidelity, and teachers will use an 11-item scale to assess coaching satisfaction. Student goal attainment progress will be reported for coaching and feedback sessions.

Results:

Researchers rated COMPASS consultation fidelity 21.75 (*SD* = 3.4) out of 25 (87%). Parent (*M* = 1.3, *SD* = .54) and teacher (*M* = 1.2, *SD* = .35) satisfaction with the consultation was high.

Results for the remaining measures, including coaching fidelity and satisfaction and student goal attainment progress, will be collected through April 2018, and analyzed and reported for the final presentation.

Conclusions:

Initial results indicate that the COMPASS consultation can be implemented with high fidelity and stakeholder satisfaction by school-based consultants. Full pilot results comparing each of the conditions based on dosage will be presented.

270 **117.270** A Single Blind, Randomized Controlled Trial of Anodal Transcranial Direct-Current Stimulation Against Cathodal and Sham Stimulation in Adults with High-Functioning Autism

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Background: Evidence suggests that Transcranial Direct Current Stimulation (tDCS) on the left dorsolateral prefrontal cortex (DLPFC) leads to an increase in working memory (WM) performance in typically developed individuals (TD) (Fregni et al., 2005; Jo et al., 2009; Andrews et al., 2011) and individuals with psychiatric disorders, such as depression (Oliveira et al., 2013), schizophrenia (Papazova et al., 2018) and ADHD (Nejati et al., 2017). However, it has not been properly looked at when it comes to autism spectrum disorder (ASD), a population which experience WM impairments. Objectives: Does anodal tDCS lead to an improvement in WM accuracy scores when administered over the left DLPFC and compared to sham in adults with high functioning Autism? Secondly, are the observed effect of tDCS over the left DLPFC and WM scores dependent on polarity?

Methods: 23 individuals with ASD between the ages of 18–35 (*M*=26; SD=5.20) were recruited for this study. The participants had IQ scores that ranged from 74 to 138 (*M* = 109.48; SD= 15.41) on the Wechsler Abbreviated Scale of Intelligence and thus were classified as high functioning. Participants underwent a three-back working memory task from which their accuracy, reaction time and errors were tracked before, during and after receiving 1.5 mA for 15 minutes over the DLPFC. Additionally, participants completed a self-administered WM questionnaire (WMQ; Vallat-Azouvi, Pradat-Diehl and Azouvi, 2012) which asks about everyday WM difficulties. The ASD group scores were compared to TD individuals, with no significant difference between IQ and age.

Results: WM performance increased in individuals with ASD following anodal stimulation compared to baseline (t=-4.66, df=22, P<0.001), sham (t=2.82, df=22, P=0.010), cathodal (t=3.62, df=22, P=0.002), and, during anodal stimulation (t=4.13, df=22, P<0.001). There was a significantly less errors made between post anodal stimulation and baseline (t=4.87, df=22, P<0.001), anodal stimulation and sham (t=2.97, df=22, P=0.007), anodal stimulation and cathodal stimulation (t=2.59, df=22, P=0.017), however, there was no significant difference between during and post anodal stimulation (t=-2.05, df=22, P=0.053). Furthermore, the analysis showed that there was no significant difference in reaction time during any of the conditions (P>0.05).

Moreover, the WMQ analysis demonstrated that individuals with ASD (M=51.78; SD=20.64) had worse scores on the WMQ than the TD group (M=16.14; SD= 8.36) showing that individuals with ASD report greater difficulties in everyday WM (t=7.53, df=43, P<0.001).

Conclusions: Our results indicate that only anodal stimulation of the left prefrontal cortex, but not cathodal stimulation of left DLPFC increases the accuracy of the task performance when compared to sham stimulation of the same area. This accuracy enhancement during active stimulation cannot be accounted for by slowed responses, as response times were not changed by stimulation. Furthermore, this effect depends on the stimulation polarity. These findings may be helpful to develop future interventions. The proposed intervention can feasibly be applied in a clinical setting, and we thus expect the experiment to lead ultimately to an optimised treatment of WM impairments in individuals with ASD to enhance WM impairments and the quality of life for individuals with ASD.

271 **117.271** A Systematic Review of Behavioral Interventions for Pediatric Insomnia in Youth with Autism Spectrum Disorder

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Background: Sleep problems, including pediatric insomnia, are common among youth with Autism Spectrum Disorder (ASD), affecting between 40-80% of this population. Behavioral interventions for insomnia (including preventative parent education, graduated extinction, and cognitive behavioral therapy for insomnia or CBT-I) have shown to be effective for youth with ASD. However, the last published review that included both parent-mediated and individual interventions was in 2014, and this review was significantly limited by the inclusion criteria.
Objectives: The purpose of this project is to systematically review the empirical evidence regarding the efficacy of behavioral interventions for the clinical management of pediatric insomnia in youth with ASD.

Methods: This review included studies using behavioral treatment for sleep problems in children and adolescents with ASD. Inclusion criteria includes: (1) Intervention studies published in a peer reviewed journal between 1970 and July 2018 (dissertations or non peer reviewed articles

were excluded from review)**;** (2) behavioral interventions or psychoeducational programs with behavioral components were implemented; (3) participants included children diagnosed with Autism Spectrum Disorder; (4) participants included were children (0-17.9 years) with insomnia, defined as bedtime problems or night wakings for younger children, and/or difficulties initiating and maintaining sleep in older children and adolescents; (5) inclusion of continuous data of continuous variables (sleep onset latency, number of night wakings, duration of night wakings, and sleep efficiency), as measured by parent report, child report and/or actigraphy; and (6) published in English. All types of studies, including case-studies and single-subject designs, were included in analyses. See Table 1 for summary of guidelines by which the classification was established, as adapted from Sackett (1993).

Results: 22 studies met criteria for review. 5 studies were randomized control trials. 7 studies were within-subjects designs, 9 studies were single-subject designs, and 2 studies were case-series. 4 of the studies included young children (mean=3.67 years), 13 included school-age children (mean=6.53 years) and 2 studies included adolescents (mean age=15.56). Only one study met Sackett evidence level I (large, high quality RCT). 5 studies met evidence level II, 6 met evidence level IV and 10 studies met evidence level V criteria. See Table 1 for more details.

Conclusions: Despite some promising additions to the literature in recent years, there remains a significant need for additional research on behavioral interventions for youth with pediatric insomnia and ASD. However, the preliminary published studies support the use of sleep education, positive reinforcement, parent education and graduated extinction as effective interventions for this population. Future research should focus on developing randomized clinical trials with larger sample sizes and appropriate control groups.

272 **117.272** A Training to Develop Emotional Awareness in Children with ASD and Cognitive Delay: A Preliminary and Qualitative Study

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Background:

Autism spectrum disorders (ASD) are complex phenomena, to which no suitable answers about the mechanisms underlying them have been found yet, involving poor abilities to establish and develop social relationships and understand emotional and mental states.

Objectives:

Our aim was the creation of an effective and specific training program for children with ASD and cognitive impairment to enable the rehabilitation of emotional skills (comprehension, expression and regulation). Specifically, the goals were the development of the ability to express and recognise emotions introspectively and with full awareness in complex social situation as well as the understanding of false beliefs.

Methods:

Five ASD teenagers (aged between 13 and 17; all males) with mild-moderate cognitive delay - were involved in the training on a weekly basis for 8 months.

The training consisted of three steps:

- **Briefing** (duration 10 minutes): the participants were asked to write down emotional relevant episodes on coloured cards (red for negative episodes and green for the positive ones), then the trainer read their stories aloud and all the children were invited to make and share their comments in the group, avoiding to take any judgmental attitude;
- **Autogenic training** (duration 30 minutes): the participants were presented with a new and very simple training created in a way to be suitable for their cognitive level: it was broken down in steps, which were repeated always in the same way, thus making their sequence predictable. Three types of exercises were included (relaxation and mindfulness, breathing, and guided imagery). During this phase, the participants were invited to tear off the red cards (filled-in previously) so to discard the negative emotions and keep instead the green cards (positive emotions) to share with the group.
- **Free drawing** (5 minutes): the participants were then asked, to make, in turn, graphic signs, or drawings (as they liked), on a large sheet so as to spontaneously expressing their internal states.

Results:

A change in the score at the TEC – Test of Emotion Comprehension – administrated to the participants before and after the training and video-recorded, was observed. Specifically, the results showed a qualitative and quantitative improvement in the ability to recognise their own emotions, as well as those of the others, and the mental states of others. Interestingly, a remarkable improvement in the participants' performance was reported in the false belief tasks. Major changes were also found in the free drawing, used as a tool for encouraging the expression of emotions. A significant improvement was observed in self-reflection ability as evident from the participants' performance in the choice of the emotional episodes to be shared with the group. Finally, a better regulation of the expression of anger, through the spontaneous use of the breathing techniques learnt during the training program, was also reported.

Conclusions:

The results show the importance of focusing on empathy skills – an element often neglected in the standard protocols applied to the rehabilitation of ASD individuals – for the development of a more effective and mindful emotional rehabilitation training.

273 **117.273** Addressing the Needs of Diverse Youth with ASD and Anxiety in Public Schools: Stakeholder Input on Adaptations of Clinic-Based Facing Your Fears

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Background: Anxiety disorders are among the most common co-occurring psychiatric conditions for youth with ASD (van Steensel et al. 2011). Cognitive-behavioral treatments (CBT) such as Facing Your Fears (FYF) (Reaven et al., 2011) have demonstrated efficacy in anxiety reduction for youth with ASD in clinic settings (Reaven et al. 2012; Ung et al. 2014). However, substantial disparities in access to psychiatric services exist for

youth from diverse and/or low income backgrounds. Schools represent a consistent resource available to underserved students with ASD and their families. To meet the mental health needs of underserved youth, there is a critical need to adapt and implement evidence-based programs in schools. Partnering with and engaging key stakeholders in the initial phase of intervention adaptation is essential to best support adoption and sustainability in school settings.

Objectives: To adapt group CBT (FYF) via iterative processes with multi-level key stakeholders, to create a feasible, effective and sustainable school-based program to manage anxiety in underserved elementary and middle school students with ASD.

Methods: Two rounds of 90-minute parent and professional focus groups were conducted across 3 school districts for a total of 14 groups (6 professional and 8 parent groups). Professional participants were interdisciplinary school team members (e.g., special education teachers, school psychologists, etc.). All parent participants had at least one school age child with ASD. In the first round of focus groups (N=36), a semi-structured guide inquired about participants' experiences regarding student anxiety in schools, and participants' perceptions of the potential barriers and facilitators to implementing FYF to maximize contextual fit for school settings and diverse populations. All focus groups were audio-recorded and transcribed verbatim. A multi-disciplinary team inductively coded the transcripts to identify potential implementation adaptations for FYF. A second round of focus groups was convened (N=32) with the same participants to "member check" or confirm and further refine the proposed adaptations (Creswell, 1998). Using the same analysis process, additional input was incorporated into a finalized version of school-based FYF in anticipation of a large implementation trial.

Results: Parents and professionals indicated that anxiety in students with ASD is manifested in numerous ways in schools, including avoidance, inflexibility, outbursts and academic struggles. They noted that school teams are often uncertain about how to handle anxiety effectively, and expressed enthusiasm with the opportunity to implement FYF in public schools. To ensure successful implementation of FYF in schools, participants offered modifications to the clinic-based FYF (a 14 week, 90 minute program delivered by mental health professionals). Modifications were organized into various categories: (1) contextual modifications (13, 45 minute weekly lessons delivered by cross-disciplinary school teams) (2) content modifications (emphasize emotion regulation, anxiety management, and parent involvement); and (3) training and evaluation modifications (12 hour interactive workshop, plus 30 minute bi-monthly phone consultation for school teams) (Wiltsey-Stirman et al. 2013).

Conclusions: Multi-level stakeholder input obtained via 14 focus groups, led to a revised, contextually appropriate school-based version of FYF for underserved youth with ASD. Next steps in the implementation of FYF for schools will be discussed.

274 **117.274** Assistive Soft Skills and Employment Training (ASSET) Program for Transition Youth and Adults with Autism Spectrum Disorder: An International Comparison Efficacy Study.

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Background: Persons with high functioning Autism Spectrum Disorder (HFASD) often have difficulties navigating the social demand in the workplace and face disappointing employment outcomes as they transition from school into the world-of-work. There is an urgent need for empirically-supported work-related social skills interventions that are cost-effective and flexible in order to address these disparities. Grounded in social cognitive career theory and developed using a developmental iterative process, the Assistive Soft Skills and Employment Training (ASSET) program, consists of ten to thirteen 90-minute sessions offered in a community-based setting. One to two trained facilitators led sessions with 6-8 youth and/or adults. Using multidisciplinary collaboration and community-based participatory design, curriculum was developed to meet the end-users needs, while emphasizing its appropriateness for practical and clinical utility. Topics covered included: communication, attitude and enthusiasm, teamwork, networking, problem-solving and critical thinking, professionalism, mental health and stress management, and awareness of self and others.

The ASSET program was originally developed and piloted for transition youth with HFASD in the United States (ASSET-US). Then, the program was adapted, expanded, and piloted with adults with ASD in Ireland (ASSET-IE), which also included a 10-week work placement that was supported by employment specialists from a vocational rehabilitation agency.

Objectives: This international study compares the program structure, content, and outcomes of the ASSET program for transition aged youth and adults with HFASD designed to improve social skills, social self-efficacy and mental health.

Methods: Twenty-seven American adults (age: *M* = 20.08; *SD* = 2.03; range 19-23; IQ: *M* = 98.21; *SD* =16.78) and 22 Irish adults with HFASD (age: *M* = 26.73; *SD* = 7.07; range = 18-43; IQ: *M* = 102.73; *SD* =17.24) participated in the ASSET-US and -IE programs. All participants reported a previous diagnosis of an ASD.

Using a mixed methods design, quantitative data was collected and analyzed to examine participants' changes in social functioning and social self-efficacy post-intervention, while qualitative data was collected to explore overall satisfaction and feedback for program improvement. Descriptive statistics were used to report participant characteristics and overall experience.

Results: For the ASSET-US program, preliminary findings revealed significant improvements in social functioning (d = 0.44), social self-efficacy (d = 0.93) and empathy self-efficacy (d = 1.50), as well as in secondary outcomes such as self-reported levels of anxiety (d = 0.68). For the ASSET-IE program, preliminary findings revealed significant improvements in job self-efficacy (d = 0.57), as well as secondary outcomes such as self-reported levels of anxiety (d = 0.64) and depression (d = 0.68). Overall qualitative results in the US and IE revealed that all participants observed positive improvements in themselves regarding work-related social skills and knowledge and reported high satisfaction with the program.

Conclusions: This study offers preliminary evidence for an efficacious cost-effective and flexible work-related social skills training on social skills, self-efficacy, and mental health for individuals with HFASD. In addition to its national and international practicality and utility in community-based settings, implications for research and practice, as well as the cultural adaptation of the program will be discussed.

275 **117.275** Attention Training in Children with Autism Spectrum Disorder Improves Academic Performance: Application of the Computerized Progressive Attentional Training (CPAT) Program in a Public Health Context in Brazil

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Mackenzie, São Paulo, Brazil, (5)Santa Casa Hospital, Sao Paulo, Brazil

Background: Atypical attention processes have been reported in individuals with Autism Spectrum Disorder (ASD) in a variety of settings. Indeed, some studies have pointed to an increase in ADHD-like symptomatology in ASD compared to control groups. Attention processes are generally important for successful interaction with the environment but have also been specifically linked to academic performance. Taken together it raises the possibility that academic difficulties (which are quite common) in ASD are related, at least to some degree, to attention processes, and consequently may benefit from attentional training. In a recent pilot study, Spaniol et al., (2018) have used the Computerised Progressive Attention Training (CPAT) - a program developed to train attention in children with ADHD, in a small group of schoolchildren with ASD in the UK. The results highlighted academic and cognitive improvements in the experimental group (compared to an active control group), pointing to the possible efficacy of attention training in ASD.
Objectives: In the present study, we applied a more rigorous methodology to verify the possible efficacy of CPAT in a cohort of children with ASD in São Paulo, Brazil, a low-income country. Specifically, we ask whether attention training in the context of the Brazilian public health care system will show similar academic benefits as the pilot study conducted in the UK and whether these effects are maintained after the intervention program.

Methods: The study was conducted at the Autism Unit of Santa Casa de Misericórdia Hospital, part of the Center for Integrated Mental Health Care. 26 children and adolescents with ASD ranging from 8 to 14 years old were assigned to either the CPAT (n=14) or active control group (n=12). They were assessed before and immediately after the intervention/active control period (two sessions per week over 8 weeks) as well as 3 months following the completion of the intervention. Cognitive, attentional and academic performance was assessed through a series of standardized tests: Raven's - Educational: Colored Progressive Matrices, Attention Cancellation task (*Teste de Atenção por Cancelamento* – TAC), and Standardized academic test in maths, reading and writing (TDE: *Teste de desempenho escolar*). Importantly, the assessment was done blindly with the experimenter unaware of the group affiliation.

Results: We found statistically significant group differences following the CPAT intervention across the three academic assessments. Thus, while no group differences were recorded before the intervention, the CPAT group showed superior performance in the math, reading and writing tests following the intervention compared to the active control group. Interestingly, these differences were maintained at follow-up.

Conclusions: Our results showed that attention training with the CPAT is a viable approach to aid school performance in ASD, providing a replication to the pilot study reported in Spaniol et al., (2018). Furthermore, it points to the generality of the approach, which leads to similar outcomes regardless of the cultural or social context in which it is applied. Importantly, the intervention did not appear to have an overarching effect on autistic behaviour (e.g., in terms of ASD symptomatology) but rather a specific cognitive/academic benefit.

276 **117.276** Increasing Social Network Integration for Children with ASD Using the Summer Treatment Program

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Background: Forming peer relationships is a key milestone in social development. This is often an area of difficulty for school-age children with autism spectrum disorder (ASD). Peer relationship challenges begin in early childhood and can persist into adolescence and adulthood. The Summer Treatment Program (STP) focuses on developing social and behavioral skills using a manualized curriculum in the context of a naturalistic day camp. It incorporates behavioral principles, sports training, and supported practice with peer relationships in a real-world setting.
Objectives: To examine the integration of children with ASD within social networks over a 5-week day camp using the STP.

Methods: The STP was conducted by the UW Autism Center for 5 weeks, Monday-Friday, 9:00am to 3:00pm. Programmatic elements included a detailed social skills curriculum, sports instruction, a token economy, and extensive training and fidelity procedures. Daily activities included common playground sports, board games, and recess games. The staff of 63 consisted of 5 doctoral level psychologists, 6 masters-level clinicians, and 52 undergraduate and graduate-level counselors. Children were divided into groups of 14 served by a team of 6 counselors, yielding a 1-to-3 staff-to-child ratio. Out of 124 children that participated during the summer of 2018, 48 children had a primary diagnosis of ASD (15 with ASD+ADHD, 45 with ADHD, and 16 with no diagnosis participated but were not included in these analyses). Children nominated a “Buddies List” each week, identifying other children they like to “hang out with” (following Cairns & Cairns, 1994). This information was used to map group social networks. This network data yielded an individual closeness score for each child, indicating the number of steps required to connect one child to each other child in the group, mathematically represented as the inverse of the number of steps required to access each vertex (individual) from a specific vertex within the network, normalized by the total number of vertices within a group. We hypothesized that children’s individual closeness scores within their social network would increase across the 5 weeks of the program.

Results: A model of change in closeness score was fit using a linear mixed effects model (using R package: nlme). The slope parameter was highly significant, finding that individual closeness scores increased by a rate of .003 per week from Week 1 to Week 5 (b = 0.003, SE = 0.0006), $t(177)$ = 5.15, $p < .0001$). The slope model yielded the following equation for individual closeness: 0.041 + (.003*Week).

Conclusions: The STP focuses explicitly on building social and behavioral skills. This is the first study to examine individual closeness within social networks of children with ASD in the context of the STP program. Children with ASD increased in closeness within their social network over the course of the program, suggesting that the STP may foster social skills with a practical impact on a child’s ability to integrate within their social group. Future studies utilizing a comparison group and randomization are needed to determine the effect of STP on this important domain of child peer relationships.

277 **117.277** Update on the Effectiveness of Psychotherapy for Anxiety Disorders in Children and Adolescents with ASD

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Background: Anxiety disorders are prevalent and impairing in children with Autism Spectrum Disorders (ASD). A growing body of research has investigated the efficacy of Cognitive Behavioural Therapy (CBT) as a treatment for anxiety disorders in children with ASD. However, a review is needed to ascertain CBT can yet be considered an efficacious treatment for anxiety in ASD, or if not, what additional studies are needed to reach this standard.

Objectives: The purpose of this review was to: (1) Critically evaluate the current evidence base for the efficacy and effectiveness of CBT for anxiety disorders in children and youth with ASD (ages 7-25) using Chambless & Hollon's (1998) criteria; and (2) Provide recommendations for future research.

Methods: 20 studies were included in the review. Studies were selected from three existing systematic reviews conducted prior to 2017, along with a more recent search in PsycINFO to identify new findings. Inclusion criteria were: An open or randomized trial design, focus on CBT for anxiety, and focus on children (ages 4 – 18 years) with ASD. Identified studies were then evaluated using Chambless & Hollon's (1998) criteria, which uses the standards of independent replication, methodological rigor, and representativeness of studies to determine if a treatment should be consider possibly efficacious, probably efficacious, or well-established.

Results: The present review identified 10 CBT programs for anxiety in children with ASD that have been evaluated in open trials (8 studies) or RCTs (12 studies). These programs varied in format (i.e., linear or modular, individual or group) and degree of modification (i.e., adaptation for use with children with ASD). At present, though no treatment program meets well-established criteria, two programs – one individual modular CBT and one group linear CBT – meet probably efficacious criteria, and five programs meet possibly efficacious criteria. Current gaps in the literature include a need for RCTs comparing CBT to alternate treatments, and a need for multi-site replication to verify the efficacy of CBT programs across settings and samples. The seven treatments that met probably or possibly efficacious criteria varied widely in format and degree of modification, suggesting that CBT may be delivered in a flexible manner to suit client, provider and setting needs while still maintaining efficacy. Yet, across our review, only four programs were assessed in community settings and only two met possibly efficacious criteria, suggesting that further research is needed to determine the effectiveness of CBT outside research settings.

Conclusions: Seven of 10 CBT programs, with ranging format (individual, group), parent involvement and degrees of adaptation for ASD, were identified in the present review as probably or possibly efficacious treatments. CBT cannot yet be considered well-established; however, two current studies, designed to compare adapted CBT to standard CBT (R01 HD080098) and adapted CBT to pharmacological intervention (P50 HD093079), are likely to address this gap. Studies illuminating the essential ingredients, implementation and effectiveness of CBT in community settings as well as the long-term impact of treatment are needed.

278 **117.278** Implementation of Social Skill Group Training Kontakt in Children and Adolescents with ASD and Psychiatric Co-Morbidity in Regular Clinical Settings

ABSTRACT WITHDRAWN

Background:
Evidence-based treatments for children with ASD and psychiatric co-morbidity have long been missing, though widely needed. KONTAKT is a social skills group training (SSGT) treatment for children and adolescents with ASD. A previous pragmatic randomized controlled multicenter trial of SSGT KONTAKT showed small to moderate effects in social skills for participants. The aim of this study was to implement SSGT KONTAKT at Swedish Child and Youth Psychiatric Clinics (BUP) in Stockholm, Sweden.

Objectives:

To investigate the outcome effect on psychiatric comorbidity anxiety (A) and depression (D), of SSGT KONTAKT in children and adolescents with ASD during implementation of the treatment in regular clinical setting (BUP).

The hypothesis was that children and youths with ASD and psychiatric co-morbidity will show a decrease in depression and anxiety after attending SSGT KONTAKT.

Methods:

A total of 35 children/adolescents aged 9-17 years (7 female/28 male) participated in 5 groups at two different units and submitted the primary outcome measure of Becks Youth Inventory (BYI) scales of Anxiety and Depression, at baseline and post-treatment. The secondary outcome measures were the parent-rated Social Responsiveness Scale (SRS) that measures social skills and communication difficulties, and Adaptive Behavior Assessment System II (ABAS-II), a scale of adaptive functioning that indexes real-word abilities and disabilities. The OSU Autism Clinical Global Impression (CGI) and Developmental Disabilities Children's Global Assessment Scale (DD-CGAS) were used as clinician rated secondary outcome measures to assess global functioning and clinical severity.

Results:

No treatment effects were found on the primary outcome Becks Youth Inventory Anxiety scale and Depression scale (BYI A p>1.0000; 95% CI, BYI D p=0.2521; 95% CI). Secondary outcomes indicated small to moderate effects on social responsiveness and adaptive behavior (SRS p<0.0001; 95% CI, ABAS-II p=0.0239; 95% CI.). The largest effect was seen on clinicians' rating of global functioning and clinical severity (CGI: p<0.0001; 95% CI, DD-CGAS p=0.0006; 95% CI).

Conclusions:

The results from previous studies of SSGT KONTAKT concerning parents' and clinicians' ratings of social skills, adaptive functioning, and clinical severity are confirmed when implementing the treatment in regular clinical settings. More research is needed to evaluate and implement treatments of patients with ASD with psychiatric comorbidity. Becks Youth Inventory, a widely used scale to measure psychiatric conditions in children and youth at Child and Youth Psychiatric Clinics (BUP) in Stockholm, Sweden, is not appropriate for patients with ASD.

279 **117.279** "I'm Destined to Ace This": Work Experience Placement for High School Students with Autism Spectrum Disorder

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Background:
The transition from high school to tertiary education, work or other community options is often challenging for youth with Autism Spectrum Disorder (ASD). This transition can be particularly difficult for those with unique social, communication, and behavioural characteristics. It is widely recognised that postsecondary outcomes for adolescents with ASD are poor, with a critical need for programs that build better pathways to employment and education for these young people.

Objectives:

This study investigates the experiences of high school students with ASD who engaged in a short-term work experience program in the Information, Communication and Technology (ICT) industry in preparation for their transition to tertiary education or work. Factors contributing to a successful work experience were explored as well as the perceived value of the program from the perspectives of adolescents, parents and employers.

Methods:

A qualitative study based on a grounded theory framework employed focus groups and interviews to explore the experiences of the work experience program with five adolescents with ASD, six parents and six supervisors in October-November 2017 and October 2018. Thematic analysis explored key factors and outcomes of the work experience program.

Results:

Environmental factors including support from parents, attitudes, understanding and knowledge of supervisors and colleagues influenced the success of the program. Parents played a key role in providing support to get to the workplace and advice on workplace attire. Gaining knowledge on ASD and how to communicate with adolescents with ASD prior to the placement enabled supervisors and colleagues to provide them with better support. Recognising the specialised skills and abilities of the adolescents with ASD and harnessing them by the supervisors was a contributing factor to the program outcomes. Supervisors employed a strengths-based approach to harness adolescents' skills and strengths, directing them to tasks capturing their interest and eliciting their qualities and abilities. Developing and applying ICT-related skills, leadership and time management skills during the placement contributed to the program outcomes. Through the placement, adolescents were exposed to a real work environment enabling them to gain practical insights into the workplace. Placements built parents hope for their child's future, while adolescents recognised their potential and strengths and gained confidence, assisting them in planning their career pathways. New perspectives and diverse ideas brought by the adolescents positively contributed to the company productivity. From an economic perspective, the return to the host organisations outweighed the effort required. Adolescents with ASD were treated as a capable team members who produced high quality work. Employers were more aware of ASD, including the strengths and challenges it brought to the work place.

Conclusions:

Providing work experience placement to adolescents with ASD may improve the transition process from school to further education and work. This study provides evidence to support this approach as an early support for adolescents with ASD in facilitating post school transition. This early experience supports adolescents with ASD in seeking a future which meets their vocational and career aspirations. This study may inform a framework for designing transition interventions for adolescents with ASD.

Poster Session
118 - Medical and Psychiatric Comorbidity
11:30 AM - 1:30 PM - Room: 710

280 **118.280** Investigating Uncertainty in Fear Conditioning and Extinction Using fMRI

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Background: Many autistic people are distressed by inconsistent or changing environments, which may contribute a desire for sameness and to elevated levels of anxiety. There is growing evidence from self- and caregiver-report surveys, that anxiety and repetitive/restricted behaviors and interests in autism are associated with "intolerance of uncertainty" (IU), a cognitive bias towards perceiving situations as ambiguous and uncomfortable. However, there little experimental data that looks directly at the link between IU and anxiety in autism. Improved understanding of the physiological response to fear learning and uncertainty may inform treatment for unique aspects of anxiety in autism.
Objectives: To explore functional brain response to fear learning and extinction under different levels of uncertainty, in autistic and neurotypical adults.

Methods: We compare two separate fMRI studies of classical fear conditioning and extinction that utilized different reinforcement schedules in autistic and neurotypical adults with average to above-average cognitive performance. The unconditioned stimulus in each study was a burst of air to the base of the neck that is startling though not painful. In each experiment, one of two visual shapes was designated as the "safe cue" which predicted no threat (i.e., was never reinforced with the air burst) while the other "threat cue" could be followed by the air burst reinforcement. Experiment 1 (*n=39)* reinforced the threat cue with the air blast 42% of the time. Experiment 2 (*n*=57) reinforced the threat cue 100% of the time. In both experiments, the fear acquisition stage was followed by a fear extinction phase in which where the threat and safe stimuli were never reinforced by the air burst. Analyses of fMRI data targeted known regions of interest for fear conditioning and extinction including amygdala, insula, and prefrontal cortex.

Results: In the more uncertain context (42% reinforcement), the autism group showed a significantly decreased differentiation of threat and safe cues in right amygdala functioning. The autism group shows an increased (possibly delayed) amygdala and insula response during the now-safe context of the extinction phase. In the more certain (100% reinforcement experimental context, there were expected main effects for condition (threat > safe) but no group differences or group x condition interactions during fear acquisition. FMRI data likewise showed no group differences or interactions during extinction, though pupillometry—which indexes a much faster physiological response—indicates a possible increase in trial-by-trial arousal in autism during the extinction phase. We also found that brain activation to threat cues was associated with self-report

sensory processing measures.

Conclusions: Exposure and extinction are frequent techniques for treating anxiety in neurotypical people. Our results suggest that initial fear learning is likely atypical in autism at least in contexts where the rules or rates of reinforcement may be ambiguous; and report an increased physiological arousal to threat during extinction, which could negatively impact extinction-based treatments. Intolerance of Uncertainty, perhaps driven by atypical sensory processing, is likely an important target for treatment of anxiety in autism and more experimental work is needed to track the mechanisms that link IU to anxiety.

281 **118.281** What Causes and Maintains Anorexia Nervosa in Autism?

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Background:

Anorexia Nervosa (AN) is a severe, debilitating and potentially life-threatening eating disorder (ED). It is consistently found that 20-30% of women with AN are on the autism spectrum (Huke et al., 2013). Compared to non-autistic anorexic women, autistic women in ED services benefit less from current treatment approaches and have poorer outcomes (Stewart et al., 2017; Wentz et al., 2009). To improve care for autistic women with AN, a better understanding of how AN develops and persists in autistic individuals is required. This project is part of the Study of Eating Disorders in Autistic Females (SEDAF).

Objectives:

This study has two aims:

Firstly, to identify causing and maintaining factors of AN in autism from the perspective of autistic women, parents and health care professionals.

Secondly, to develop a model of autism-specific mechanisms for restrictive eating disorders.

Methods:

In-depth interviews were conducted with 45 participants: 15 autistic women with experience of AN (average age 32 years, range 23-58), 15 parents, and 15 clinicians with relevant experience. A collaborative approach to thematic analysis (Braun & Clarke, 2006) was used to identify patterns of meaning in the data.

Autistic women with experience of AN acted as advisors to the study. They helped develop the interview schedule and procedure and contributed to data analysis and interpretation.

Results:

Causing and maintaining factors of AN that were identified by our autistic participants related to the following themes: social difficulties, sensory sensitivities, difficulties with emotions, sense of self and identity, need for control and predictability, and certain thinking styles. Parents and professionals provided additional insights into early development, and how transition points often trigger eating problems. AN in autistic women seems to be distinct from AN in non-autistic women, in terms of its presentation and underlying mechanisms. AN is conventionally understood as being driven by weight and shape concerns, but these were rare amongst autistic women. Instead, their eating difficulties frequently stemmed directly from their autism, for example reflecting sensory aversions to foods or a special interest in calorie counting. Also, eating difficulties arose as an attempt to cope with the stresses of being autistic. For example, starvation helps to numb anxiety and sensory overload; and controlling food intake can counter anxiety arising from being in an unpredictable environment. Based on these findings we developed a model of autism-specific mechanisms for restrictive eating difficulties.

Conclusions:

The discoveries made in this study show that autistic women with AN need autism-specific treatments. This may explain why autistic women with AN currently have such poor outcomes, as they are given standard treatments that fail to address the mechanisms underlying their EDs. This research can contribute to the development and testing of interventions to treat AN and to prevent its development in autistic girls and women.

282 **118.282** Cognitive Behavioural Theory, Social Anxiety and Autism

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Background: Social Anxiety Disorder (SAD) has a lifetime prevalence of 12% in the general population. Studies report 50% of autistic adults meet criteria for SAD. Effective psychological treatment informed by the cognitive behavioural model cites negative self-beliefs, self-focussed attentional processes including observer-perspective self-images and high standards for social performance as significant maintaining factors. A developmental model has been proposed for SAD co-occurring with ASD. High trait anxiety and social interaction difficulties foster an anxious and avoidant style in respect of social situations (Bellini, 2006). Distinct approaches to psychological treatment arise from these different theories. Objectives: To investigate the relevance of cognitive factors to social anxiety co-occurring with autism.

Methods:

Study 1 Negative performance beliefs: ASD participants (aged 16-21 years) (N=41) were identified as low social anxiety (LSA) (N=19) and High social anxiety (HSA) (N=22) on the basis of the Social Anxiety Scale for Adolescents (SAS-A). A small group discussion task (adapted from Parr and Cartwright-Hatton, 2009) with post-hoc self and objective observer ratings of social performance, revealed significant differences between raters (self vs observer) ($F(1, 38) = 8.74$, $p<0.05$), but no effect of group (HSA vs LSA). There were no differences between the groups in observer rating of social performance, but self-rating was significantly lower in the HSA group.

Study 2 Self-focused attention: Participants (n=33) (aged ≥ 16 years) completed the Social Phobia Inventory (SPIN): (HSA N=16; LSA N=17). A small group discussion task was followed by completion of the Focus of Attention Questionnaire (SFA) and Adapted Autonomic Perception

Questionnaire (APQ). There was a significant main effect of group (F (2, 30) =.755, partial η2=.34) on SFA scores, which were significantly higher in the HSA group (F(1,31)=14.66, p=.002, partial η2=.32). The majority of participants (82%) noticed changes in physiological symptoms on the adapted APQ. APQ scores were significantly higher in the HSA group than the LSA group (t(32)=-2.28, p=.029, 95% C.I. -.57--.03).

Study 3 Images: Adults (n=62) with clinical diagnosis of ASD recruited via an online survey (SPIN scores: (HSA) (N=31) and (LSA) (N=31)) participated in an adapted Imagery Interview (Hackmann et al., 1998). The interview comprised 3 conditions, Relaxing Image 1, Social Situation Image and Relaxing Image 2. State anxiety ratings and image dimensions: vividness, frequency, distress, and controllability were compared between the groups. State anxiety ratings differed by Image condition but not group. The HSA group reported more frequently distressing images of themselves in social situations with an observer- perspective.

Results: The results of these preliminary studies suggest factors central to CB models of Social Anxiety Disorder (SAD) may have relevance for Autism. There was some tentative evidence of negative performance beliefs but the study was lacking statistical power. Significant differences in self-focussed attention and distressing self-images were reported by participants high in social anxiety.

Conclusions: Larger scale studies should aim to replicate these findings. If established, treatment endeavours should consider how best to adapt cognitive change techniques in interventions adapted for autistic people.

283 **118.283** Positive and Negative Symptomology in ASD and Schizophrenia

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Background:

Few studies have directly compared clinical dimensions of ASD and schizophrenia, and diagnostic confusion between these disorders persists. This study empirically investigated Foss-Feig et al.'s (2016) proposed framework to compare adults with ASD and schizophrenia in terms of *positive*symptoms(the presence of atypical characteristics such as delusions, hallucinations, or restricted and repetitive behaviors), and *negative* symptoms (the absence or reduction of typical characteristics such as social initiation or affective sharing).

Objectives:

To identify shared and distinct symptomology between ASD and schizophrenia.

Methods:

Participants were adults aged 18-35 who met DSM-5 criteria for ASD (n=59) or schizophrenia (n=45) and a group of typically developing (TD) controls (n=55). Participants completed the Scale for the Assessment of Positive Symptoms (SAPS) and Scale for the Assessment of Negative Symptoms (SANS) to assess schizophrenic symptoms, and the Autism Diagnostic Observation Schedule-2 (ADOS) to assess autism symptoms. ADOS items were designated as "positive" or "negative" following the framework developed by Foss-Feig et al. (2016). Items that could not be differentiated as positive or negative were not included in relevant analyses.

Results:

Across ASD, Schizophrenia and TD samples, the sensitivity of the ADOS was 71.2% and the specificity was 78.0%. Notably, 20 out of 45 participants with schizophrenia met ADOS criteria (44.4%). To understand symptomatology across disorders, we compared diagnostic groups on positive and negative symptomology. The main effect of diagnosis on positive ADOS symptoms was significant (F(2,80.23)=22.45, p<.001), and post hoc tests revealed that the ASD group scored higher on positive ADOS symptomology than both the SCZ and TD groups (ps<.001). For negative ADOS symptoms, the main effect of diagnosis was significant (F(2,93.21)=24.92, p<.001). Post hoc tests revealed that both the ASD and schizophrenia groups scored higher than the TD group on negative ADOS symptomology (ps<.005). There were not significant group differences between the ASD and schizophrenia groups (p=.097).

The main of effect of diagnosis on SAPS scores was significant (F(2,57.66)=17.59, p<.001). Post hoc tests revealed that the schizophrenia group had higher SAPS scores than both the ASD (p= .017) and TD groups (p<.001). The main effect of diagnosis on SANS scores was significant, (F(2,58.63)=67.96, p<.001). While both the ASD and schizophrenia group had higher SANS scores than the TD group (ps<.001), there were not significant group differences between the ASD and schizophrenia group (p=.571).

Conclusions:

A pattern emerged such that both ASD and schizophrenia appear to share symptomology related to *negative* social symptoms, such as reduced social-emotional reciprocity (e.g., blunted affect, apathy, reduced affective sharing and reduced social overture and response). In contrast, positive symptomology qualitatively differentiated ASD and schizophrenia. Those with schizophrenia demonstrated higher positive symptoms related to psychosis (e.g., delusions and hallucinations) whereas those with ASD demonstrate higher positive symptoms associated with abnormalities in language and speech, restricted interests, and repetitive behaviors. The distinction between positive and negative symptoms may be useful for parsing heterogeneity within the ASD population and across disorders. However, there is a need to design measures of autism symptomology that clearly differentiate positive and negative symptoms.

284 **118.284** Profiles of Psychosis Symptoms and Neural Predictors of Conversion Among Individuals at Clinical High Risk for Psychosis, with and without Autism Spectrum Disorder

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Background: Individuals with autism spectrum disorders (ASD) have symptoms, including social and sensory deficits, and neurobiological alterations that overlap with schizophrenia. Though high rates of psychosis symptoms occur in ASD, little is known about psychosis prodrome or predictors of psychosis conversion in this population.

Objectives: In this study, we leverage data from clinical high risk (CHR) patients from the NAPLS2 consortium to examine: a) baseline differences in psychosis symptoms and social functioning, b) relative risk of conversion, and c) whether electrophysiological markers of attention orienting yield differential predictors of conversion in CHR individuals with and without ASD (CHR/ASD+; CHR/ASD-).

Methods: Clinical, electrophysiological, and 24-month follow-up data were available for 305 individuals (14 CHR/ASD+; 291 CHR/ASD-). We examined baseline differences on the SOPS, GFS, and TASIT, as well as rate of conversion to psychosis, defined as SOPS>6 at 2-year outcome. Using electrophysiological data recorded at baseline, we examined P300 amplitude to infrequent Target(10%) and Novel distractor(10%) stimuli from visual and auditory oddball tasks, and MMN response for duration(5%), frequency(5%), and duration+frequency(5%) deviants.

Results: In line with our expectations, CHR/ASD+ had worse functioning than CHR/ASD- on the GF-Social scale (t=-4.2, p<.01) and TASIT total score (t=-2.9, p=<.01), but groups did not differ in their psychotic symptoms on the SOPS (Positive: p=.72; Negative: p=.13; Disorganization: p=.13; General: p=.86). Groups did not differ in the rate at which they converted to psychosis (CHR/ASD+: 15.4%; CHR/ASD-: 11.1%; p=.50). EEG data revealed dissociable profiles regarding neural response to sensory stimuli in those who did versus did not convert to psychosis, depending on ASD status. P300 amplitude to Novel visual stimuli was smaller in CHR/ASD− converters(n=71) than CHR/ASD− non-converters(n=220), but larger in CHR/ASD+ converters(n=4) than CHR/ASD+ non-converters(n=10) (Modality×ASD×Converter Interaction, F=3.57;p=.06). For auditory and visual Target stimuli, whereas P300 amplitude was similar for CHR/ASD+ non-converters and all CHR/ASD− individuals, CHR/ASD+ converters had larger P300 amplitudes (ASD×Converter interaction, F=12.12;p=.001). For MMN, there were no significant amplitude differences between groups (Conversion,p=0.31; ASD,p=0.57) or deviant type (p=0.56).

Conclusions: Individuals with ASD and CHR have greater social deficits than the general CHR population, but show similar psychotic symptoms and have similar risk for conversion to psychosis. Neural response during orienting of attention to sensory stimuli is important for understanding risk for conversion, and differs among CHR individuals dependent on whether they have ASD. In particular, whereas all CHR individuals who do not convert share a common pattern of attenuated ERP amplitudes reflecting attention allocation to target and novel auditory and visual stimuli, CHR/ASD+ who convert have a unique pattern of heightened P300 responses to infrequent target stimuli. Deviance detection, however, did not differ as a function of ASD status. These findings have two important implications: 1) individuals with ASD do convert to psychosis and have similar CHR symptom and risk profiles clinically; 2) in CHR individuals with ASD in particular, examining neural markers of attention allocation to sensory stimuli may reveal important predictive clues about risk for conversion.

285 **118.285** Neural Architecture of Default Mode Network during Social Interaction in Autism Spectrum Disorder and Schizophrenia: Categorical Vs. Dimensional Approaches

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Background:

Although autism spectrum disorder (ASD) and schizophrenia (SZ) are considered separate clinical entities, deficits in core social function are characteristic of both. Social function depends on complex interwoven processes that lie on a continuum, encompassing clinical and non-clinical populations. However, the dimensionality of social-cognitive processes across ASD and SZ samples, and delineation of common or disparate neural mechanisms, have yet to be determined.

Objectives:

We aimed to (1) characterize latent social processing constructs based on multiple social cognitive measures and assess their dimensionality, differences, and overlaps between healthy young adults and clinical samples of ASD and SZ participants; (2) delineate the functional connectivity (FC) within the default mode network (DMN), a neural network shown to be involved in social processes, while individuals engaged in a social competitive game during functional MRI (fMRI) scanning; and (3) determine whether FC measures better aligned with categorical diagnosis of ASD or SZ or with dimensional social constructs.

Methods:

Forty-two adults with high-functioning ASD, 60 with SZ and 73 healthy participants (mean age=26.1±7.4 years) completed a battery of social-cognitive measures, and a competitive Domino fMRI task. Exploratory factor analysis (EFA) was used to identify latent social constructs from social-cognitive scores and group differences were assessed with ANCOVA. FC was computed using high-order independent component analysis (ICA; 75 component estimated). Ten DMN components were selected and mentalizing-specific beta weights, reflecting the degree to which brain regions included in a component are modulated by the mentalizing condition, were calculated during a task-interval when participants attempted to predict the other player's next move. ANCOVAs were used to estimate the effect of diagnosis and social factors on components' beta values. All analyses were controlled for age, gender and estimated IQ.

Results:

EFA revealed 5 social factors interpreted as mentalizing and empathy (F1), social distress (F2) social-emotional perception (F3), fantasizing/daydreaming (F4) and self-emotion processing (F5). Factors 1, 2, 3 and 5 differed by diagnostic group (F>6.6, p<.002), with ASD and SZ distinguished from healthy participants but not from each other. Inspection of the factor loadings demonstrated clear overlap and continuous distribution between all 3 groups. Similarly, ASD and SZ showed decreased DMN FC during mentalizing relative to healthy particiapnts in posterior cingulate cortex and bilateral temporoparietal junctions (F>6.38, p<.01). An interaction between diagnosis and F2 (social distress) was found in subgenual anterior cingulate cortex (sgACC; F=5.9, p=.005), such that SZ showed negative association between F2 and sgACC connectivity,

significantly differing from ASD (p=.05) and healthy individuals (p=.001).

Conclusions:

The current study delineates five dimensional social constructs across SZ, ASD, and non-clinical individuals. While four showed significant differences between the clinical and non-clinical groups, ASD and SZ overlapped in ability. Similar patterns were observed in neural connectivity within posterior and lateral regions of the DMN. However, when taking into account social factors, a significant difference between ASD and SZ was identified in the ACC in relation to social distress, suggesting that categorical and dimensional approaches are complementary and should be taken into account during individual assessment and treatment.

286 **118.286** A Computerized Tool for Identifying Underlying Sources of Distress for Minimally-Verbal Adolescents and Adults Presenting with Agitation

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Background:

Individuals with ASD who have low verbal ability often have difficulty communicating their sources of distress, discomfort or frustration. Often times these individuals communicate their needs indirectly through irritability and disruptive behavior. These behaviors can create a substantial barrier in their capacity to access appropriate medical care, participate in their community, and maintain residence with their parents or other caregivers. To address the needs of this population, medical providers must develop facility in translating observable behaviors to appropriate treatment protocols.

Objectives:

The primary objective of the current project is to convert parent and caregiver social capital (i.e. resources and knowledge) into improved behavioral and health outcomes for adolescents and adults with ASD with minimal verbal ability. In addition, this project seeks to improve medical provider efficiency via a carefully designed and sequenced delivery of questions that focus on known behaviors associated with specific psychiatric and medical conditions in this population.

Methods:

The current study reports on qualitative data from six focus groups with 14 parents or caregivers of adolescents or adults with ASD. Study participants completed an online assessment that was designed to indicate psychiatric or medical conditions using discreet behavioral indicators. The computer adaptive measure was created to follow a branching logic scheme where positive answers lead to expanded questions on specific topics. Our analysis followed a qualitative data methods outlined by Ritchie and Spencer (1994). Atlas.ti (version 5.1) software was used to organize and analyze the focus group data. The data interpretation plan followed several steps. First, we utilized inductive reasoning and the constant comparative method (Strauss & Corbin, 1998) by systematically comparing parent and caregiver statements within and across focus groups. Then, we focused on cross-group saturation in order to identify perspectives that represented community-wide beliefs among parents and caretakers. By analyzing data across the five focus groups, we were able to assess whether the perspectives that emerged from one group also emerged for the others, subsequently serving as a proxy for theoretical sampling in order to assess the meaningfulness of participant perspectives.

Results:

In the current study, all of participants reported positive acceptability of the content of the measure. All participant also reported positive acceptability of the time required to complete the measure. Despite consistent positive remarks regarding the existing content, participants indicated a desire to expand content in several categories (e.g. gastrointestinal, self-injurious behavior, dental) and add categories that were not previously included (e.g. gynecological/menstruation).

Conclusions:

The current project documents the development and initial validation of a measure designed to support medical providers in caring for minimally verbal adolescents and adults with ASD. This initial study showed positive acceptability for the content and structure of the question algorithm. While efficiency of the measure was a goal in the initial design, focus group participants called for expanded content in several key areas. This feedback has led to more comprehensive coverage of medical and psychiatric considerations that impact individuals with ASD.

287 **118.287** A Gene Enrichment Approach Applied to Sleep and Autism

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Background:

Sleep problems/disorders (SD) are common in autism spectrum disorder (ASD), and up to 80% of individuals diagnosed with ASD will experience a SD within their lifetime (Richdale & Schreck, 2009). SDs regularly include increased sleep onset latency, frequent and prolonged night awakenings, insomnia, and/or early morning rise times (Cortesi et al., 2010; Krakowiak et al., 2008; Richdale & Baglin, 2015). Although SD and ASD are highly comorbid, relatively little is known about the mechanistic intersections of these two disorder classes.

Objectives:

Using a gene enrichment approach, the present study (1) identifies genes that contribute to both SD and ASD and (2) discusses common mechanistic/biological pathways.

Methods:

We used the core autism gene set from the Autism KB database library (Xu et al., 2011). The ASD core gene set includes 171 genes, each with a total evidence score of 16 or higher (higher scores indicate greater confidence in their ASD affiliation). Additionally, we hand-curated a sleep gene database using existing literature. Inclusion in the final sleep gene set required a minimum of two peer-reviewed empirical findings (per gene) indicating the association of structural variations in that gene with a sleep phenotype, or at least one peer-reviewed GWAS finding. The final

curated sleep gene set contained 154 genes.

First, we determined the number of genes appearing in both the sleep and ASD core gene datasets and calculated whether the ASD gene set was enriched for sleep-related genes (e.g., whether more genes were in both gene sets than expected by chance). Specifically, we compared our final sleep gene set against the published ASD core gene set. We used the *Nematode bioinformatics analysis tools and data* (Lund, n.d.) to calculate the statistical significance of genetic overlap between the two gene sets. Then, we subjected the list of overlapping genes to an over-representation pathway analysis (Marceau & Abel, 2018). The over-representation analysis was conducted by uploading the overlapping genes into the online over-representation tool maintained by the *Consensus Pathway Database* (CPDB; http://cpdb.molgen.mpg.de/).

Results:

Overall, we identified 16 common genes across the sleep and ASD core gene sets (Table 1). The expected number of overlapping genes was (154[sleep gene set size]*171[ASD core gene set size])/19,000[total genes in genome]=1.386. The representation factor was therefore 16[identified genes]/1.386[expected genes]=11.54, p<6.645e-13, indicating significantly more overlap than expected by chance (based on the size of each gene set and the total number of genes in the genome).

The identified overlapping genes are involved in circadian entrainment (CACNA1C, GRIA3), melatonin synthesis (ASMT), and are linked with several known genetic syndromes (e.g., MECP2, MAOA, UBE3A). An over-representation analysis identified several enriched pathways (Table 2) that suggest dopamine and other chemical synapses in the neuronal system as potential shared mechanisms of SD and ASD.

Conclusions:

The gene overlap set and the highlighted biological pathways discussed in this study serve as a stepping-stone for new genetic investigations of SD and ASD comorbidity or may be used in existing ASD genome databases to answer critical questions about SD in individuals with ASD across the lifespan.

288 **118.288** Amygdala-Frontal Functional Connectivity Predicts Longitudinal Anxiety during the Transition to Adulthood in Autism

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Background: The prevalence of anxiety disorders in individuals with Autism Spectrum Disorders (ASDs) is estimated at approximately 40%, and the transition to adulthood is a period of particular vulnerability. Functional connectivity between amygdala and prefrontal cortices has been hypothesized to reflect a circuit tied to emotion down-regulation and anxiety in the general population, with some research indicating that these circuits are also linked to anxiety in ASDs (Kleinhans et al., 2016). Fishman et al. (2018) reported an absence of age-related increases in amygdala-prefrontal connectivity during adolescence in ASDs compared with typically developing (TD) individuals, suggesting that lower amygdala-frontal connectivity could be a risk factor for developing anxiety later on. However, longitudinal studies that could directly test this hypothesis are required. Characterizing the neural predictors of risk and resilience for anxiety disorders in ASDs may help increase the efficacy of clinical interventions, resulting in improved care and higher quality of life during this crucial transition period.
Objectives: To examine, in a longitudinal design, whether amygdala-frontal connectivity patterns predict anxiety in ASDs during the transition to adulthood.

Methods: Longitudinal data from 10 adolescents and young adults with ASDs participating in an ongoing study are presented. Data include diagnostic evaluations, T1-weighted anatomical MRI, and eyes-open resting-state fMRI acquired at baseline [mean age(sd) at Time1 = 13.6(2.0) years], and measures of anxiety symptoms acquired at follow-up [mean age(sd) at Time2 = 18.3(3.8) years, inter-timepoint interval = 4.6(2.8) years] using the parent-report form of the Multidimensional Anxiety Scale for Children 2nd edition (MASC-2, a = .9). Following standard image preprocessing, we extracted mean time series from the left and right amygdala (from the Harvard Oxford subcortical atlas, thresholded at 50% probability), and tested the correlation between seed to frontal-lobe connectivity at baseline and Time2 anxiety using AFNI 3dttest++. Due to the currently limited sample size, we report results at a voxelwise $p < .05$, cluster size > 100.

Results: As in previous studies, we found remarkable elevations in anxiety in ASD participants, with 40% showing elevated MASC-2 T scores of >60 (i.e., evidence of clinically significant anxiety). Lower functional connectivity between the left amygdala and right dorsolateral prefrontal cortex at baseline was strongly associated with higher anxiety scores at follow-up. We also observed a negative correlation between baseline amygdala connectivity (bilaterally) with medial frontal gyrus and anxiety at Time2. Specifically, higher anxiety scores at Time2 were associated with lower connectivity between the amygdala and medial frontal gyrus.

Conclusions: These results suggest that functional connectivity within previously hypothesized circuits of emotion regulation and anxiety (amygdala-frontal circuits) may predict long-term anxiety levels in adolescents and young adults with ASDs. Notably, weaker connectivity between amygdala and prefrontal regions, even during a resting-state, predicted risk for anxiety later on. Although these results should be viewed with caution given the as yet small sample size, they suggest that effective preventative interventions for anxiety disorders during the transition to adulthood in ASDs could potentially target amygdala-prefrontal circuitry.

289 **118.289** Anxiety Symptom Structure in Youth with ASD Receiving Residential Care Is Distinct and Varies By Informant

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Background: Anxiety in youth with autism spectrum disorder (ASD) is highly prevalent and impairing (Kerns et al., 2015). In recent years, there has been significant progress in accurate assessment of anxiety in non-treatment seeking as well as outpatient samples of youth with ASD (e.g., Kerns et al., in press). However, a large proportion of youth with ASD have profound challenges that necessitate care in residential treatment settings (Siegel at al., 2015). While such challenges are likely to alter expression of co-occurring psychopathology, resulting in different symptom presentation compared to that seen in non-treatment seeking and outpatient youth, little is known about internalizing symptom presentation in this population (Rosen et al., 2018). Moreover, obtaining reports from multiple informants is necessary to fully understand context differences of symptom presentation within clinical samples (De Los Reyes, 2013).
Objectives: The present study explored the structure of anxiety symptoms in a sample of ASD youth living in three residential settings, and

whether structure differed as a function of residential manager or teacher report.

Methods: The Child and Adolescent Symptom Inventory (CASI-5; Gadow & Sprafkin, 2013) was administered for 146 youth (M_{age} = 15.27, SD_{age} = 3.12; 119 male) with severe intellectual (IQ ≤ 70) and adaptive functioning ($M_{Vineland}$ = 43.25, $SD_{Vineland}$ = 14.11) difficulties, receiving care in state-funded residential facilities across NY. Classroom teachers completed the CASI teacher version, whereas residential managers who provided intensive, around-the-clock behavioral support, completed the CASI parent version. An exploratory factor analysis (EFA) of the CASI-20 anxiety scale, an adapted, reliable, and valid measure of anxiety symptoms in ASD (Lecavalier et al., 2014), was conducted separately for residential manager and teacher report. Maximum Likelihood estimation and Geomin rotation were utilized, and separation anxiety items were removed for analyses. Standard fit indices were used to evaluate model fit (Table 1).

Results: Residential manager report yielded a 3-factor structure accounting for 63% of item variance, whereas teacher report yielded a 2-factor structure accounting for 52% of item variance (Table 1). Residential manager factors were over-arousal, performance fears/physical symptoms, and social fearfulness; teacher report factors were social fearfulness/generalized anxiety disorder (GAD) and GAD/physical symptoms/obsessions (Table 2).

Conclusions: Non-treatment seeking ASD youth show distinct factors of social anxiety and GAD (Hallett et al.); in the present study, this differentiation was evident from residential manager report, but not teacher-report. Such informant differences bear consideration for measurement design, such as adapting measures to each informant accordingly. Moreover, anxiety structure in ASD youth in residential facilities differs from that of outpatient youth with ASD, as outpatient youth have GAD symptoms that load on to one unitary factor (Lecavalier et al., 2008). Further, all CASI anxiety symptoms in ASD youth receiving residential care do not form one unitary construct, which contradicts current conceptualizations and CASI-informed anxiety measurement approaches for ASD (e.g., Scahill et al., in press). It may be that increased challenges lead to more complex and nuanced symptom presentation for youth receiving residential care, which might not be adequately captured even by anxiety instruments adapted for ASD.

290 **118.290** Are Restrictive and Repetitive Behaviors Associated with Emotion Dysregulation in Youth with Autism Spectrum Disorder?

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Background: Although autism spectrum disorder (ASD) is characterized by impairments in social communication and restrictive/repetitive behaviors (RRBs), the extent and severity of RRBs ranges widely among youth with ASD, leading some researchers to question whether RRBs are inherently a core symptom of ASD stemming from a common underlying cause, or a concurrent feature for some but not all individuals. There is a well-documented correlation between the severity of core ASD symptoms and the presence of mental health disorder symptoms, although the nature of this linkage remains poorly understood, specifically whether they are unique and stronger for RRBs as compared to social-communication symptoms. One emerging hypothesis suggests that RRBs may reflect a specific manifestation of underlying emotion dysregulation and therefore measures of RRBs may have strong statistical affinity for measures of emotion dysregulation. A corollary hypothesis is that the RRB cluster is more strongly associated with emotion dysregulation constructs than is the ASD social-communication symptom cluster. A secondary corollary suggests that, of the two main symptom domains of emotion dysregulation, internalizing symptomatology (versus externalizing symptomatology) may be particularly strongly linked with RRBs due to various shared behavior features. Extant research has not yet addressed these hypotheses comprehensively.

Objectives: To explore the relationship between RRBs and emotion dysregulation in youth with ASD.

Methods: Data from the National Database for Autism Research (NDAR) were compiled to examine the patterns of association between well-established continuous symptom measures, namely the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1991) and the Social Responsiveness Scale (SRS; Constantino & Gruber, 2012). Participants included all youth with ASD ages 6-18 years old (*N*=2921) with valid scores for both measures. Linear mixed models (LMMs) were used to test the above hypotheses, accounting for assessments conducted at multiple timepoints. The SRS RRB subscale and Social Communication and Interaction (SCI) subscale were used in the models simultaneously to predict CBCL Internalizing scores. Similarly, the Internalizing and Externalizing CBCL subscales were used simultaneously to predict SRS scores.

Results: In the primary LMM, RRBs were a better predictor of internalizing symptoms (b=.265) than was social-communication symptoms (b=.197). In the secondary LMM, internalizing symptoms were a better predictor of RRB severity (b=1.328) than were externalizing symptoms (b=.443).

Conclusions: This study highlights a substantial and specific relationship between RRBs and emotion dysregulation in youth with ASD. Although by no means resolving diagnostic questions about the centrality of RRBs in the ASD taxon, these results illustrate a specific affinity between RRBs and internalizing symptomatology, as predicted by emerging conceptual models, which aligns with research on the frequent mental health comorbidities seen in ASD as well as theories of "multiple autisms". Perhaps RRBs are, to some extent, manifestations of underlying emotion dysregulation that also leads to anxiety, depression, aggression, and similar comorbid mental health symptoms and diagnoses. Future research may be able to test RRBs as underlying manifestations of emotion dysregulation more directly with multi-method assessment of internalizing behavior at both neural and behavioral levels in heterogeneous groups of youth with ASD.

291 **118.291** Association between Impairments in Objectively Measured Social Cognition and Emotional and Behavioural Problems in Adolescents with Autism Spectrum Disorders

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Background:

Many young people with autism spectrum disorder (ASD) exhibit co-occurring emotional and behavioural problems. The development of effective interventions requires greater knowledge of the causes of these problems. One approach is to explore whether variation in specific neurocognitive processes, thought to be impaired in individuals with ASD, is also associated with additional psychopathology. Social cognition difficulties are often reported in ASD, but how these relate to co-occurring emotional and behavioural problems (including callous-unemotional (CU) traits) has not been well explored. Different aspects of social cognition (emotion recognition vs. theory of mind) may be associated with

different types of co-occurring psychopathology.

Objectives:

To test the association between objective metrics of social cognition and co-occurring emotional and behavioural problems, in a well-characterised sample of adolescents with ASD (QUEST sample; part of the wider IAmHealth study; n=48; 28 males, 20 females; 11-15 years) with a wide-range of IQ (mean = 85.85, range = 33-129).

Methods:

Assessment of social cognition included performance on two computerised tasks; measuring emotion recognition (including assessment of gaze patterns using eye-tracking) and theory of mind (Animated Shapes task; Castelli et al., 2002). Co-occurring psychopathology was assessed using the ADHD, emotional and conduct problems sub-scales of the parent-rated Strengths and Difficulties Questionnaire (SDQ) and the Inventory of Callous-Unemotional traits (ICU). Multivariate regression was used to test associations between co-occurring psychopathology and social cognition. Age, sex and IQ were included as covariates.

Results:

An association was found between higher levels of emotional problems and more time spent looking at the eyes relative to the mouth for neutral faces (β=0.07, p<0.05) and a trend association was found for sad faces (β=0.04, p=0.08) (Figure 1). This pattern remained in covariation analyses (neutral β=0.07, p=0.05; sad β=0.04, p<0.05). A trend association was found between increased CU traits and longer RTs for fearful faces in covariation analyses (β=0.04, p=0.06). No associations were found accuracy in the emotion recognition task.

Poorer theory of mind ability was associated with greater emotional (β =-1.46, p<0.05) and conduct problems (β =-.86, p<0.05) (Figure 2). Associations remained significant or at a trend (p=0.06 for the association with conduct problems) in covariation analyses. No associations were found with ADHD symptoms in either task.

Conclusions:

The association between emotional problems and relative looking to the eyes when viewing sad and neutral faces could indicate a bias towards negatively valenced social stimuli, as is reported in typically developing populations. Similarly, difficulties in recognising fear in individuals with CU traits is comparable to that reported in typically developing populations, suggesting these two types of co-occurring psychopathology may have comparable aetiologies in typically developing and ASD populations. The association between objectively assessed difficulties in theory of mind and emotional and behavioural problems builds on prior work which has which has found comparable associations using caregiver-report of theory of mind. Overall, findings suggest that social cognition atypicalities should be investigated in aetiological models of co-occurring psychopathology in ASD, and that assessment of socio-cognitive functioning could be helpful in the planning of interventions.

292 **118.292** Association between Puberty, Age, and Behavior in Children and Youth with Autism Spectrum Disorder: Data from the Pond Network

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Background: Puberty is often cited as a cause of challenging behaviour in children with autism spectrum disorder (ASD), although there is little evidence to support this.

Objectives: The objective of this study was to determine the association between pubertal status, age, and internalizing/externalizing behavior in children and youth with ASD.

Methods: This was a cross-sectional study using data from the Province of Ontario Neurodevelopmental Disorders network and included children and youth with ASD aged 8-19. All participants' caregivers completed the Child Behavior Checklist (CBCL). Participants or caregivers reported Tanner stage of puberty. Participants were grouped into three pubertal stages: pre-pubertal (Tanner 1), pubertal (Tanner 2-4), and post-pubertal (Tanner 5). The influence of pubertal stage on CBCL internalizing and externalizing behavior scores was assessed using multivariable linear regression controlling for age. Because the sample consisted of more males than females, separate analyses were done for each sex, with the primary analysis for males and a secondary analysis for females.

Results: Three hundred fifty-seven participants (277 males and 80 females) were included. In males, an interaction term between pubertal stage and age was not significantly associated with internalizing behavior (p=0.07); however, within the pre-pubertal and pubertal stages, there was a significant positive association with age and internalizing behavior, with older males in these pubertal stages demonstrating higher levels of internalizing behavior (pre-pubertal p=0.0009; pubertal p=0.007; Figure 1). There was a non-significant negative association between age and internalizing behavior in the post-pubertal sample (p=0.7). There were significantly lower externalizing behavior levels in male participants with each successive pubertal stage (p=0.0001) with a significant positive association between age and externalizing behavior (p=0.0009), meaning that older males within that pubertal stage had higher levels of externalizing behavior (Figure 2). Internalizing behavior in female participants showed a borderline significant positive association with age (p=0.04). There was no significant independent effect of puberty on internalizing behavior for female participants (p=0.5). No significant associations were found between externalizing behavior and age (p=0.3) or pubertal stage (p=0.7) in female participants.

Conclusions: Older males within pre-pubertal and pubertal stages demonstrate higher levels of internalizing behavior and older males in all pubertal stages demonstrate higher levels of externalizing behavior, raising the possibility of a protective effect of earlier puberty. Levels of externalizing behavior for males are lower in each successive pubertal stage. Females demonstrated higher levels of internalizing behavior with increasing age; however, further study is needed on larger samples.

293 **118.293** Association of Child and Adolescent Sleep Problems with Child and Parental Health

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Background: The stress of caring for a child with autism spectrum disorder (ASD) and problematic behaviors can affect caregivers' physical and mental health. Studies have shown that the presence of additional medical conditions in the child with ASD has a negative effect on quality of life beyond having ASD alone. We hypothesize that co-occurring sleep problems in children with ASD can affect child and parental medical and mental health beyond effects of the child's ASD alone.
Objectives: The purpose of this study is to examine the relationship of co-occurring sleep problems in children with ASD and medical and mental health in the child and parents .

Methods: U.S.-based primary parents of children with ASD were recruited from a validated and verified national autism registry. Parents completed an online survey on co-occurring conditions that incorporated family and child demographic information including the CSDI, a validated tool that scores the frequency and duration of six sleep habits (scored 0-2) over the previous month. Commonly co-occurring medical conditions in the child (gastrointestinal, sleep, epilepsy, etc.) were documented. Parents were asked about their own medical and mental health conditions such as hypertension, overweight, diabetes, anxiety, and depression. Participants also responded regarding any extra visits beyond routine health supervision to health professionals for their child or themselves.

Results:

579 mothers/child dyads were analyzed. Responding parents were the primary caregiver, primarily white (89%) and non-Hispanic (92%); mean age of 43.2 (SD 7.26; range 25-65) years. Children were primarily male (81%), white (84%), and non-Hispanic (88%); mean age of 12.1 (SD 3.61; range 3-17) years. On the CSDI parents rated their child's sleep problems as Severe (score≥4) =363 (63%); Not Severe (score<4) =216 (37%). There was no statistically significant difference in maternal age, race (white/non-white), or ethnicity (Hispanic/Non-Hispanic) between those with and without severe sleep problems.

According to parents' reports, children classified as Severe sleep problems required additional visits for non-routine medical care to their primary care provider ($\chi^2(1) = 12.7643$, $p = 0.000$), specialist ($\chi^2(1) = 13.3529$, $p = 0.000$) or emergency room ($\chi^2(1) = 7.0662$, $p = 0.008$) as compared to those with Not Severe sleep problems. Mothers of children with Severe sleep problems were more likely to be overweight ($\chi^2(1) = 9.1322$, $p = 0.003$)) diabetic ($\chi^2(1) = 5.9005$, $p = 0.015$), and report higher rate of anxiety or depression ($\chi^2(1) = 6.8281$, $p = 0.009$).

Conclusions:

Children with ASD and co-occurring sleep problems require additional primary care provider, specialist or emergency room visits. Primary caregivers of children with ASD and severe sleep problems had increased prevalence of overweight, diabetes and anxiety or depression. Co-occurring sleep problems in ASD have serious implications on child medical support and parent health, with subsequent economic burden on the family. A better understanding of those factors that impact caregiver burden could help healthcare providers identify appropriate services and treatments to promote better health for their child with ASD and reduce negative effects on caregiver health status.

294 **118.294** Autism Spectrum Disorder Is Associated with an Increased Risk of Development of Underweight in Children: A Systematic Review and Meta-Analysis

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Background: Underweight, defined as having a BMI of ≤ 5th percentile for age and sex (Kuczmarski et al., 2000), is associated with multiple macro- and micro-nutrient deficiencies, a high risk of acquiring infections (e.g. pneumonia, gastrointestinal infection) (Dobner & Kaser, 2018) and a higher mortality rate (Wake et al., 2013). Possibly due to restricted dietary patterns such as food selectivity (Bandini et al., 2010; Sharp et al., 2018) and abnormal meal time behaviors (Malhi et al., 2017), children with autism spectrum disorders (ASD) are often thought to be at a higher risk of being underweight, compared to typically developing children. However, evidence on the association between ASD and underweight are equivocal.
Objectives: To conduct a systematic review and meta-analysis of the literature to examine the prevalence and relative risk of underweight in children with ASD.

Methods: ProQuest, PubMed, Scopus and Web of Science databases were systematically searched per the PRISMA guidelines (**see Figure 1**). Results were screened to identify studies that reported the prevalence of underweight in children with ASD and when available, in typically developing control groups. DerSimonian–Laird random-effects meta-analyses were performed using the 'meta' package in R software to determine the pooled prevalence and the relative risk of underweight among children with ASD.

Results: Underweight had a prevalence of 7.2% (95% CI, 5.5-9.4) among children with ASD overall (24 study arms) and a prevalence of 4.8% (95% CI, 4.3-5.4) among children with ASD in the United States (9 study arms). These estimates were significantly greater than the prevalence of childhood underweight in the United States in 2013-2014 (i.e. 3.8%) (Fryar, Carroll, & Ogden, 2016). A subsequent exploratory univariate meta-regression analysis revealed that the proportion of non-Caucasian children in a given sample had a significant positive moderator effect (β = 0.470; SE = 0.185; 95% CI = 0.108, 0.832; p = 0.011) on the prevalence on underweight on children with ASD. Similarly, mean age of the study sample (β = 0.109; SE = 0.054; 95% CI = 0.004, 0.214; p = 0.042) was an independent positive moderator, while the year of publication was an independent negative moderator (β = -0.081; SE = 0.032; 95% CI = -0.145, -0.018; p = 0.012). The risk of being underweight for children with ASD overall and for children with ASD in the United States were 76.4% ((95% CI, -0.4-212.3; 8 studies) and 59.8% (95%CI, -4.1, 62.8; 4 studies) had a trend of being greater than typically developing controls (p = 0.0515 and p = 0.066 respectively). Year of publication negatively moderated this association (β = -0.176; SE = 0.066; 95% CI = -0.305, -0.047; p = 0.007).

Conclusions: Children with ASD seem to have a greater likelihood of becoming underweight. Non-Caucasian and older children with ASD appear to have a greater risk of developing underweight. Future research studies should be vigilant about exploring risk factors that may lead to development of underweight in this special population of children and explicating the role of these risk factors in interventions.

295 **118.295** Autistic Mothers' Wellbeing during Pregnancy and the Postnatal Period

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Background: Research into how autistic women experience the challenges involved in pregnancy and parenting is scarce. The perinatal period is a time of great change that for non-autistic women can often bring increased stress, anxiety and depression (Dunkel Schetter & Tanner, 2012). For autistic women, it is possible that the sensory changes of pregnancy and the social demands of interacting with medical professionals may make this time additionally challenging. It is therefore important to explore mental wellbeing for autistic women during pregnancy and beyond.
Objectives: The study aimed to explore stress, anxiety and depression during the perinatal period for autistic and non-autistic women, in order to identify areas where more support may be needed.

Methods: Participants completed self-report questionnaires, measuring stress (Cohen's Perceived Stress Scale), anxiety (State-Trait Anxiety Inventory) and depression (Edinburgh Postnatal Depression Scale). The questionnaires were completed once during weeks 30-33 of pregnancy and again 8-12 weeks after birth. Participants were 20 non-autistic women (mean age 33 years) and 10 autistic women (mean age 30 years) who had completed questionnaires at both time points. A further 6 autistic women have completed the prenatal stage but have not yet reached the postnatal stage and a further 4 autistic women have been recruited but have not yet reached 30-33 weeks of pregnancy. Full data from at least 20 participants per group is expected by spring.

Results: T-tests to explore group differences for each questionnaire within each time point were conducted. Autistic mothers were significantly more stressed (t= -2.94 (16.02) p=0.01) and anxious (t= -2.65 (11.59), p=0.02) than non-autistic mothers at the postnatal time point but these were not significant at the prenatal time point. Difference scores were created for each questionnaire by subtracting prenatal from postnatal scores. Independent t-tests were performed on these difference scores to explore group differences in change over time for each questionnaire. There was a striking pattern across all questionnaires of an improvement in non-autistic mothers' wellbeing from pregnancy to post-birth and a decrease in autistic mothers' wellbeing. This difference did not reach significance for any of the questionnaires, though it approached significance for anxiety, t= -1.99(12.97), p=0.068. No other group differences were significant.

Conclusions: These findings indicate that autistic mothers may have lower wellbeing during the postnatal period than non-autistic mothers. There may potentially be a trend of an improvement in wellbeing for non-autistic mothers from pregnancy to 8-12 weeks post-birth and a decrease in wellbeing for autistic mothers. The small sample size may explain the lack of statistical significance for many of the comparisons conducted. It is possible that the differences will reach significance once data collection is complete. These tentative findings highlight a potential need for greater support for autistic mothers, particularly during the postnatal period.

Dunkel Schetter, C., & Tanner, L. (2012). Anxiety, depression and stress in pregnancy: implications for mothers, children, research, and practice. *Current opinion in psychiatry*, *25*(2), 141-8.

296 **118.296** Autistic People's Experience of Psychotropic Medication for the Treatment of Mental Health Conditions

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Background: Previous research has shown that autistic people are more likely to experience mental health difficulties during their lifetime (Lever & Geurts, 2016). Despite this, psychopharmacological studies have mainly focussed on the treatment of core symptoms of autism, rather than the treatment of co-occurring mental health conditions. Currently, little is known about autistic people's experience of psychotropic medication for the treatment of mental health conditions.
Objectives: The current study explores autistic people's subjective experience of taking medication for co-occurring mental health conditions.

Methods: 183 autistic and 74 non-autistic adults completed an online survey on topics surrounding mental health, self-injury and suicidality. Participants who had received at least one mental health diagnosis were asked: 1) whether they were taking medication for any of their mental health conditions, 2) which medications they were currently taking, and how long they had been taking them, 3) to rate how helpful the medication had been to them, 4) to rate how satisfied they were with their medication, 5) whether there had been any unwanted side effects and 6) what their experience of taking medication for their mental health condition(s) had been. Chi-square analysis was used to compare proportion of autistic to non-autistic participants on medication (Question 1) and experiencing side effects (Question 5). Pairwise comparisons were used to compare length of time on medication (Question 2), helpfulness rating (Question 3), and satisfaction rating (Question 4). Thematic analysis was used to analyse qualitative data (Question 6).

Results: There was a higher proportion of autistic participants on current medication for their mental health conditions compared to non-autistic participants. The most common medication listed by participants was antidepressants. After controlling for age, there was no significant difference in the length of time that autistic and non-autistic people had been on medication. Autistic participants rated their medication to be less helpful and were less satisfied with their medication compared to non-autistic participants. Autistic participants were no more likely than non-autistic participants to report experiencing side effects. Autistic people's experiences of taking medication were mixed, with both positive (e.g. "The medication helps reduce perseverative/intrusive suicidal thoughts significantly, which is great.") and negative (e.g. "I hated taking the medication every day... I sleep a lot because of the aripiprazole and it slows down my brain. I don't think antipsychotics should be given to people with autism.") examples present in the data.

Conclusions: Given previous findings that co-occurring mental health are more commonly reported in autistic adults (Lever & Geurts, 2016), and the current findings that autistic people report more negative experiences of medication compared to non-autistic people, it is therefore imperative that future research is conducted to determine the effectiveness of psychotropic medication for treating mental health conditions in autistic people.

297 **118.297** Autistic Traits in Psychotic Disorders: A Large-Scale Comparison across Patients, Siblings and Typical Comparisons and Impact on Social Functioning

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Background: Autism traits are present at elevated rates in individuals with psychotic disorders (PD). However, prevalence varies across clinical samples and it is unclear whether individuals with a genetic risk for psychosis (GR) also report more symptoms. Furthermore, it is unknown to what extent comorbid autism symptoms may have an impact on social functioning in psychotic disorders.
Objectives: To address these questions in a large sample of 504 individuals with a PD, 572 individuals with GR (siblings) and 337 typical comparison (TC) individuals

Methods: Autism traits were assessed with the Autism Spectrum Quotient (AQ) and social functioning was measured with the Social Functioning Scale.

Results: The proportion of AQ scores >32 (indicative of autism diagnosis) was 6.6% for PD, 1.1% for GR and 1.2% for TC. For AQ scores >26 (indicative of high autism traits) respective percentages were: 21.4%, 2.8% and 2.4%. Mean group differences for autism traits (PD > GR > TC) and social functioning (PD < GR < TC) were all significant, albeit with small effect sizes for GR vs TC. Within the PD and GR group, autistic traits showed a negative impact on overall social functioning above and beyond the effect of positive psychotic symptoms.

Conclusions: At least 1 in 5 individuals with a psychotic disorder is characterised by elevated levels of autism traits. In addition, levels of social functioning are negatively affected by autisms traits in individuals with (a genetic predisposition to) psychotic disorders. These findings warrant specific clinical guidelines for psychotic patients who present themselves with autistic comorbidity.

298 **118.298** Behavioral Concerns Associated with Sleep Disturbance Severity in Children with ASD

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Background: Sleep problems are commonly reported in children with ASD. Sleep difficulties are known to be associated with increased behavioral problems and can have negative impact on both child and family functioning.
Objectives: To examine the relationship of parent-reported behavioral concerns with sleep problems in children and adolescents with ASD as measured by the Composite Sleep Disturbance Index (CSDI).

Methods: U.S.-based primary caregivers of children with ASD were recruited from the Interactive Autism Network, a national autism registry. Parents completed an online survey on co-occurring conditions that incorporated family and child demographic information including the CSDI, a validated tool that scores the frequency and duration of six sleep habits (scored 0-2) over the previous month; total score range=0-12; score≥4 indicates a severe sleep problem. Parents were asked to rate their child's behavior on a scale from 0 to 3 with 0 = absent and 3 representing most severe.

Results: 610 parent/child dyads were analyzed. Responding parents were the primary caregiver, primarily female (94%), white (89%), and non-Hispanic (92%); mean age of 43.3 (SD 7.2; range 25-65) years. Children were primarily male (81%), white (84%), and non-Hispanic (88%); mean age of 12.1 (SD 3.6; range 3-17) years. On the CSDI, parents rated their child's sleep problems, scoring as severe (≥4) in 377 (62%) or not severe (<4) in 233 (38%). 370 (60.7%) reported no or minimal behavioral concerns while 240 (39.3%) rated behavioral problems as Moderate, severe, or very severe. The percentage of parents rating their child's behavioral problems as severe/very severe rose from 6% within the group with no sleep problems to 25% within the group with severe sleep problems. ($\chi 2(6) = 64.17$, P=0.000).

Conclusions: Sleep problems and behavioral difficulties in children with ASD are associated, with the prevalence of reported severe behavioral problems increasing with increasing severity of sleep based on parent report. These data confirm the association between behavioral issues and sleep issues in children with ASD. The presence of parent reported behavioral problems in a child with ASD should prompt screening for other comorbid conditions, such as sleep problems.

299 **118.299** CYP2D6 Phenotype Related to Ongoing Medication in Adults with Autistic Spectrum Disorder and Intellectual Disability

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Background: Adults with autism spectrum disorder (ASD) and intellectual disability (ID) associated many comorbidities and drug prescriptions implying a wide polypharmacy with potential drug-drug interaction and suspicion of adverse drug reactions (ADR). Metabolizer phenotype could also influence on drug security profile. **Objectives**: To correlate the safety drug profile with CYP2D6 metabolizing phenotype in adults with ASD and ID. **Methods:** Ambispective, multicenter, pharmacovigilance trial (VIGITEA study), was develop in subjects with ASD and ID who attend or live in residential facilities. Characterization enzyme CYP2D6 metabolizer profile (Extensive metabolizer (EM), poor metabolizer (PM) and ultra-rapid metabolizer (UM), TEA-CYP study) was done by PCR and correlated to drug security profile (ADR, prescritions and polypharmacy as ≥ 5 simultaneous drug prescription). Statistycal analises were performed using R 3.5.1 and the study received Ethical Comitee Approval. **Results:** Eighty-three participants (30 ± 10 years old, 14% women, BMI 27±6 Kg/m2, 100% Caucasian, 57% on polypharmacy). The majority of comorbidities were related to the nervous system (33%). Suspicion ADR was associated more with antipsychotic medications (52%), specifically, risperidone (13%). Metabolizer CYP2D6 profile (EM 85%, PM 8%, UM 5%) associated a significantly higher dose prescription in EM phenotype. **Conclusions:** The evaluation and knowledge of the CYP2D6 metabolizer profile of the prescribed drug could help to a better dose selection in the most prevalent phentoype and, consequently could prevent the aparition of dose dependent suspected ADR.

300 **118.300** Characteristics of Toddlers with Autism Spectrum Disorder Are Associated with the Severity of Anxiety Symptoms at Adolescence: A Long-Term Follow-up Study

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Background: Anxiety is among the most common mental health problems in autism spectrum disorder (ASD). Up to 40% of individuals with ASD are diagnosed with at least one anxiety disorder at some point in their lives. Previous studies reported that anxiety in ASD negatively impacts functioning. However, research has not focused on which early signs in toddlers with ASD may predict later development of anxiety.

Objectives:

1. To examine the prevalence of anxiety subtypes in adolescents who were diagnosed as toddlers with ASD.
2. To compare parental evaluation of the severity of anxiety subtype symptoms with the self-perception of adolescents with ASD.
3. To search for predictors of social and separation anxiety severity in adolescence at the time of ASD diagnosis.

Methods: The study included 65 participants, 60 males and 5 females (mean age=13:8y), diagnosed with ASD at toddlerhood. Participants underwent a comprehensive assessment of cognitive ability, adaptive skills and autism severity at toddlerhood and adolescence. The severity of anxiety was assessed by the Screen for Child Anxiety Related Disorders (SCARED) completed by parents (n=61) and study participants (n=37).

Results: According to parental SCARED reports, 39.3% of the study population had significant (≥5) separation anxiety symptoms, 27.7%, social anxiety (≥8), 18% generalized anxiety (≥9), 6.6% panic/somatic complaints (≥7) and 3.3% school avoidance (≥3). Comparing parents' and adolescents' SCARED reports (n=37) revealed that the participants noted more severe symptoms than their parents for panic/somatic complaints, separation anxiety, and school avoidance. We then examined the correlations of SCARED subdomain scores at follow-up with cognitive ability, autism severity and adaptive skills at toddlerhood. The SCARED social anxiety subdomain correlated negatively and significantly with VABS communication scores (r=-.41, p<.01) at diagnosis; SCARED separation anxiety correlated negatively and significantly with DQ (r=-.27, p<.05) scores, and positively and significantly with ADOS-RRB-CSS (r=.26, p<.05); SCARED generalized anxiety correlated positively and significantly with VABS socialization (r=.28, p<.05) and DQ (r=.30, p<.01) scores and negatively and significantly with ADI-R social interaction and communication subdomain (r=-.24,p<.05) scores. Next, we looked for predictors at toddlerhood for the two most frequent anxiety subdomains, social and separation anxiety at adolescence, using two hierarchical regression analyses. Age, sex, DQ, VABS composite and ADI-R subdomain scores at toddlerhood were used as the independent variables. For SCARED separation anxiety symptoms, the model explained 25.6% of the variance, but only the DQ scores at baseline correlated negatively and significantly with separation anxiety scores (β=-.42, p<.01). For SCARED social anxiety symptoms, the model explained 19.7% of the variance, but only the VABS composite scores at baseline correlated negatively and significantly with social anxiety scores (β=-.36, p<.05).

Conclusions: In adolescents with ASD, separation, social, and generalized anxiety symptoms are highly prevalent. Adolescents with ASD have a more severe perception of their anxiety symptoms than their parents' evaluation. Toddlers with higher cognitive ability or poorer functioning are at increased risk for anxiety at adolescence. In light of these findings, it is important to assess anxiety symptoms in adolescents with ASD, including self-reports when available, in order to provide timely interventions.

301 **118.301** Comorbid Anxiety and ADHD Differentially Impact Clinical Presentation in Preschoolers with Autism

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Background: Psychiatric comorbidities are common in individuals with autism spectrum disorder (ASD). Two of the most prevalent comorbidities are anxiety and ADHD. Approximately 40-60% of children with ASD meet criteria for one or both of these disorders. The presence of these comorbid diagnoses has been linked to more severe social deficits and repetitive behaviors, increased sensory challenges, and higher levels of irritability. Despite their high prevalence, relatively little is known about how comorbid anxiety and ADHD diagnoses differentially influence clinical presentation in young children with ASD.

Objectives: Using parent-report measures, we aimed to understand how comorbid anxiety and ADHD impact clinical presentation in children with ASD.

Methods: Sixty-nine 3-6-year-old children with ASD participated in this study. Anxiety disorders and ADHD were assessed through parent interview using the Preschool Age Psychiatric Assessment (PAPA). We hypothesized that meeting criteria for any anxiety disorder and ADHD on the PAPA would be differentially associated with higher ASD symptom severity (ADOS-2 severity scores), increased severity within different domains of repetitive behaviors (e.g. ritualistic behaviors, stereotyped motor behaviors, sensory features; Repetitive Behavior Scale-Revised subscale scores and Sensory Experiences Questionnaire), and higher levels of irritability (Aberrant Behavior Checklist). To explore the impact of multiple comorbidities on the functioning of children with ASD, we used an additive main effect general linear model. This method provides marginal predictions for both anxiety and ADHD on the outcomes of interest. This approach accounts for non-independence between groups, given that some children have both anxiety and ADHD, and identifies the unique contribution of anxiety and ADHD on each outcome.

Results: Based on the PAPA, 87% of children met criteria for ADHD, anxiety, or anxiety+ADHD. Specifically, 16% of our sample met criteria for ADHD only, 26% met criteria for anxiety only, and 45% met criteria for ADHD+anxiety. When both anxiety and ADHD diagnoses were included in the same model, anxiety ($F(1)=4.6$, $p=0.04$), but not ADHD ($F(1)=0.89$, $p=0.3$), was associated with increased overall ASD symptom severity as measured with the ADOS-2 severity score. In analyses using the RBS-R subdomain scores to assess repetitive behaviors, ADHD was found to be uniquely associated with increased self-injurious behavior ($F(1)=4.4$, $p=0.04$), whereas anxiety was uniquely associated with increased ritualistic ($F(1)=10.15$, $p<0.01$) and sameness behaviors ($F(1)=3.97$, $p=0.05$). Neither anxiety nor ADHD were associated with stereotyped motor, compulsive, or restricted behaviors. With regard to associated features of ASD, comorbid anxiety ($F(1)= 16.5$, $p<0.001$), but not ADHD ($F(1)=0.27$, $p=0.6$), was associated with increased sensory over-responsivity. In contrast, comorbid ADHD ($F(1)=7.27$, $p<0.01$), but not anxiety ($F(1)=0.89$, $p=0.4$), was associated with increased irritability.

Conclusions: Preschoolers with ASD have high levels of psychiatric comorbidity, with anxiety and ADHD particularly prevalent. The presence of these comorbidities significantly and differentially impacts the clinical presentation in children with ASD. These results suggest that comorbid psychiatric disorders may not only contribute to the clinical heterogeneity inherent in ASD, but may also impact the diagnosis and treatment of the disorder.

302 **118.302** Deciphering the Associations between Autism and Schizophrenia: Evidence from a Two-Sample Multivariable Mendelian Randomization Study.

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Background:
Although autism and schizophrenia are considered distinct diagnostic entities, the conditions seem to be intertwined at a genetic and phenotypic level. Family history of schizophrenia has been associated to autism risk in the offspring, while individuals with autism are at increased risk of psychosis spectrum disorders. Little is known on the possible cofounding role of IQ in the autism-schizophrenia associations, with observational studies providing inconclusive evidence and whole genome approaches suggesting that the two conditions present divergent associations with IQ. There is a need to decipher the role of IQ in the autism-schizophrenia associations, using approaches robust to the limitations of observational and whole genome approaches. Mendelian randomization (MR) is an instrumental variable approach, utilizing genetic variants as proxies for environmental exposures. The method provides robust control over residual or unmeasured confounding and allows the detection of pleiotropy. This is the first study in the field of autism research to utilise MR in order to:

Objectives:

- Assess the bi-directional associations between genetic liabilities for autism and schizophrenia using two-sample MR.
- Examine whether IQ confounds these associations, by applying an extension of MR, multivariable MR.

Methods:

Instruments for genetic liability to autism were based on the latest GWAS meta-analysis of autism. Due to the small number of significant hits identified (5 SNPs, P-value<= 5e-08), a relaxed P-value threshold for SNP inclusion was utilised to increase statistical power and precision of the estimates (P-value<=5e-07, 10 instruments). Instruments for genetic liability to schizophrenia were 128 independent (r^2=0.01) genome-wide significant SNPs identified in the latest GWAS of schizophrenia. In the multivariable MR analyses, IQ was entered as a covariate in the models. Instruments for IQ were 246 independent (r^2=0.01) SNPs identified in the largest GWAS on intelligence. Estimates were generated using an inverse-variance weighted model. Sensitivity analyses to identify and exclude outliers and test for violations in the MR assumptions, were conducted.

Results:

There was limited evidence to suggest an effect of genetic liability to autism on schizophrenia (crOR: 0.93; 95%C.I.: 0.82- 1.06; p=0.27). After adjusting for IQ, there was evidence consistent with an approximately 24% increase in the odds of schizophrenia for each unit increase in log-odds liability to autism (adjOR: 1.24; 95%C.I.: 1.08- 1.43; p= 0.004). For the reverse direction, the effect of genetic liability to schizophrenia on autism, the was evidence suggesting that one unit increase in log odds liability to schizophrenia was associated with an approximately 19% increase in the odds of autism (crOR: 1.19; 95%C.I.: 1.14- 1.24; p= 1e-14). The effect estimate did not change markedly upon adjusting for IQ in the model (adjOR: 1.26; 95%C.I.: 1.18- 1.35; p= 1e-10).

Conclusions:

In a two-sample MR framework, we found evidence suggesting bi-directional associations between genetic liabilities to autism and schizophrenia, after adjusting for IQ. The meaning of the findings and the possible contribution of IQ in the autism-schizophrenia associations as well as directions for future research will be discussed.

303 **118.303** Depression in Autistic Adults: Rumination and Insistence on Sameness

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Background: Autistic people are four times more likely to experience depression than typically developing people. Rumination defined as repetitive thinking about sadness, has been shown to be a key risk factor for depression in the general population. Autistic people may be at elevated risk of rumination due to the repetitive, restricted behaviours, interests or activities (RRBIs) characteristic of Autism. RRBIs may contribute to the elevated levels of depression by increasing the risk of repetitive thinking patterns. RRBIs have been classified into two sub-types, insistence on sameness (IS) and repetitive sensory motor (RSM) behaviours. Of these two sub-types, the phenomena making up IS, particularly an adherence to restricted routines and ritualised verbal and non-verbal behaviours are most likely to be related to depression. Research has found links between autistic traits, rumination and depression in the general population, and in a small sample of autistic adolescents and adults.
Objectives: Firstly, we investigated whether levels of rumination are higher in autistic adults compared to typically developing adults using a non-clinical sample. Secondly, we investigated the contribution of IS to depression in a mixed community and clinical autistic population and the potential for rumination as a mediator of this relationship.

Methods: We recruited a community sample of autistic participants (n=34) and typically developing participants (n=35). Autistic participants all had a validated diagnosis from a health professional. We also recruited a sample of autistic participants with validated clinical diagnoses of autism and depression (n=66) from NHS clinics who were participating in a clinical trial of a depression treatment (ADEPT). For the current study participants completed self-report measures of repetitive behaviour (IS subscale of RBQ-2A), Rumination (subscale of RRQ) and Depression (PHQ-9).

Results: As predicted, Rumination scores were significantly higher in the community autism sample (M=3.94, SD=0.70) compared to the typically developing sample (M=3.1, SD=0.89), t(67)=4.51, p<.001. Further, the community autism sample also had higher significantly higher scores on the depression measure (M=11.7, SD=6.1) compared to the typically developing sample (M=3.9, SD=2.5), t(66)=6.9, p<.001). A mediation analysis using

ordinary least squares path analysis which included all autistic participants (n=100) found that IS scores affected depression scores via an effect on rumination levels. There was a significant positive effect of IS on rumination (a=0.52, p<.001) and rumination had a significant effect on depression scores (b=2.37 p=.01). A bootstrap confidence interval was generated for the indirect effect and was above zero (0.22 – 2.48). IS scores did still affect depression scores when controlling for rumination (c'= 2.12, p<.05), but to a lesser extent than when rumination was not included in the model (c=3.35, p<.001) demonstrating partial mediation.

Conclusions: Depression and rumination scores are higher in autistic people compared to non-autistic people. Moreover, insistence on sameness, a core feature of the Repetitive Behaviours domain in Autism, contributes to depression by increasing levels of rumination. Thus, a tendency towards behavioural repetition contributes to repetitive thinking patterns with negative content which contributes in turn to elevated depression symptoms.

304 **118.304** Development and Use of an Observational Measure of Parent-Child Interaction in Autism Spectrum Disorder: Relationships with Parent and Child Mental Health

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Background:

Children with Autism Spectrum Disorder (ASD) and their parents are at increased risk for mental health problems (MHP). Evidence from the general population suggests the reciprocal relationship between parent and child MHP may be mediated by parent-child interaction (PCI). Despite progressing research on this topic in the field of ASD, most studies rely on parent-report measures of own behavior and MHP, and those of their child.

Objectives:

As part of the Improving Autism Mental Health (IAMHealth) research programme, we aimed to: (1) develop an observational instrument suitable for assessing PCI in autistic adolescents and their parents; (2) validate this instrument against existing measures of parental discipline strategies, expressed emotion (EE) regarding the child and household disorganization; (3) investigate concurrent associations with parent and child MHP.

Methods:

The QUEST study is a well-characterized community cohort of children with ASD and their parents. At child age 11 to 15 years, we administered a videotaped Etch-a-Sketch (EAS) task to a subset of 59 families. The task required collaboration on drawing a picture of a house on the EAS toy, using one control each. Fifty-four adolescents had the functional ability to access the task as intended, 63% male and of a wide IQ range (27-129). Videos were rated using a coding scheme adapted previously employed in general population research, assessing aspects of child behavior (e.g. task persistence and engagement with the parent) and parent behavior (e.g. physical and verbal control, approval of, disapproval of and engagement with the child). Parental EE was assessed using a researcher-rated autism-specific five-minute speech sample (AFMSS), during which parents talked about their child. Parents self-reported on discipline strategies, household disorganization and own MHP. Child MHP were measured by parent- and teacher-report questionnaires.

Results:

Inter-rater reliability, assessed on 31 randomly-selected cases, was good (average intra-class correlation coefficient .76; range .48-1.00). Exploratory item factor analysis (n=54) of reliable parent behavior codes produced a two-factor solution (Figure 1). Parental "warmth" was indexed by behaviors including approval, engagement and autonomy-granting, whereas parental "control" was indexed by instruction, control-seeking and disapproval. These factors showed a significant negative correlation of -.34 (p=01), whereby parents showing more warmth showed less control. Child behaviors loaded onto one factor conceptualized as "co-operation".

Parental warmth correlated positively with parental praise in the AFMSS (ρ=.35, p<.05), whereas parental control correlated positively with self-reported ineffective discipline strategies (r=.31, p<.05) and household disorganization (r=.38, p<.01). Neither parent factor related to child autism symptom intensity; however, high warmth related to higher child IQ (r=.44, p<.01). Greater child co-operation related to both higher IQ (r=.51, p<.001) and lower autism symptom intensity (r=-.50, p<.001). PCI factors were not associated with parent or child MHP.

Conclusions:

The PCI instrument captured variance in parent and child behavior across families that was adequately reliable across raters and showed meaningful relationships with existing measures of parenting and household management style. The lack of association with child or parent MHP may reflect true independence in the relationship, inadequate power or failure to capture related aspects of behavior.

305 **118.305** Diagnostic Challenges in Evaluating Comorbid ADHD in Young Children with ASD

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Background: Although co-occurrence of Attention-Deficit/Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD) symptoms has long been described, comorbid diagnosis of these conditions has only been permitted since publication of the DSM-5. Current estimates suggest ADHD occurs in 20-70% of cases of ASD (Matson et al., 2013), with this broad prevalence range likely associated with different diagnostic methods. Accurate methods of diagnosing these comorbid conditions are needed to clarify prevalence rates and inform research on treatment for the ASD+ADHD phenotype. To date, however, few guidelines exist for the clinical evaluation of this comorbidity.

Objectives: Despite distinct sets of diagnostic criteria, clinicians encounter a number of challenges when evaluating comorbid ADHD and ASD. The current study aims to explore these specific diagnostic challenges and to identify their impact on the diagnostic process and outcomes.

Methods: The Duke NIH Autism Center of Excellence research program aims to improve understanding of the onset, developmental course, and treatment of comorbid ADHD and ASD in young children. Participants complete comprehensive evaluations including gold-standard assessment

tools for ASD (i.e., ADI-R, ADOS) and ADHD (ADHD Rating Scale, semi-structured psychiatric clinical interviews) and cognitive (Mullen, DAS-II) and adaptive behavior (Vineland 3) assessments. Historical response to school-based and ASD-focused interventions also informs the diagnostic process. Case review and consensus discussions by clinical psychologists and psychiatrists with expertise in ADHD and ASD are conducted to finalize diagnostic conclusions. Finally, ratings are assigned to each diagnosis to quantify diagnostic confidence.

***Results*:** Thus far, twenty participants with ASD (mean age=68 months, SD=17 months) have completed a diagnostic evaluation, and six (30%) have received a comorbid ADHD diagnosis. A three-point diagnostic confidence scale was used (range 1-3) with higher ratings indicating more confidence. Mean confidence for ASD diagnosis was 2.85 (SD=0.37); mean confidence for ADHD diagnosis was 2.17 (SD=0.75). Diagnostic challenges fall into two broad categories. One challenge arises when distinguishing specific ADHD symptoms from common ASD behaviors, especially when the ADHD-like behavior improves whenever ASD behavioral supports are provided (e.g., using a visual schedule). For example, parents may report that a child often has "*difficulty sustaining attention*," but the child's sustained attention may actually be exceptional for high interest items. Similarly, parent-report of "*fidgety*" behavior may be more consistent with observed stereotyped, repetitive movements than typical ADHD-like fidgeting. A second often-noted challenge involves incorporating cognitive ability, including intellectual disability and variability in cognitive and/or language skills, into determination of whether symptom presence is excessive for developmental expectations. For example, parent-report of "*difficulty following through on instructions*" may be better explained by delayed receptive language skills, whereas "*difficulty waiting one's turn*" may be age-appropriate when considering a child's developmental level.

***Conclusions*:** Identifying comorbid ADHD and ASD is essential for ensuring that affected children have access to effective interventions. Given the diagnostic challenges associated with evaluating these comorbidities, identifying procedures to optimize the diagnostic process is essential for making reliable diagnoses. The current project will contribute essential information to the fields of ADHD and ASD research that will inform future research and clinical endeavors.

306 **118.306** Differences in Anxiety Symptoms Among Males and Females with ASD per Parent- and Self-Report

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Background: Research within typically developing (TD) youth indicates that females experience more anxiety than males. Additionally, youth with autism spectrum disorder (ASD) tend to have higher anxiety than TD youth. Differences in anxiety symptoms between males and females with autism, however, is not as well-established. Some prior work has attested to the view that females with ASD are more anxious than males with ASD (due to the "double hit" of ASD and gender) but the literature is equivocal; several studies have found no differences in gender. Moreover, many studies explore general internalizing symptoms rather than anxiety alone.

Objectives: This research aims to clarify relationships between anxiety and gender in high-functioning children with ASD by: 1) comparing overall anxiety among males and female with ASD and 2) investigating whether types of anxiety endorsed differ across gender.

Methods: Anxiety was measured by both parent- and self-report, using the Multidimensional Anxiety Scale for Children 2nd Edition (MASC-2). The MASC-2 provides an overall total score and subscale scores (harm avoidance, separation anxiety, social anxiety, and physical symptoms; March et al, 2013). As part of a larger study, a group of 99 youth between 10-to-13 years with ASD (74 males, mean age = 11.29; 25 females, mean age =11.30) completed the MASC 2-Self, while their parents (n=100, 74 male children, 26 female children) completed the MASC 2-Parent.

Results: The MASC 2-Parent revealed significantly higher total anxiety scores in male youth ($t(98)$=-2.11, p=.04). In contrast, there was no difference in total score between males and females on the MASC-Self ($t(97)$=-.53, p=.60). Regarding types of anxiety, separation anxiety/phobia ($t(98)$=-4.87, p=.000) and harm avoidance ($t(98)$=-3.89, p=.001) were significantly higher per parent report in male youth than female youth. Correspondingly, males self-reported higher separation anxiety/phobia ($t(97)$=-2.26, p=.03) and harm avoidance ($t(64.90)$=-2.96, p=.004).

Conclusions: In the current study, both parent and self-report measures showed significantly higher separation anxiety/phobia and harm avoidance in male youth with ASD, though parent-report alone found males to have higher total anxiety overall. This counters trends in TD youth and thus suggests distinctive interactions between anxiety and gender in ASD. The anxiety subscales endorsed—separation anxiety/phobia and harm avoidance—are related to separation anxiety disorder, which appears to be particularly relevant to ASD. This study expounds on that association by specifying gender-related differences within youth with ASD. While separation anxiety is generally higher in female youth than males, some work has suggested that the reverse is true in clinical populations— in agreement with the current results. This could be related to societal gender role expectations. If separation anxiety in males is seen as abnormal, awareness and report of symptoms may increase. Concurrently, males and females on the autism spectrum may be less likely to be impacted by societal gender roles, and consequently express emotions in ways differing from the TD population. These results highlight the complex relationships between gender, anxiety, and ASD and emphasize need for continued exploration to build understanding as to the unique profiles and experiences of males and females with ASD.

307 **118.307** Double Trouble: Use of Two Concurrent Antispsychotic Medications in Adolescents with ASD

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Background: The atypical antipsychotics risperidone and aripiprazole have US Food and Drug Administration indications to treat irritability associated with autism spectrum disorder (ASD) for pediatric patients as young as 5. In their official Practice Parameters for ASD and for Atypical Antipsychotic Medication, the American Academy of Child and Adolescent Psychiatry urges extreme caution in prescribing these powerful medications for children and that the use of multiple antipsychotic medications should be avoided due to the high likelihood of negative physical health outcomes. As atypical antipsychotics are becoming more widely used to treat mood irritability issues with youth with ASD, especially adolescents, there is concern that cautions about limiting medication exposure are not being rigorously followed.

Objectives: In this study, we examined a large, national healthcare claims database of a privately insured population in the US to compare the prescription rates of more than one antipsychotic concurrently, in adolescents with and without ASD to examine areas of discrepancy in utilization and prescription patterns with other medications.

Methods: Using the 2005-2014 MarketScan® Commercial Claims and Encounters database, we identified a cohort of adolescents (ages 12-21). We constructed a sub-cohort of adolescents with ASD [n=181,686], documented by at least two separate diagnoses of ASD (ICD 9 codes 299.XX), and a

sub-cohort of adolescents without ASD (CTL) [n=2,271,205]. (The prevalence of mental health disorders with serious impairment in US adolescents is estimated to be 22.2%.) We also broke down the entire cohort by gender and by age range: early adolescence (12- to 14-years-old), middle adolescence (15- to 17-years-old) and older adolescence (18- to 21-years-old). In each of the cohorts, we described the proportion of patients who were prescribed two antipsychotic medications in different prescription patterns with other psychotropic medications

Results: A substantially higher proportion of adolescents with ASD were prescribed two different antipsychotic (AP) medications concurrently than adolescents without ASD (ASD 5.56% vs. CTL 0.06%). This includes adolescents that were prescribed two AP medications only, or two AP medications with additional other medications. There was little difference in utilization of two AP medications across age ranges in both groups (change up to 0.23% for ASD sample and 0.01% for CTL group). Among adolescents prescribed two concurrent AP medications, in the ASD sample, 94.51% were prescribed one or more additional psychotropic medication(s) compared to 58.86% of the CTL sample. In both groups, male adolescents were more likely to be prescribed two concurrent APs than females (ASD: M =5.84%, F = 4.48%, CTL: M=0.07%, F=0.04%).

Conclusions: In this sample, adolescents with ASD had far greater exposure to psychotropic medications than the control cohort. Of concern is that this medication exposure puts them at higher risk for negative physical health outcomes due to the increased rates of double antipsychotic use and higher risk for poor mental health outcomes due to the use of three or more psychotropic medications. Further study is needed to determine whether increased medication exposure for adolescents with ASD is reflective of complex needs, suboptimal medication management, underutilization of other treatments, or some other factor(s).

308 **118.308** Early Repetitive Behavior Severity As a Risk Factor for Elevated Anxiety in Autism Spectrum Disorder

D. A. Baribeau[1], *S. Vigod*[2], *E. Pullenayegum*[3], *P. Mirenda*[4], *I. M. Smith*[5], *T. Vaillancourt*[6], *J. Volden*[7], *C. Waddell*[8], *L. Zwaigenbaum*[7], *T. Bennett*[9], *E. Duku*[10], *M. Elsabbagh*[11], *S. Georgiades*[10], *C. M. Kerns*[12], *W. J. Ungar*[13], *A. Zaidman-Zait*[14] *and P. Szatmari*[3], *(1)University of Toronto, Toronto, ON, Canada, (2)Women's College Hospital, Toronto, ON, Canada, (3)The Hospital for Sick Children, Toronto, ON, Canada, (4)University of British Columbia, Vancouver, BC, Canada, (5)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (6)University of Ottawa, Ottawa, ON, Canada, (7)University of Alberta, Edmonton, AB, Canada, (8)Simon Fraser University, Vancouver, BC, Canada, (9)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (10)McMaster University, Hamilton, ON, Canada, (11)McGill University, Montreal, PQ, Canada, (12)Department of Psychology, University of British Columbia, Vancouver, BC, Canada, (13)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada, (14)Tel-Aviv University, Tel-Aviv, Israel*

Background: A significant proportion of children with autism spectrum disorder (ASD) will meet criteria for an anxiety disorder during childhood. Restricted and repetitive behavior (RRB) severity in ASD positively correlates with anxiety severity in cross-sectional surveys. The relation between RRB severity in preschool children with ASD and future anxiety symptoms has not been explored.
Objectives: In the current study we aimed to examine the association between repetitive behavior severity at the time of receiving an ASD diagnosis (age 2-5 years) and the presence of elevated anxiety symptoms in middle childhood (age 8-11 years), while accounting for potential confounding factors.

Methods: In a longitudinal inception cohort of children with ASD (n=421), RRB severity at study enrollment (age 2-5 years) was classified as mild, moderate, or severe using the Autism Diagnostic Interview-Revised. Anxiety was measured on the Child Behavior Checklist at age 8-11 years (T-score cut-off >65). Multivariable logistic regression with multiple imputation for missing data was used to examine the association between RRB severity and anxiety symptoms while adjusting for age, sex, adaptive functioning, baseline anxiety on the CBCL, family income, and parenting stress, generating adjusted odds ratios (aORs) and 95% confidence intervals (CIs).

Results: Approximately 58% of children with severe RRB had elevated anxiety by age 11, compared to 41% of those with moderate RRB, and 20% of those with mild RRB. Moderate and severe RRB was associated with increased odds of elevated anxiety in the adjusted model [Moderate aOR: 2.5 (1.2 to 5.3); severe aOR: 3.2 (1.4 to 7.5)].

Conclusions: RRB severity at time of ASD diagnosis is associated with risk for elevated anxiety symptoms in later childhood. This finding increases our understanding of which children with ASD will develop anxiety disorders, and can help to inform prevention, early identification, and treatment.

309 **118.309** Eating Problems and Patterns Among Toddlers and Young Boys with and without Autism Spectrum Disorders

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Background:
Eating and feeding problems are common comorbidities among children with autism spectrum disorders (ASD) yet the reasons for this are unclear, and relatively few studies have compared the eating problems seen in ASD to a typically developing control group.

Objectives:

To shed light on the eating patterns seen in ASD by assessing the differences in eating problems and patterns between children with ASD and typically developing children and to explore the influence of age on eating problems and patterns among typical children and children with ASD.

Methods:

Differences in eating problems and patterns between children with ASD and typically developing children were assessed, as well as differences between eating problems and patterns between toddlers (aged 2-3 years) and young children (aged 3-7) with ASD. A total of 105 children with ASD and 95 typically developing children were included in the study. Of the 91 toddlers, 65 had a diagnosis of ASD and of the 112 young children, 40 had a diagnosis of ASD.

Results:

Children with ASD displayed significantly more eating problems in every domain assessed than children with typical development. The overall effect of age was found only in ritualistic behavior during eating, which older children displayed more than younger children. In addition, typically developing children ate a significantly greater variety of all food groups than children with ASD, except drinks and snacks. An overall age effect

was also found. Younger children ate a greater variety than older children in the majority of food groups, except for drinks, snacks and meats.

Conclusions:

This study supports previous findings regarding the greater incidence of eating problems and patterns among children with ASD and provides new findings about the role of age in eating problems. More research is needed to shed light on underlying causes of eating problems and patterns in ASD.

310 **118.310** Exploring Anxiety in ASD Using Cross-Species Neuroimaging Analytics

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Background:

Children and adolescents with Autism Spectrum Disorder (ASD) often present with a wide variety of comorbidities (Pasciuto et al, 2015). Among these, anxiety is the most common psychiatric comorbidity, with rates as high as 84% (Kerns et al, 2015). ASD patients who also suffer from anxiety experience an increased burden of disease. In spite of this, there are no established clinical pathways for the treatment of anxiety in ASD (Vasa et al, 2016). Moreover existing pharmacological treatments that are effective in the general population result in adverse effects when used to treat patients with ASD (Vasa et al, 2016). A greater understanding of the neuroscience underlying anxiety in ASD will facilitate the development of novel treatments for this vulnerable population.

Objectives:

Using structural magnetic resonance imaging (sMRI) data from patients with ASD and from a variety of mouse models for ASD, we examine which neuroanatomical regions are associated with anxiety as a comorbidity.

Methods:

Three data sets were used from the Province of Ontario Neurodevelopmental Disorders (POND) network: 1. Ex-vivo sMRI scans of 2084 mice from 61 genetic mouse models of ASD with literature-based annotations for anxiety, 2. Ex-vivo sMRI scans and anxiety-related behavioural assays of 822 mice from inbred strains related to ASD, and 3. 571 sMRI scans and anxiety assessments of child and adolescent patients with neurodevelopmental disorders. Volumetric measures were computed from the MRI scans using an image registration pipeline and deformation-based morphometry (Lerch et al, 2011). Statistical analyses using multiple linear and mixed-effects regressions were performed on a structure-wise basis for each of the three data sets to examine the association between neuroanatomical volume and anxiety. Appropriate statistical models were selected to account for the effects due to sex and age. Results were corrected for multiple comparisons using the false discovery rate (FDR) method.

Results:

A number of brain regions were found to be significantly associated with anxiety within each of the data sets, at a FDR level of 0.05. Convergence of results across all three data sets implicates the amygdala, the cerebellum and the cingulate cortex. Structures displaying convergence only between the mouse studies additionally included the midbrain, the pons, the basal forebrain and the anterior commissure.

Conclusions:

Anxiety is not well understood in ASD despite being the most common psychiatric comorbidity. Neuroimaging studies are an indispensable tool when it comes to understanding which regions of the brain are associated with a given condition. Using an approach relying on convergence across multiple mouse and human studies, we have identified the amygdala, the cerebellum, and the cingulate cortex as being implicated in anxiety within ASD. It is well known that the amygdala plays a role in emotional regulation and a recent study has demonstrated that it is associated with anxiety in ASD (Herrington et al, 2017), so these results are in line with the existing literature. While the cerebellum is known to be involved in ASD, our results suggest that it may also play a role in anxiety, perhaps through a pathway that is unique to ASD.

311 **118.311** Exposure to Trauma and Post-Traumatic Stress Symptoms Among Adults with Autism Spectrum Disorder

N. Haruvi Lamdan*, S. A. Puris, M. Kraus, D. Horesh and O. Golan, Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel*

Background: Post-Traumatic Stress Disorder (PTSD) is the most common chronic stress disorder resulting from exposure to traumatic events. The first diagnostic criterion for PTSD is an exposure (direct or indirect) to actual or threatened death, serious injury, or violence (APA, 2013). In recent years, studies indicated that PTSD may also develop following bullying experiences (Nielsen et al., 2015). Previous research indicates that individuals with Autism Spectrum Disorder (ASD) are at increased risk of experiencing traumatic events and being significantly affected by them (Mandell et al., 2005). However, PTSD symptoms among individuals with ASD and the nature of the traumatic events have yet to be sufficiently studied.

Objectives: The main aim of this study was to examine PTSD symptoms among high-functioning adults with ASD and typically developing controls, following various potentially traumatic life events, such as serious accidents, life-threatening illness or injury, and a wide range of negative social events.

Methods: Fifty adults, 25 (15 males) with a formal ASD diagnosis and 25 (15 males) with typical development (TD), matched on age and gender, took part in the study. Participants completed several self-reported on a comprehensive list of potentially traumatic life events that included "classic" traumatic events (based on the Life Events Checklist for DSM-5; Weathers et al., 2013) and negative social events (based on the bullying questionnaire; Sourander et al., 2010), and on PTSD symptoms with regards to the most significant traumatic event they chose from the list (PCL - PTSD Check List for DSM-5; Weathers et al., 2013).

Results: 32% of participants from the ASD group met the PCL cutoff for PTSD probable diagnosis, compared to only 8% in the TD group. Compared to TD participants, participants with ASD reported significantly more PTSD symptoms in general, and particularly more symptoms of hyper-arousal. Participants with ASD reported on more traumatic life events in general, and specifically more negative social events, compared to TD participants. Exposure to negative social events was related to PTSD symptoms among participants with ASD but not among TD participants. In contrast, exposure to "classic" traumatic events was related to PTSD symptoms among TD participants but not among participants with ASD. Moreover, 60%

of participants in the ASD group chose a negative social event as the traumatic event, compared to only 24% of the TD group.

Conclusions: Compared to the TD group, participants with ASD were more exposed to traumatic life events and developed higher levels of PTSD symptoms following them. According to our results, the social field may be particularly traumatic for individuals with ASD. The higher level of exposure to traumatic events in the ASD group could also be related to the unique subjective perception of the event that may be influenced by cognitive, emotional and sensory characteristics. It is possible that PTSD is an under recognized co-morbid diagnosis in individuals with ASD, which required diagnostic and therapeutic attention.

312 **118.312** Factors Predicting Psychiatric Disorders Among Children with ASD: Analysis from the 2016 National Survey of Children's Health

A. Karpur[1] *and T. W. Frazier*[2]*, (1)Autism Speaks, Princeton, NJ, (2)Autism Speaks, New York, NY*

Background: As many as 70% of children with Autism Spectrum Disorders (ASD) have co-occurring psychiatric conditions (Simonoff et al., 2008). In addition to being associated with conditions such as Attention Deficit Hyperactivity Disorders (Gordon-Lipkin et al., 2018), contextual characteristics such as access to high quality health insurance, parental stress, and exposure to adverse childhood exposures may be related to higher prevalence of co-occurring psychiatric conditions among children with ASD.
Objectives: The current study examined association between key contextual factors with co-occurring psychiatric conditions among children with ASD using a national survey data.

Methods: The 2016 National Survey of Children's Health data was utilized to examine the prevalence of co-occurring psychiatric conditions (i.e., diagnosis of anxiety, depression, and other behavior disorders) among children with ASD with Intellectual or Developmental Disability (ASD + IDD; N = 207), ASD only (N = 1043), other disabilities (N = 10,205), and children without disabilities (N = 38,690). Using weighted logistic regression models, the contributions of contextual factors such as access to health care, financial burden of care, and parental socio-economic status were examined along with individual characteristics such of children – i.e., disability classification (ASD+IDD/ASD only/Other disabilities/No disabilities), age group, race/ethnicity, co-occurring neurological conditions (e.g., ADHD, epilepsy, Tourette's syndrome, Downs syndrome, speech or other language disorders), and presence of functional limitations (e.g., problems with breathing, eating and digesting food, physical pain, dental problems, etc.). Changes in model-based tjur-rsquared values were calculated to understand contribution of contextual factors in explaining variations in the outcome variable while retaining individual characteristics.

Results:

Children with ASD + IDD had highest frequency of co-occurring psychiatric diagnosis (88.8%), followed by children with ASD only (69.0%), children with other disabilities (40.3%), and children without disabilities (5.4%). Based on the multivariate model, compared to children without disabilities, children with ASD + IDD were 8 times more likely (OR = 7.9; 95% CI: 3.1 – 20.1); children with ASD only were 6.5 times more likely (OR = 6.5; 95% CI: 4.4 – 9.5); and children with other disabilities were 3 times more likely (OR = 2.6; 95% CI: 2.1 – 3.4) to have co-occurring psychiatric diagnosis. Children having high out-of-pocket payment for clinical services, those with low-quality health insurance plans, those facing financial difficulty in paying medical bills, whose parents reporting higher stress of care giving, and those exposed to adverse childhood experiences are likely to have higher prevalence of psychiatric conditions. The contextual factors explain an additional 52% of variation in outcome variables when compared to a model with only individual characteristics defined by disability classifications, co-occurring neurological conditions, functional limitations, age, race/ethnicity, and number of other children with disabilities in households.

Conclusions:

Contextual factors predict substantial variations in prevalence of co-occurring psychiatric conditions among children with ASD, even beyond other individual characteristics and co-occurring neurological conditions. These findings highlight their potential in clinical, program, and policy recommendations to impact prevalence and/or burden of co-occurring psychiatric conditions in children with ASD.

313 **118.313** Family Characteristics Associated with Emotional and Behavioural Problems Displayed By Young Children with ASD

M. Palmer[1]*, S. Webb*[1]*, J. Paris Perez*[1]*, T. Cawthorne*[1]*, A. Pickles*[2]*, V. Slonims*[3]*, E. Simonoff*[1]*, S. Scott*[1] *and T. Charman*[4]*, (1)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (2)Biostatistics and Health Informatics, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (3)Guy's & St Thomas' NHS Foundation Trust (Evelina Children's Hospital), London, United Kingdom, (4)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Significant associations between family characteristics and problematic emotions and behaviours have been identified in typically developing children. Proposed influential factors include parental mental health, parenting behaviour and socioeconomic circumstances (e.g., Finkenauer et al., 2005; Mazza et al., 2017). It is well established that children with ASD often meet criteria for additional psychiatric diagnoses (Salazar et al., 2015; Simonoff et al., 2008). Given the likelihood of co-morbid difficulties in the ASD population, it is important to identify risk and protective factors related to a child's emotional and behavioural problems (EBP). Current literature in this area has focused on demographic factors (Chandler et al., 2016; Simonoff et al., 2013) and parental mental health (Simonoff et al., 2013; Yorke et al., 2018). Other work has found that parenting behaviours such as high levels of criticism and hostility account for a significant proportion of the variance in behavioural problems in children with ASD (Bader et al., 2015). More research using objective measures is needed to further understand these relationships.
Objectives: We aimed to investigate the association between family characteristics and EBP in children with ASD using a mixture of observational and self-reported data.

Methods: As part of the IAMHealth research programme, the sample consisted of 82 parents and their 4-8 year old child with ASD participating in the ASTAR trial. Objective measurement of parenting behaviour and child EBP was extracted from a novel observational assessment of parent-child interaction. Observed frequencies of child-centred parenting (e.g., positive comments, clear commands, praise), child-directive parenting (e.g., negative comments, physical handling), and child EBP (e.g., non-compliance, aggression, avoidance) are coded. Associations between observed child EBP and observed parenting behaviours, self-reported parenting practices (Parenting Scale-PS), parental wellbeing (SWEMWBS), parenting stress (Autism Parenting Stress Index-APSI) and family socioeconomic factors (parental education, parental employment and household income) were tested using correlational analyses. Multiple regression was carried out to examine the overall amount of variance explained and the strength of individual relationships.

Results: More child-centred and more child-directive parenting was significantly associated with greater child EBP (r=.369, p<.001 and r=.412, p<.001 respectively). No significant correlations were observed for self-reported measures of parenting practices, parental wellbeing and stress or any family socioeconomic factors. Observed parenting behaviours accounted for a modest yet significant amount of the variation in observed child EBP (R^2=.188, p<.001), with only child-directive parenting making a unique contribution, accounting for 9% of the variance (p=.027).

Conclusions: Preliminary results suggest that child-directive parenting behaviours are associated with more EBP in young children with ASD, consistent with literature using samples of children without ASD. Given the cross-sectional nature of the data, we cannot make conclusions about the direction of effect and it is possible that children with more EBP elicit more parenting behaviours. In contrast to previous research which has tended to use parent-report measures of EBP, we did not find any associations between parental wellbeing or socioeconomic factors and observed child EBPs. These findings could be used to inform possible interventions for families with young children with ASD displaying EBP.

314 **118.314** Identifying Mechanisms That Contribute Towards the Development of Social Anxiety in Autistic and Neurotypical Young People.

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Background: Social anxiety is one of the most common and disabling mental health problems for autistic young people, which has a significant impact on school performance and opportunities to form important peer relationships. Despite the high prevalence rates seen in this population, very little is known about the cognitive, emotional and perceptual mechanisms underpinning the development of social anxiety in autistic adolescents. Further research focusing on understanding the profile of mechanisms that contribute towards social anxiety in autistic adolescents and how this may differ from neurotypical adolescents is imperative for understanding aetiology and informing effective disorder-specific interventions.

Objectives: Our project aims to explore the inter-relationships between mechanisms that may contribute towards feelings of social anxiety in autistic and neurotypical young people. The cognitive mechanisms that were explored include Theory of Mind, social insight and intolerance of uncertainty. Additional difficulties often experienced by autistic individuals, such as alexithymia, interoceptive processing, emotion regulation processes and sensory processing, were also explored. This project aims to answer two key research questions. Firstly, are the mechanisms underpinning social anxiety the same in young people with and without a diagnosis of autism? Secondly, are there some mechanisms related to social anxiety in autistic young people that are specific to these individuals?

Methods: We employed a mixed experimental design, with young people completing both cognitive tasks (e.g. IQ, Theory of Mind, interoceptive processing) and questionnaires (e.g. social anxiety, intolerance of uncertainty, social insight, alexithymia, emotion regulation, sensory processing). Parent-reported questionnaires were also completed (e.g. autistic traits, intolerance of uncertainty, emotional difficulties). In total, 61 autistic (42 boys, $mean_{age}$ = 13.46) and 62 IQ-matched neurotypical (26 boys, $mean_{age}$ = 13.52) young people took part in our research project. Questionnaire data from 119 parents was also collected.

Results: We have recently completed data collection for this project. Firstly, we observed no significant difference in social anxiety symptoms for autistic and neurotypical young people. Significant associations were observed between several mechanisms (e.g. intolerance of uncertainty, emotion regulation, sensory processing sensitivities, alexithymia) and social anxiety symptoms across the whole sample. As such, we plan to conduct further group-level analyses to investigate specific mechanisms associated with social anxiety symptoms for autistic and neurotypical young people. Analyses investigating group differences (e.g. ANOVA), in addition to correlational analyses and multiple linear regressions will be reported.

Conclusions: The present research will have important implications for understanding the mechanisms that contribute towards the development of social anxiety in autistic and neurotypical young people. Furthermore, this research has important clinical implications for prevention, early identification and subsequently informing the development and adaptation of interventions to improve the efficacy of treatments designed to target social anxiety in autistic young people.

Poster Session
119 - Social Cognition and Social Behavior
11:30 AM - 1:30 PM - Room: 710

315 **119.315** Chameleon Effect in Autism: Decreased Mimicry of Body Movements in Social Interaction Contexts

B. Tuncgenc[1]*, C. A. Koch*[2]*, I. M. Eigsti*[3] *and S. H. Mostofsky*[4]*, (1)Neurology, Johns Hopkins University, Baltimore, MD, (2)Developmental Cognitive Neurology, Center for Neurodevelopmental and Imaging Research, Kennedy Krieger Institute, Baltimore, MD, (3)Psychological Sciences, University of Connecticut, Storrs, CT, (4)Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD*

Background:

Chameleon effect refers to nonconscious mimicry of interaction partners' movements, postures and facial expressions (Chartrand & Bargh, 1999). Research shows that such mimicry facilitates interpersonal liking and prosocial behaviours in children and adults. It has been shown that children with autism spectrum disorders (ASD) mimic others' emotional facial expressions less than typically-developing children (TDC). Facial mimicry deficiency might stem from broader attention and emotion recognition problems. Yet, given mounting research indicating autism-associated impairments in elicited motor imitation, spontaneous mimicry of a broader range of actions may also be decreased in ASD. Examining different action types can elucidate how mimicry contributes to social-communicative functioning in autism.

Objectives:

(1) To investigate whether children with ASD will mimic object-oriented and non-object-oriented body movements less frequently than TDC.

(2) To examine associations between decreased mimicry frequency and increased autism symptom severity through the Autism Diagnostic Observation Scale (ADOS-2) and parent ratings of Social Responsiveness Scale (SRS-2).

Methods:

Data have been collected from 28 8-12 year-old children, with mimicry coding completed on 20 age- and IQ-matched participants to date (10 ASD:1 female, 10 TDC:2 females).

Children played a "memory game", in which they watched a video of a narrator tell a story in five parts (2 baseline, 3 test). In the test blocks, the narrator performed four body movements per block in two categories (Figure-1): object-oriented (drinking) and non-object-oriented (yawning, arm scratching, face rubbing). Following each block, children told the story back to the narrator who was shown listening intently. Mimicry was assessed during both "listen" and "retell" phases.

Results:

A 2(TD vs ASD)*2(Baseline vs Test) ANOVA on the frequency of object-oriented actions (drinking) revealed no significant main or interaction effects. Analysis of non-object-oriented (yawning, arm scratching, face rubbing) actions revealed no main effect of diagnosis, but a main effect of phase such that overall, children mimicked more in the test phase than in baseline ($F(1,18)=8.50$, $p=.009$). Moreover, interaction effect for non-object-oriented actions was significant, showing that mimicry difference between baseline and test was higher in TDC as compared with children with ASD (Figure-2a; $F(1,18)= 4.78$, $p=.04$). Furthermore, increased autism symptom severity was associated with less mimicry of non-object-oriented actions among children with ASD (Figure-2b; ADOS-Total: $r=.70$, $p=.03$, ADOS-Social Affect subscale: $r=.70$, $p=.02$, ADOS-Restricted, Repetitive Behaviour subscale: $r= .28$, $p>.05$) and across the sample (SRS-2 Total: $r=-.45$, $p=.05$, SRS-2 Social Communication and Interaction subscale: $r=-.43$, $p=.068$, SRS-2 Restricted Interests and Repetitive Behaviour subscale: $r= -.45$, $p=.05$).

Conclusions:

The findings reveal that children with ASD show reduced spontaneous mimicry of non-object-oriented actions and that this is associated with autism severity, particularly the social affect domain. In contrast, no significant differences between diagnostic groups were found in mimicry of object-oriented actions, potentially reflecting lesser availability of mimicry opportunities, or differences in salience of the object-oriented action. Our design provides a novel method that is both naturalistic and well-controlled to assess spontaneous mimicry in social interaction contexts. Investigating differences in mimicry of different types of actions can elucidate non-verbal factors influencing social interactions and autism-related social-communicative issues.

316 **119.316** Rhythmic Synchronisation Does Not Come Naturally to Children with Autism

B. Tuncgenc[1], *Y. Zhao*[2], *B. Caffo*[3] *and S. H. Mostofsky*[4], *(1)Neurology, Johns Hopkins University, Baltimore, MD, (2)Department of Biostatistics, Johns Hopkins University, BALTIMORE, MD, (3)Department of Biostatistics, Johns Hopkins University, Baltimore, MD, (4)Center for Neurodevelopmental and Imaging Research, Kennedy Krieger Institute, Baltimore, MD*

Background: Rhythmic synchronisation with another person's movements is a prevalent feature of human social interactions. Research shows that typically developing (TD) children and adults spontaneously entrain their movement rhythm to others, and that such synchronisation facilitates pro-social behaviours and social bonding. Investigating the spontaneous synchronisation tendency of children with autism spectrum disorders (ASD) is important, because it can help us (a) understand how the motor system interacts with and influences social cognition in autism, and (b) develop behavioural interventions that help improve social-communicative skills of children with autism.
Objectives: Using a custom-made video game, we assessed how likely children with ASD were to spontaneously synchronise their movements with the character in the video game. The children's movements were tracked using the Kinect Xbox motion capture system, which is free of physically constraining sensors or cables. This novel method enables precise identification of synchronisation deficits and provides support for the use of this game as a potential behavioural intervention in the future.

Methods: Thirty 8- to 12-year-old children (19 ASD:1f-18m, 11 TD: 2f-9m) participated in the study; data collection is ongoing. The ASD and TD groups were matched on chronological age and IQ. In three 90-second repeated trials, children were asked to move their arms in a particular way (see Figure 1) in order to "collect food for the monkey in the video". They were told that they could do this "as slowly or as fast as [they] like, but that [they] would continue doing the movement until that game level ended". Simultaneously, the children watched the monkey in the video perform the same move in time to three different rhythms: slow (0.8Hz), medium (1Hz) and fast (1.33Hz). We used three different rhythms in order to examine whether synchronisation is easier with varying speeds and to examine children's adaptability to new rhythms.

Results: Children's movement rhythm within each speed block was assessed using a Fourier transform on the z (horizontal plane) coordinate of the two forearm joints. We found that, across all speeds, children's movement rhythm significantly differed from the rhythm of the stimulus more so in the ASD group than in the TD group (see Figure 2a), indicating poorer synchronisation in the ASD group. To examine children's adaptability to new rhythms, we also assessed their likelihood of transitioning into a new speed. For this analysis, children were considered as having 'transitioned' into a new rhythm if they performed the movement within +/-10% of the stimulus rhythm for 20% and 40% of the block duration. Survival analysis models revealed that regardless of how strictly or liberally a transition event was defined, children in the ASD group were significantly less likely to transition into a new rhythm as compared to TD children (Figure 2b).

Conclusions: These findings suggest that children with ASD are less likely to spontaneously synchronise rhythmic movements with others. Associations of synchronisation tendency with social-communicative and motor functioning will be examined, and how these movement games can be used to improve social-communicative functioning in ASD will be discussed.

317 **119.317** A Dynamic and Process-Oriented Approach Provides Insights for Identifying Behavioral and Neural Mechanisms of Social Interaction in Autism

P. Fitzpatrick[1], *S. McGuire*[2], *D. Damiano*[2], *T. Mitchell*[3], *J. Frazier*[4], *D. Cochran*[4], *D. Kennedy*[4] *and R. Schmidt*[5], *(1)Psychology Department, Assumption College, Worcester, MA, (2)Math, College of the Holy Cross, Worcester, MA, (3)Psychology, Brandeis University, Waltham, MA, (4)Psychiatry, UMass Medical School, Worcester, MA, (5)College of the Holy Cross, Worcester, MA*

Background: Social interactions typically involve movements of the body that become synchronized over time and both intentional and spontaneous synchrony have been found to be important in human interaction. However, our understanding of the temporal dimensions of social synchrony and its role in social interaction and communication is limited and identification of an objective, bio-behavioral marker for ASD and

isolation of underlying mechanisms have been elusive. Methodologies that investigate the dynamic process as how social interactions unfold hold much promise for providing measures with heightened temporal resolution to better index social performance and isolate underlying mechanisms.

Objectives: In Study 1 we compared synchronization ability of adolescents with and without ASD and examined the relationship between social cognition, clinical measures of attention and social responsiveness, and social synchrony. In Study 2 we evaluated differences in neural activity for intentional and spontaneous synchronization in healthy controls to establish an EEG methodology to be used with ASD participants.

Methods: A social movement task that involved swinging a hand-held pendulum and measured wrist movement using goniometers was employed in both studies. In spontaneous coordination, participants swung at his/her own tempo while looking at their partner's pendulum and in intentional coordination participants synchronized the movements of their pendulums. In Study 1, social cognition was assessed using Frith-Happe´ theory of mind (ToM) animations, the Social Responsiveness Scale, and Autism Diagnostic Observation Schedule. Attention was measured using the Child Behavior Checklist ADHD raw score. There were nine adolescent (12-17 years)-parent pairs in the ASD group and nine age-matched healthy control (HC) pairs. In Study 2, we measured EEG activity at multiple frequency bands as well as social synchrony in seven HC, young adult pairs.

Results: In Study 1 we found that adolescents with ASD demonstrated significantly less synchronization in both spontaneous and intentional tasks. Results also revealed that spontaneous synchrony was related to ToM and intentional synchrony was related to clinical measures of attention and social responsiveness. Facial emotion recognition was not related to either ToM or social synchrony. In Study 2 we found evidence for mu enhancement for spontaneous coordination while mu suppression was found for intentional coordination (both in phase and anti-phase). In addition, higher levels of synchronization were significantly associated with higher levels of mu suppression in the right hemisphere. Through a combination of network theory and topological analysis, we also found consistent clusters of electrodes across synchrony conditions and frequency bands.

Conclusions:

The findings suggest that the processes underlying spontaneous synchrony in ASD are different than the processes underlying difficulties in intentional synchronization, and the two types of synchronization may have different underlying neural circuitry. Our findings also highlight the importance of attention for more fully understanding the social behavior characteristic of ASD. Preliminary data comparing the EEG activity of adolescents with and without ASD will also be presented. The implication of these findings for isolating behavioral and neural measures that may provide an objective bio-behavioral marker for ASD that could lead to better classification and targeted treatments will be discussed.

318 **119.318** Cultural Transmission in Autism: The Relation between Imitation and Perceived Likeability of Autistic Adults

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Background:

Imitation serves important social functions, boosting feelings of affiliation between interaction partners (Chartrand & Bargh, 1999). Imitation may also be a key driver of cultural transmission within social groups (Legare & Nielsen, 2015). Previous work has demonstrated that autistic individuals engage in less imitation of neurotypical targets than would be typically expected (Williams et al, 2004), potentially leading autistic people to miss important social conventions. However, no work has examined the extent to which this reduction in imitation is mirrored in neurotypical individuals when responding to autistic targets.

Objectives:

This study specifically examines whether autistic adults are imitated less frequently than neurotypical adults. In addition it aims to assess the extent to which likeability of the demonstrators mediates the relationship between diagnosis and imitation.

Methods:

Twenty-four neurotypical adults watched movies of autistic and neurotypical targets (adult, 2 male and 2 female, high-functioning) introducing a task in which participants were shown how to make a clay object. Participants were blind to the target diagnosis and had no knowledge that the study was about autism. Following each introduction clip, the movie cut to a demonstration of a pair of hands making the clay object, which participants believed belonged to the introducer. In reality, the demonstration movies depicted the same neurotypical confederate across all trials (see Figure 1).

Each demonstration included four target actions for which later imitation was assessed. These actions were the choice of clay colour, tool choice, an unnecessary action (throwing and catching the clay), and the style of an action (squashing the clay with a little finger). Participants were instructed to make the clay objects and spontaneous imitation of the target actions was coded. Following the imitation task, participants completed likeability ratings for each of the targets and were asked to select one target for a hypothetical future clay task.

Results:

Target actions were imitated less when the task was introduced by an autistic person ($F(1,23)=8.31$, $p<0.01$), compared to a neurotypical person. Likeability ratings were lower for the autistic compared to the neurotypical targets ($F(1, 93)=8.27$, $p = .009$). Regression analyses indicated that likeability ratings rather than target diagnosis best predicted imitation ($B=.42$, $p=.011$), indicating that likeability could have a mediating effect on the relationship between autism diagnosis and imitation. Autistic targets were selected below chance for the future task ($\chi2$ (3, N = 24) = 9.33, $p < .025$).

Conclusions:

The findings from this study have two important implications. First, a bidirectional reduction in imitation occurs between diagnostic groups. If imitation drives cultural transmission then this finding provides a mechanism for the origins of divergent autistic and neurotypical cultures, as proposed by a neurodiversity perspective (Davidson, 2008). Second, autistic targets were perceived as less likeable and were selected for future interactions less frequently than neurotypical targets. These findings demonstrate how being autistic can lead to social isolation and exclusion from neurotypical society, highlighting the need for societal-level interventions which tackle this problem.

319 **119.319** Efficiency and Interaction during Information Transfer between Autistic and Neurotypical People

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Background: Social cognition is an umbrella term referring to behaviours thought to be necessary for successful interactions with others. To date, most social cognition research in autism has focused on apparent deficits on traditional laboratory tasks, which in theory underpin difficulties in real-world interactions with others. If social cognition is impaired in autism, interactions between two autistic people should be especially challenging. However, multiple autistic first-person accounts suggest that autistic people find interacting with other autistic people more comfortable, successful and satisfying compared with interacting with neurotypical adults.
In this study, we adapted a cultural learning paradigm used widely in comparative psychology, to explore transmission of information between individuals, contrasting autistic, neurotypical, and mixed neurotypical/autistic pairs.

One possibility is that transmitting information to someone of a different neurotype is more demanding because of cognitive resources being required to, for example, mask autistic behaviours or interpret different social cues. This may result in less computational power to dedicate to the experimental task, reflected in reduced accuracy. Alternatively, or additionally, transmitting information to someone from a different diagnostic group might be harder because a lack of interpersonal affiliation reduces motivation to attend to the other person, or to replicate their actions precisely. This would result in lower feelings of rapport and less engagement in the task.

Objectives: To examine whether performance on cultural transmission tasks varies depending on the diagnostic status of the social partner.

Methods: Using a 'diffusion chain' technique - a controlled, experimental form of "telephone" which probes cultural learning between individuals in a group - a researcher told the first participant in each chain a story which they were told to pass on to the next participant. They were then asked to pass it on to the next participant, and so on. The story was divided *a priori* into 30 specific details, meaning accuracy was scored on a scale from 0-30. Each diffusion chain included eight participants; who were either all autistic, all neurotypical, or alternating autistic and neurotypical. Participant interactions were filmed and participants rated rapport with their partners after the task.

Results: Data collection was completed in November 2018; at the time of submission 64 of 72 participants data have been scored for accuracy. Figure 1 illustrates these preliminary findings from three autistic (n=24), three alternating (n=24), and two neurotypical (n = 16) diffusion chains. Results indicate that accuracy in story details declines more slowly for both all-autistic and all-neurotypical chains. However, alternating chains show a steeper decline and lower final accuracy scores. Planned analyses on the complete dataset will explore the difference scores between pairs in each chain. In addition, we will report data on participant's perception of rapport, and coded video capturing interactive behaviours between pairs.

Conclusions: Preliminary findings suggest that both autistic and neurotypical people benefit from having an interaction partner with the same diagnostic status, when performing an information transfer task. These findings will be interpreted in light of an emergent autism theory: the Double Empathy Problem.

320 **119.320** Outcomes of Real-Time Social Interaction between Autistic Adults and Unfamiliar Autistic and Non-Autistic Partners

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Background: Autistic adults often experience poor social outcomes despite having a desire and motivation for social relationships. Recent work has highlighted relational factors contributing to poor social outcomes, as the characteristics of both the autistic person and those they interact with affect social experiences.
Objectives: Most studies examining how autistic adults are perceived by others have been limited to self-report measures and use of videos and vignettes. The current study empirically assessed in real-time how autistic adults interact with both autistic and neurotypical (NT) social partners, and examined how these social experiences are perceived by each person.

Methods: 88 male adults (58 ASD) were assigned to one of three conversation dyads: 20 ASD-ASD, 18 ASD-NT, and 6 NT-NT. Each dyad completed a 5 minute unstructured social interaction in which they were tasked with getting to know each other. The three conversation dyads were similar on IQ as measured by the Wide Range Achievement Test (p=.80). After the interaction, participants completed the First Impression Scale rating their conversation partner on six traits (e.g., awkwardness) and four behavioral intentions (e.g., comfort living near). They also completed a previously-published social interaction measure, rating the conversation on quality, and a standard measure of how "close" they felt to their partner.

Results: The Actor Partner Interdependence Model (APIM) was applied to detect the effect of diagnosis on social outcomes, yielding actor effects (e.g., effect of one partner's diagnosis on his own outcomes), partner effects (e.g., effect of the partner's diagnosis on the other partner's outcomes), and interaction effects (e.g., the effect of one partner's diagnosis on their own outcome depending on their partner's diagnosis).

Relative to NT adults, autistic adults reported feeling closer to both their autistic and their NT partners, (b=0.27, p<.001). Autistic and NT adults alike rated autistic partners as more awkward (b=-0.29, p = .001) and less attractive (b=-0.21, p = .021) than NT partners. Autistic adults were also more willing to live near their partners (b=0.18, p = .01), and a significant interaction (b=.24, p =.02) revealed autistic adults were more willing to live near autistic compared to NT partners (b=.27, p=.02). Autistic adults were more willing than NT adults to hang out with their autistic and NT partners (b=.18, p = .01). Finally, NT adults rated being more engaged in the conversation compared to autistic adults (b=-0.28, p = .049). No other effects (ps>.11) were significant, though data collection is ongoing.

Conclusions: Preliminary results suggest autistic adults are socially motivated to engage with their conversation partners. They express feeling closer to their partners and report greater interest in future interaction than NT adults. Consistent with past studies (Sasson et al., 2017), autistic adults were rated as more awkward and less attractive than NT adults, suggesting these perceptions extend to real-time interactions. However, in contrast to prior work autistic adults were not rated less favorably on other first impression items, suggesting that autistic adults may be evaluated more favorably within extended real-world interactions than on "thin slice" information.

321 **119.321** Big Five Personality Traits in Children and Adults with Autism Spectrum Disorder: Findings from the National Database for Autism Research

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Background: The most notable gap in the existing literature on personality traits and autism spectrum disorder (ASD) is the lack of research on how specific core symptoms relate to personality traits.
Objectives: The current study expands on prior research on the relationship of Big Five personality traits to autism symptoms by testing this relationship within individuals with a ASD diagnosis with symptoms broken down by symptom category.

Methods: The relationship of personality traits to ASD symptoms is tested in two independent samples from the NDAR. Sample 1 is a sample of 98 children from NIMH/NIH #R01MH094391-01 (Wood, 2012) who completed the Big Five Questionnaire-Children version (BFQ-C; Caprara et al., 1993). Participants were 9.84 years (SD = 1.94, range = 6.17 – 13.92), primarily male (n = 84, 85.7%) and White (n = 51, 52.0%). Sample 2 is a sample of 32 adults from NICHD/NIH #P50HD055748-01 (Minshew et al., 2007) who completed the NEO Five Factor Inventory (NEO-FFI; Costa and McCrae, 1992). Participants were 23.89 years (SD = 7.92, range = 14.00 – 44.17), primarily male (n = 28, 87.5%), and White (n = 29, 90.6%). In both samples, ASD symptoms were measured by the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) and the Autism Diagnostic Interview-Revised (ADI-R; Rutter et al., 2003). All analyses were conducted in R. Correlations were calculated using Kendall's *tau* to account for the non-continuous nature of ADOS and ADI-R scores.

Results: The one consistent significant effect across both samples was the negative relationship between agreeableness and ADOS restricted and repetitive behavior scores. In addition, conscientiousness and agreeableness were negatively related to ADOS social affect scores in the child sample. This indicates that children, and to some extent adults who are low in conscientiousness and agreeableness experience a higher symptom burden at least on the ADOS. It is important to note that these effects did not replicate in the ADI-R. Openness was positively related to ADOS restricted and repetitive behaviors in the adult sample.

Conclusions: Effects were, in general, less robust than those from the meta-analytic results presented in Talk 1. This may be due to the within ASD nature of the analyses. Prior work has largely focused on comparisons between individuals with ASD and control samples. While controlling for gender, ethnicity, and age did not significantly impact study findings, we urge caution in interpreting the effects from Sample 2 given its limited size and lack of demographic diversity. As both personality traits and ASD symptoms can and do change with age, it will continue to be important to consider developmental differences in future research on personality and ASD.

322 **119.322** Exploring Multiple Autisms through the Lens of Personality: A Latent Profile Analysis

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Background: Within the autism spectrum disorders (ASD) population, there is considerable variability in individuals' symptom expression, verbal/intellectual ability, and comorbid symptoms. This heterogeneity can also be observed in the ASD genetics and neuroscience literature, which presents ASD as a neurodevelopmental syndrome that consists of multiple separable phenotypes with different etiological causes (Geschwind, 2011). Thus, a recent goal in ASD research has been to identify the possible subtypes that are represented under this broad clinical diagnosis. Although the relationship between personality traits and ASD symptomatology has been explored (Lodi-Smith et al., 2018), personality research has yet to be utilized in identifying underlying subtypes and etiological pathways, something which has been effective in other mental health fields. Comprehensive descriptions of personality such as the five-factor model incorporate most areas of human behavioral variability into their taxonomies, providing a unique lens for identifying meaningful subgroup differences with a frame that goes considerably beyond clinical symptoms and theoretical constructs such as social motivation. As such, the intersection between personality research methods and the "multiple autisms" model provides a promising direction in understanding the heterogeneity within the ASD population.
Objectives: To identify meaningful, homogeneous personality subgroups that may be representative of autism subtypes in the ASD population.

Methods: The current study utilized data from a randomized, controlled trial comparing personalized cognitive-behavioral therapy (CBT) to group CBT for school-aged youth with ASD (*N*=105). A latent profile analysis was conducted using the participants' baseline personality measure scores (i.e., Hierarchical Personality Inventory for Children). A best-fitting model was determined by relative fit indices, including the Bayesian Information Criterion (BIC) and sample size-adjusted Bayesian Information Criterion (SS-BIC), as well as considerations for parsimony and interpretability. Concurrent validity was assessed by comparing the identified personality subgroups (i.e., classes) on measures of ASD symptomatology and comorbidities (SRS, CASI, CBCL) and measures of cognitive performance (WISC-IV, D-KEFS).

Results: A 4-class solution emerged as the best-fitting model with significant reductions in fit indices through four classes, while the 5-class solution presented an increase in BIC value. The additional class in the 5-class solution was deemed spurious given its similarity to another class and small class membership (representing less than 5% of the sample). The class with the largest membership (*n*=55) was characterized by low scores across all five personality factors. Another class (*n*=27) exhibited normative scores in Conscientiousness and Imagination, with low scores in Agreeableness, Extraversion, and Emotional Stability. The third class (*n*=14) presented very low Extraversion and Imagination scores, while the fourth class (*n*=9) presented high Imagination scores. The four classes were significantly different in SRS scores, as well as CASI and CBCL subscale scores and several WISC-IV and D-KEFS scores.

Conclusions: Results suggest that subgroups of children with ASD (IQ>70) seeking behavioral treatment may possess distinct personality profiles which may affect the autism symptom expression, severity level, cognitive features, and comorbid symptomatology which characterize them. Future research should determine the clinical significance of identified personality subgroups and whether or not they are identifiable on a neurobiological level as well.

323 **119.323** A Sensitive Measure of Social Interaction Styles and Social Vulnerability in Developmental Disorders – Moving Beyond the Constraints of the Social Responsiveness Scale 2

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Background: The Social Responsiveness Scale (SRS-2; Constantino & Gruber, 2012) is the most widely used, standardised measure to examine social functioning abilities/disabilities in developmental disorders. However, much evidence suggests the SRS-2 lacks specificity in capturing subtle social differences between developmental groups; indeed it was not designed for this purpose, rather to capture the presence/severity of social atypicalities characteristic of functioning on the autism spectrum.
Objectives: The aim of this large project was to provide a new parent-report questionnaire probing social interaction styles in more detail than

the SRS-2, and provide sufficient specificity to understand social skills that transcend diagnostic boundaries, alongside those that might be more syndrome-specific. We collected questionnaire data from parents of children with 3 developmental disorders known to impact upon social skills; Autism Spectrum Disorder (ASD), Williams Syndrome (WS) and Attention Deficit Hyperactivity Disorder (ADHD). This poster focuses on 2 clear objectives of the study, specifically to capture i) the (a)typicality of social interaction styles with peers versus adults, and ii) evidence of social vulnerability within the social profiles.

Methods: 94 parents of children with developmental disorders (4-17y), including children with ASD (n=29), WS (n=30) and ADHD (n=36), completed an online questionnaire focusing on social interactions and social vulnerability. A subgroup of parents also completed the SRS-2 to allow comparisons across measures. The questionnaire was developed utilising the SRS-2 and the Diagnostic Interview for Social and Communication Disorders (DISCO; Wing et al., 2002).

Results: The mean for all groups showed significant levels of social atypicality and fell in the atypical range as measured by the SRS-2 (WS M=71.00, SD=11.57; ASD M=83.91, SD=6.77; ADHD M=78.65, SD=10.19). On the social interaction questionnaire, mapping to objective (i) a 3x2 ANOVA analysed whether social interaction styles differed depending on the person (adult vs peer) and diagnostic group. There was a significant person.x.group interaction ($F(2,91)=7.897$, $p<0.001$), suggesting social interaction atypicalities not only differed depending on whether the interaction was with an adult or peer, but also by diagnostic group. While there was no significant difference between adult and peer interaction ability in ASD ($p=0.34$) or ADHD ($p=0.52$), the WS group showed more atypicalities with peers than adults ($t(28)=4.873$, $p<0.001$). Mapping to objective (ii) a one-way ANOVA revealed no significant difference in mean social vulnerability levels between groups ($p=0.072$). The important aspect of these data is that the social vulnerability levels reported for all groups were significantly higher than existing data from a 'typical' sample – therefore suggesting heightened social vulnerability across these developmental disorders.

Conclusions: These data provide evidence of overlapping social atypicalities in children with ASD, WS and ADHD. Furthermore, they suggest that social atypicalities may vary depending on who the child is interacting with, but that the pattern may be syndrome-specific, and this is important for theory and intervention. The social vulnerability data emphasise the necessity to understand/capture social skills accurately in these developmental groups and the potential consequence of atypical social functioning.

324 **119.324** Activity Participation, Friendship, and Internalizing Problems in Children with Autism Spectrum Disorder

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Background: Social interaction difficulties in children with autism spectrum disorder (ASD) can be challenging, especially during adolescence. In addition, high rates of comorbid internalizing disorders in ASD can lead to social isolation. With limited social activity participation, social deficits and internalizing problems in ASD may be related to participation, exposure, and practice with friends.

Objectives: Children with ASD are at high risk for internalizing symptoms and social isolation. Understanding the factors that may protect against those difficulties is important for helping to promote social-emotional well-being. The purpose of this study was to evaluate the relations among friendship, activity participation, and internalizing problems (See Figure 1).

Methods: Participants included 129 children with ASD between the ages of 6 and 18. Measures of friendship, participation in sports, hobbies, and clubs, and internalizing problems were assessed using the Child Behavior Checklist (CBCL). We analyzed the relationship between 1) activity participation and friendships, 2) activity participation and internalizing problems, and 3) friendships and internalizing problems. For significant bivariate relationships, we subsequently examined the influence of covariates on the relationship between variables.

Results: See Table 1 for participant characteristics. The most popular types of hobbies were screen-based media, academic-based (e.g., reading), or toy-based. The most popular clubs were religious in nature or special-interest groups (e.g., marching band, chess club). Children with higher IQs had more internalizing problems than children with lower IQs ($r = .348$, $p < .001$). Children with at least one friend had significantly higher IQs ($M = 84.58$, $SD = 28.15$) than children with no friends ($M = 70.62$, $SD = 26.40$) [$t\ (124) = -2.866$, $p = .005$]. Activity participation was related to more friendships, even after controlling for IQ. Activity participation was not significantly related to internalizing problems ($r = .037$, $p = .678$), and friendships were not significantly related to internalizing problems ($r_s = .010$, $p = .914$).

Conclusions: This study sheds light on the impact of social engagement with peers in developing and maintaining friendships as well as managing internalizing problems. Extracurricular activities offer children opportunities for regular and sustained social interactions focused on shared interests, leading to development of relationships among co-participants. However, it is also possible that children are more likely to join activities if they have friends who are already involved in those groups or clubs. Similarly, children with ASD may be more likely to participate in activities if they have stronger social skills and greater social interest at the outset. Longitudinal studies examining more comprehensive assessments of friendship and activity participation over time are necessary to help understand the directionality of these relationships in children with ASD. In addition, future research should evaluate the specific contributions of physical exercise (e.g., Ströhle, 2009), typically developing peer role models (e.g., Bauminger-Zviely & Agam-Ben-Artzi, 2014; Dolan et al., 2016), and specific types of organized activities that are conducive to interpersonal skill development (Larson, Hansen, & Moneta, 2006).

325 **119.325** An Analysis of Social Competence in Individuals with Autism Spectrum Disorder and Co-Occurring Conduct Problems

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Background: A core diagnostic feature of Autism Spectrum Disorder (ASD) is impairments in social competence (APA, 2013). Deficits in social competence have meaningful implications for individuals with ASD, including social isolation, co-occurring internalizing conditions, and poorer overall quality of life (White, 2007). There is also high co-occurrence between ASD and conduct problems (CP), such as Conduct Disorder (Sipes, 2011). However, little is known about the effects of co-occurring CP on social competence in individuals with ASD.

Objectives: In the current study, we compared social competence in individuals with ASD both with (ASD+CP) and without (ASD-CP) co-occurring CP. It was hypothesized that individuals with ASD+CP would have greater social deficits than individuals with ASD only.

Methods: Participants include 31 children and adolescents with ASD (with language impairment = 4, with intellectual impairment = 6; male = 25, female = 6) between the ages of 6 and 18 years from the southwest Virginia area. Families seeking an ASD assessment visited the university clinic and research center for a diagnostic evaluation and were asked to complete several measures. The Social Responsiveness Scale - 2nd Edition

(SRS-2) measures overall ASD symptomology, as well as Social Awareness (SA), Social Cognition (SC), Social Motivation (SM) and Social Communication (SCM). Co-occurring CP was determined by scores above the clinical cutoff on the Conduct Problems subscale of the Child Behavior Checklist. An independent samples t-tests were used to compare ASD+CP (*n*=13) with ASD-CP (*n*=14) on parent reports of SA, SC, SM, SCM, and total ASD severity.

Results: The research indicated that individuals with ASD+CP have greater ASD severity than individuals with ASD-CP as measured by the SRS-2 total score (*M*=83.31, *SD*=7.016, *M*=72.29,*SD*=8.145; t(25)= -3.583, *p*<.001). Additionally, individuals with ASD+CP have greater deficits that individuals with ASD-CP on measures of SA (*M*=78.85, *SD*=5.60, *M*=68.21, *SD*=6.23, respectively; t(25)= -4.65, *p*<0.001), SC (*M*=81.08, *SD*=6.28,*M*=72.64, *SD*=9.71, respectively; t(25)= -2.66, *p* = 0.014), SM (*M*=73.92, *SD*=12.24, *M*=63.71, *SD*=11.52, respectively; t(24) = -2.19, *p*= 0.039), and SCM (*M*=71.36;*SD*=8.46,*M*=81.54, *SD*=6.70; t(25)= -3.44, *p*= .002).

Conclusions: These findings help to better understand the impact that co-occurring CP can have on core ASD symptomology (i.e., social competence), such that individuals with co-occurring CP had more severe impairments with regard to social motivation, cognition, and awareness. These findings can inform the prognosis of children with ASD and co-occurring disruptive behavior concerns, specifically with respect to social outcomes. Additionally, these findings support the importance of social competence instruction, especially in cognition, awareness, and motivation, for individuals with ASD and co-occurring CP.

326 **119.326** An Examination of the Role of Executive Functioning in Predicting Social Competence in Children with and without ASD

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Background:

All children with autism spectrum disorder (ASD) experience social difficulties but they differ with regard to the type and severity of social difficulties. Potentially powerful interventions focused on improving social skills in children with ASD (Koning, Magill-Evans, Volden, & Dick, 2013; Waugh & Peskin, 2015; Whalon, Conroy, Martinez, & Werch, 2015)may have limited effectiveness if they are not tailored to the child's specific profile of strengths and challenges. To effectively target interventions there is a need to understand the key factors that contribute to different strengths or challenges in social competence (eg. emotion regulation versus socio-cognitive skills) in children with ASD. One factor that may play an important role in social competence is executive functioning (EF). EF may influence social competence by facilitating higher-order strategies such as emotional and cognitive regulation which is necessary for social interactions (Riggs, Jahromi, Razza, Dilworth-Bart, & Mueller, 2007).

Objectives:

To examine parent reports of EF using the Behavior Rating Inventory of Executive Functioning (BRIEF-2; Gioia, Isquith, Guy, & Kenworthy, 2015). Composite indices may mask variations within the component subscales, particularly for children with ASD, who often demonstrate uneven profiles of functioning. To address this, the present study had two goals: 1. To examine and compare EF and social competence profiles in children with ASD without cognitive disability and typically developing (TD) children; and 2. To determine whether specific EF skills can predict social competence in both groups.

Methods:

The study is based on archival data from 117 children and adolescents, aged 5 to 13, including 62 with ASD (M=10.07, SD=1.64), and 55 who were TD (M=9.52, SD=1.64). Caregivers completed the BRIEF-2 Parent Form, assessing everyday EF skills, and the Multidimensional Social Competence Scale (MSCS; Yager & Iarocci, 2013), measuring 7 distinct domains of social competence. Hierarchical multiple regression analyses were conducted separately for each group (TD, ASD) with MSCS scales entered as the dependent variables and executive functioning indices and scales of the BRIEF-2 as the main predictor variables.

Results:

The first investigation of EF indices (BRI, ERI, CRI) as a predictor of social competence domains in TD children, revealed that problems with emotional regulation significantly predicted difficulties with empathy after controlling for age and IQ. For children with ASD, deficits in emotional regulation significantly predicted difficulties in modulating negative states and nonverbal conversation skills. Additionally, impairments in behavioral regulation also emerged as a significant predictor of deficits in social inferencing and verbal conversation. To determine the specific EF skills that related to social competence, a scale analysis of the BRIEF-2 was conducted. Deficits in self-monitoring were a significant predictor of poorer social inferencing, empathy, and social knowledge for children with ASD.

Conclusions:

Self-monitoring, emotional control, and initiation played a significant role in predicting social inferencing, emotion regulation, empathy, and social motivation in children with ASD. A more precise understanding of the particular EF skills that contribute to various aspects social competence can inform the development of tailored, individualized, and effective interventions for individuals with ASD.

327 **119.327** Analyzing Behavioral Components of Social Functioning in Autistic Adults

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Background: To better design treatments that target social functioning for autistic adults, it is important to improve our understanding of the various behavioral components of social functioning -- including social motivation, social anxiety, social cognition, and social skills -- and the relationships among them. Few studies have examined all of these components in the same set of adult participants. However, a recent study from our group (Pallathra et al., 2018) that included 28 autistic adult participants without intellectual disability found that impairment in social motivation was positively correlated with both social anxiety and overall autism symptoms, and negatively correlated with social skills. Pallathra and colleagues also found that social anxiety was positively correlated with overall autism symptoms, but that social cognition was not correlated with other components of social functioning.

Objectives: As the participants included in the Pallathra et al. study were modest in number (N=28) and within a limited age range of adulthood (20 – 48 years), the current study sought to test the hypothesis that the correlations reported by Pallathra et al. would be replicated in an independently recruited, larger sample of autistic adults without intellectual disability.

Methods: Forty-six autistic individuals without a history of intellectual disability (33 male, 13 female; aged 20 - 77 years; see Table 1 for additional demographic information) were recruited for participation in an autism genetics study at the University of Pennsylvania. Eligibility was determined based on a detailed clinical and developmental history, as well as Social Communication Questionnaire (SCQ) and Social Responsiveness Scale-2 (SRS-2) scores consistent with a diagnosis of autism spectrum disorder. Measures of overall autism symptoms included several self-report questionnaires -- SRS-2, Autism Quotient (AQ), and Broader Autism Phenotype Questionnaire (BAPQ) -- as well as the informant report SRS-2. Social motivation was measured using the aloof subscale of the BAPQ, while social anxiety was measured by the Liebowitz Social Anxiety Scale (LSAS). Social cognition was measured using the Penn Emotion Recognition Task (ER40), a performance-based measure of facial emotion perception (Gur et al., 2010).

Results: Impairment in social motivation was positively correlated with both social anxiety and the self-report measures of overall autistic behaviors (AQ, SRS, and BAPQ total). Additionally, the social anxiety measure was positively correlated with the self-report measures of overall autistic behaviors. The social cognition measure was not correlated with any of the other measures. (See Figure 1 for r and p-values.)

Conclusions: We found that social motivation and social anxiety are related both to each other and to overall autism symptoms, while social cognition is not related to any of the other components of social functioning measured in our sample of autistic adults. Our data largely replicate the findings of Pallathra and colleagues (2018) in a larger sample of autistic adults, with a wider age range and a higher percentage of female participants. Understanding relationships among these components of social functioning can help us to better design and target interventions aimed at improving social functioning in autistic adults.

328 **119.328** Association between Visual Gaze Patterns during Tickling Interaction and Autistic Traits in Preschool-Aged Children

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Background: Touch is the primary form of communication in the first year of human life. Tickling is an intriguing tactile perception related to self-other recognition, as it is difficult to tickle oneself but easy to be tickled by others. Infant-mother tickling interaction reportedly promotes the development of social communication in infancy; infants tend to look at their mothers' faces and tickling hands alternately during pauses before actual tickling. This gaze behavior seems important to anticipate others' intentions.
Social communication impairment is a core feature of Autism Spectrum Disorders (ASD), and an atypical pattern of eye contact and gaze behavior in ASD is well-established. Based on previous findings, we hypothesized that children with autistic traits would show less visual attention to faces during pauses before actual tickling.
Objectives: The objective of the current study was to investigate the relationship between gaze patterns during tickling interactions and autistic traits. We focused on preschool-aged children to conduct the eye tracking-based methodology.

Methods: The participants were fourteen typically developing children between 42 and 68 months of age (seven boys and seven girls). We utilized Tobii Pro Glasses 2 to obtain eye tracking data during dynamic interactions with a sampling rate of 50 Hz. A child wearing the head unit was seated on a chair facing the examiner. The examiner tickled four different body parts (neck, side, underarm, and chest) for five seconds; each body part was tickled two times consecutively, once without a pause before the actual touch and again with a pause of three to five seconds before the actual touch. Beforehand, the children were told "This is the game. I will tickle you. Tell me whether it is ticklish." The total duration of fixation on the face area during the pause was calculated using Tobii Pro Lab. A fixation filter with minimum fixation duration of 60 milliseconds was applied. The average of the face fixation ratio (face duration [s] / pause duration[s]) was calculated as an indicator of gaze pattern. The Social Responsiveness Scale – Second Edition (SRS-2), including five treatment subscales (social awareness, social cognition, social communication, social motivation, restricted interests and repetitive behavior), was utilized to assess autistic traits. Preschool teachers were asked to fill out the SRS-2. Pearson's correlation coefficients were used to measure the strength of linear associations between visual attention and T-scores reported on the SRS-2.

Results: There was no significant association between the SRS-2 total scores and gaze patterns (p=0.31). Only "social awareness," which is one of treatment subscales, was significantly related to gaze pattern (r =0.54, p=0.04, R2 =0.30, power [1-β] = 0.51) (Fig 1).

Conclusions: The findings of our study suggest that gaze pattern during tickling may relate to some autistic traits in preschool-aged children. During pauses before actual touch, the children anticipated the examiner's actions and resulting feelings of ticklishness. Although this study was conducted with typically developing children, autistic traits are distributed along a continuum. Therefore, focusing on response to tickling may be potentially useful to understand social development in children with ASD.

329 **119.329** Attainment of the Sit Milestone Is Related to Trajectories of Social Communication in Children with Autism Spectrum Disorder

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Background: Throughout the first year of life, infants attain and refine a myriad of skills in both motor *and* social communication domains. In typically-developing (TD) infants, the attainment of motor milestones in particular transforms the ways in which infants are able to interact with their surroundings, affording them a wide range of new experiences that are fundamental to the emergence of social communication skills. In children with ASD, a small number of studies have begun to address how motor development relates to communication development, but have thus far focused only on the onset of walking. Sit milestone attainment relates to increases in social communication in TD infants, but remains largely unaddressed in infants with ASD. The present study will be the first to investigate this relationship in infants later diagnosed with ASD.
Objectives: (1) Model longitudinal growth in social communication for children with ASD and TD age-matched peers. **(2)** Assess the extent to which attainment of the sit milestone impacts within-group trajectories of social communication. **(3)** Assess the extent to which attainment of the sit

milestone relates to future social communication scores.

Methods: 81 age-matched infants (38 ASD; 43 TD) were administered the Communication and Symbolic Behavior Scales (CSBS) at 9 and 12 months of age. A parent caregiver questionnaire (PCQ) was completed by a primary caregiver, and the age at which each infant first sat without support was collected. Trajectories were modeled for social communication scores on the CSBS across the two time points using (a) chronological age and (b) an adjusted age based on age at attainment of sitting (Figure 1). "Early" and "late" sitters were identified relative to group median sit-onset age, and scores were plotted and compared for each group. Within-group analyses were run to test for correlations between sit onset and social communication scores at 9 and 12 months.

Results: Trajectories of CSBS scores adjusted for age-of-sitting show improved goodness-of-fit statistics (r-square, SSE, RMSE, adjusted r-square) compared to unadjusted, chronological-age trajectories (Figure 1). Early sitters exhibit higher CSBS scores at 9 months than late sitters: sit onset is significantly correlated with CSBS total scores and with Symbolic and Speech composites (*p*'s<.05), and approaches significance for Social composite scores (*p*=.0503)(Figure 2).

Conclusions: This study reveals a relationship between the attainment of the sit milestone and trajectories of social communication in children with ASD, such that adjusted age based on sit onset better models growth in social communication than chronological age alone. In addition, infants who sit earlier exhibit stronger social communication at 9 months, suggesting that sitting affords these infants experiences that may have positive cascading effects on communication development. These findings highlight the dynamic nature of co-occurring and interrelated domains of development in the first year of life. Knowledge of how early motor milestones relate to emerging communication skills in children with ASD can provide insight into mechanisms that impact the unfolding of the social-developmental disorders, and in turn may aid development of timely and effective interventions to support communicative growth in this vulnerable population.

330 **119.330** Attentional Biases in Autistic Traits: Implications for Social Cognition

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Background: Social communication issues, coupled with restricted interests and repetitive behaviors (RRBs), define autism spectrum disorder (ASD). Recent evidence suggests impairments in lower-level processing may contribute to these issues. One possible lower-level process that may impact core issues is attentional bias (AB), where individuals typically favor processing of socio-emotional inputs. We suspect that changes in AB may cascade into core issues that define ASD, particularly as they relate to known anxiety issues in ASD.
Objectives: The present study was driven by two goals: 1) identify the patterns of AB for socio-emotional information and how they relate to traits associated with the diagnostic features of autism, and 2) test whether any such relationships are mediated by anxiety.

Methods: Participants included typically-developed individuals (*N*=33, data collection ongoing) who completed a well-established dot-probe paradigm, designed to assess AB for socio-emotional cues (Figure 1a). Two images of faces were briefly presented, one featuring a neutral expression and one featuring an emotional expression. A visual target then appeared in the previous location of one image, and participants indicated at which location the target occurred. Faster responses to targets presented in the previously socio-emotional cued location indicated AB for that domain. Eye-tracking was used as a concurrent measure of AB for emotional expressions. Participants completed questionnaires reporting the presence and degree of various ASD-related social (Social Responsiveness Scale; SRS-2), RRB (Repetitive Behaviors Questionnaire; RBQ), and sensory (Sensory Profile) traits, as well as a measure of anxiety (the adult-adapted Spence's Children's Anxiety Scale). AB responses were then correlated with the level of ASD-related traits for each measure, as well as anxiety. Mediation analyses were conducted to assess the role of anxiety in the relationship between AB and ASD traits.

Results: Positive correlations were found between AB and scores on the SP-2, RBQ, and SRS (all r-values>0.30, all p-values<0.05). Anxiety significantly correlated with AB (r=0.44, p=0.012), as well as with the three measures of ASD traits (all P-values<0.05). Regression analyses were used to test the hypothesis that anxiety mediated the effect of AB and ASD-related symptom outcomes. Regression analyses and the associated Sobel's tests revealed anxiety did not mediate the relationship between AB and ASD-related symptom outcomes for scores on the SRS (S=2.56, p=0.01, Figure 1b), but anxiety did mediate the relationship for RBQ (S=1.14, p=0.254, Figure 1c) and SP-2 scores (S=1.92, p=0.054, Figure 1d).

Conclusions: The results demonstrate the relationship between AB for emotional cues, and the core issues associated with ASD. For sensory disruptions and RRBs, this relationship was significantly mediated by overall anxiety levels. While there was a direct relationship between AB and social responsiveness measures, this relationship was not mediated by anxiety. This more direct relationship is likely due to the social nature of the stimuli presented, resulting in a more explicitly direct relationship with social abilities. These findings support the hypothesis that atypical patterns of AB for socio-emotional cues may contribute to autistic traits more generally, and that for non-social symptoms including sensory issues and RRBs, this relationship is mediated by anxiety.

331 **119.331** Attenuated Attention to People but Not Humanoid Puppet Figures in Children with Autism Spectrum Disorder

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Background: Previous eye-tracking studies have found attenuated attention to faces in young children with ASD, relative to typically-developing (TD) and developmentally delayed (DD) groups (Klin et al., 2009; Chawarska et al., 2012; Pierce et al., 2018). While social attention varies by activity type (Chawarska et al. 2012) and social load (1 vs. multiple humans) (Moore et al., 2018; Speer et al., 2007), less is known about how simpler, humanoid figures (e.g., puppets) may influence viewing patterns in ASD. Research using artificial intelligence in interventions has found that simplified, predictable humanoid figures may facilitate learning in ASD (Scassellati et al., 2018). A direct examination of perception of humanoid vs veridical human social figures in ASD can critically inform such intervention practices.
Objectives: We investigated attention to the faces of a puppet and person engaged in a conversation and its association with clinical features. If puppet and person are perceived as equivalent social agents, then children with ASD may exhibit attenuated looking to both figures compared to TD and DD groups. If the puppet is less socially ostensive than the person, then between-group differences may be present for the person but not puppet.

Methods: 81 children with ASD (N = 29, mean age=46.92 months), TD (N = 27, mean age=39.83 months) and DD (N = 25, mean age= 51.29 months) participated in a free-viewing eye-tracking paradigm consisting of a video depicting a puppet and an actress engaged in conversation (Figure 1). Percent of time spent viewing the social scene (%valid), percent of valid viewing time looking at the puppet or person (%Face), and a puppet-person ratio (PP_ratio) (e.g., relative time spent viewing puppet vs person) were calculated. Participants were administered the ADOS-2 and a cognitive test (e.g., Mullen or DAS).

Results: Children in the ASD group had lower %Valid than TD or DD groups ($F_{2,77}$=8.26,p=.001, $p\eta^2$=.17; ASDvsTD: p<.001; ASDvsDD: p=.004). %Face-Puppet did not vary by diagnosis ($F_{2,77}$=0.44, p=.65, $p\eta^2$=.01), but %Face-Person was attenuated in ASD ($F_{2,77}$=3.84, p=.026, $p\eta^2$=.09; ASDvsTD:p=.01; ASDvsDD: p=.05; Figure 2). Using the puppet-person ratio, greater relative attention to puppet vs person in the ASD group was associated with greater social impairment (r=.422, p=.032). Across all participants, greater attention to the person was associated with lower ASD symptom severity (r=-.374,p=.001), and better verbal (r=.409,p<.001) and nonverbal cognitive skills (r=.376,p<.001). Attention to the puppet was not significantly associated with any clinical features.

Conclusions: Consistent with prior work, children with ASD exhibited attenuated attention to human-speaker face, but their attention to the puppet-speaker face was comparable to DD and TD groups suggesting that simpler, perceptually salient humanoid form may serve as an enhancer of social attention in children with ASD. This was particularly true of children with greater severity of autism symptoms who spent proportionally more time monitoring the puppet speaker's face than the human speaker's face. This suggests that puppet-like agents may provide a particularly effective way of engaging attention of children with more severe symptoms, though whether this enhancement facilitates social learning remains to be determined.

332 **119.332** Atypical Eye Movement Characteristics during a Biological Motion Preference Task in Individuals with Autism Spectrum Disorder

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Background: Typically developing (TD) individuals exhibit a visual preference for biological over non-biological motion. Such preference has been shown to be less prominent in individuals with autism spectrum disorder (ASD). However, the characteristics of eye movements associated with this atypical visual preference for biological motion in ASD have not been well described.
Objectives: To examine differences in multiple eye gaze characteristics during a biological motion task in individuals with ASD and TD controls using eye tracking.

Methods: The study population included 40 TD (males = 65%, mean age [range] = 16.4 [6-63] years) and 121 ASD (76%, 14.6 [6-54] years) participants. Diagnosis of ASD was confirmed according to the Autism Diagnostic Observation Schedule (ADOS, 2nd edition). Participants were presented with a series of videos with point light displays representing biological motion on one side and non-biological motion on the other, and their eye movements were recorded. Each video lasted approximately 4 seconds. In total, 60 trials were presented with the biological-nonbiological side counterbalanced, and each trial preceded with a centering stimulus. Eye movements of each participant were characterized by: % total time gazing at the stimuli, % time gazing at biological versus non-biological motion, % time the first saccade was oriented towards biological motion, % time the first fixation was on biological motion, average latency of the first saccade and fixation on either type of stimuli.

Results: Each of the eye movement characteristics was modelled separately as a linear sum of participant's age, gender and group. There was a significant effect of group on all characteristics (all p's < 0.05), except "% time the first fixation was on biological motion". In comparison to TD participants, the ASD participants at the population level were gazing less at the presented stimuli (difference = 8.8%) and biological motion (7.7%). Furthermore, the ASD participants were more frequently orienting their first saccade towards biological motion (2.6%) and had greater average latencies of the first saccade (112-132 msec) and fixation (105-118 msec) on either type of stimuli. The effect of group persisted the use of different data inclusion criteria (N = 3) to account for the presence of outliers, whereas the effects of age and gender varied across these criteria. The ASD participants demonstrated a subtle but significant preference for biological motion (mean = 54.5% versus 61.9% in the TD controls, comparisons against 50%: both p's < 10^{-8}). This preference (> 50%) was also observed in groups of the ASD participants with different severity levels (mild, moderate, severe) of the ADOS "restricted and repetitive behavior", "social affect" and "total" symptom scores (all p's < 0.05).

Conclusions: Individuals with ASD differ from TD controls on multiple properties of eye movements associated with biological motion preference. Age and gender appear to have little or no impact on these differences. However, individuals with ASD, like TD controls, exhibit preference for biological motion that appears across different symptom domains and levels of ASD. These findings have implications for the use of biological motion preference tasks as a biomarker for ASD.

333 **119.333** Autism Attitude and Acceptance Scale (AAAS): A Scale Development and Validation

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Background: Previous studies on attitudes toward ASD have examined neurotypical individuals' openness to (Neville & White, 2011), stigmatizing of (Harrison et al., 2017), and awareness of (GillespieLynch et al. 2015) ASD. This study proposes autism acceptance as a new construct to be studied and measured. The concept of autism acceptance, which emerged from autistic advocacy and the neurodiversity movement, contends that autistic individuals do not need to be cured but should be appreciated for who they are as they are (Sinclair, 1999). While autism advocates are increasingly emphasizing the difference between being aware of autistic differences and acceptance of autism (Kassiane, 2012), there is currently no validated measure for assessing neurotypical individuals' autism acceptance.
Objectives: The purpose of this study was to develop a valid and reliable selfreport instrument to measure neurotypical adults' acceptance of autistic individuals.

Methods: From an extensive review of the existing literature of autism attitude and neurodiveristy, the 30 items Autism Attitude and Acceptance Scale (AAAS) were newly drafted. Two professors, eight doctoral students, and a female autistic adult were involved in developing the initial 21

pilot items, which were administered online via Qualtrics. Professors at a Jesuit university in the United States shared the link to the survey with their students. Also, the link was posted on the investigator's SNS. The final sample included 120 neurotypical adults (Table 1). After reading a brief description of ASD, participants completed AAAS first. Subsequently, existing ASD attitude measures, quality and quantity of previous contact measures, and an ASD knowledge measure were administered in a random order. All items within each measure also were randomly ordered. Finally, participants completed a demographic questionnaire. The full list of instruments administered is presented in Table 2. Principal component analysis and reliability analysis were conducted to optimize the structural and psychometric properties of the measure. DeVeills' (1991) guidelines for survey development were applied. Pearson's r correlations and oneway ANOVA were employed to examine the relations between AAAS and conceptually related variables.

Results: The AAAS yielded two subscales, scored on a 5point scale: Beliefs about Autistic Symptoms (BAS) and General Acceptance (GA). Lower scores on the 3item BAS indicate participants strongly believed the reduction of autistic symptom would benefit autistic individuals. Higher scores on the 14item GA indicate higher levels of willingness to offer support or consideration of autistic individuals as equals. While the mean score of the BAS was 2.05 (SD =0.8), that of GA was 3.63 (SD =0.91). Also, 67.5% of participants agreed, "Autism is a unique way of being that should be appreciated" (an item from GA), but 74.2% of participants also agreed "it is important for researchers and doctors to devote resources to find a cure for autism" (an item from BAS). Table 2 reports the association between the AAAS and existing measures of ASD attitude, ASD knowledge, previous contact, and demographic factors.

Conclusions: The AAAS could complement existing tools to identify modifiable variables of higher acceptance and target biased societal conceptions to promote a greater appreciation of autistic differences.

334 **119.334** Autistic Adults Are Sensitive to Social Agency When Interpreting Patterns and Forming Predictions.

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Background:

Humans are remarkably sensitive to patterns arising from the behaviour of social partners. This skill allows an understanding of the preferences and choices of others, and is thought to arise from theory of mind (ToM) processing. However, individuals with a diagnosis of an autism spectrum condition (ASC) typically show deficits in ToM processing, and are also insensitive to detecting patterns derived from the behaviour of social partners. Sensitivity to social stimuli and the ability to recognise patterns of social behaviour is critical to the development of adaptive social behaviours. Consequently, impairments in these abilities may have far reaching consequences for a person's integration as a member of a social group.

Objectives:

The aim of this study was therefore to investigate whether autistic adults are sensitive to, and use information regarding social agency when forming predictions.

Methods:

Autistic (n=29, m=35.9, SD=12.4) and Neurotypical (NT) participants (n=27, m=36.7, SD=11.2) completed a prediction task during which they had to infer selection preferences from an animation of a red cursor. The agency of the cue was manipulated across two parts of the study; in the first part it was described as a computer algorithm, and in the second half as representing the eye movements of another participant.

Results:

A 2x2 mixed model ANOVA revealed a main effect of condition ($F(1,54)=10.096$, $p=.002$, $\eta\rho^2=.158$), as the proportion of correct responses was greater in eye movement condition (M=.68, SD= .13) compared to the computer algorithm condition (M=.61, SD=.12). However, there was no condition x group interaction ($F(1,54)=.014$, $p=.906$, $\eta\rho^2=.000$), demonstrating that both neurotypical and autistic participants were significantly more accurate when they believed that the cue represented the eye movements of another participant.

Conclusions:

This therefore provides evidence that adults with an ASC show the same social facilitation effect as neurotypical adults and can more accurately predict another's choices when granted access to social information. This suggests that whilst autistic adults may show deficits in social behaviours this does not arise from a lack of sensitivity to social agency, or from an inability to form predictions of social behaviour on the basis of social agency.

335 **119.335** Being but Not Appearing to be Autistic: Qualitative Exploration of Social Compensation Strategies in Autism

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Background: It has been proposed that some autistic people use strategies during social interaction to 'compensate' for core social cognitive difficulties (e.g., in theory of mind). By using social compensatory strategies, these individuals demonstrate 'typical' social behaviour, despite continued social cognitive difficulties. Whilst compensation might have several positive consequences (e.g., for gaining and maintaining employment, social relationships), evidence suggests it may come at a cost to mental health. Additionally, compensation might help explain why some autistic people do not receive a diagnosis, and therefore appropriate support, until adulthood. Very little, however, is known about the nature and type of social compensatory strategies used by autistic people, as well as the consequences for clinical outcomes.
Objectives: Using an exploratory qualitative approach, this study is the first to explore social compensatory strategies in autistic adults. Individuals with a clinical autism diagnosis were recruited, in addition to a group without a diagnosis but reporting high autistic traits, to explore how compensation operates across the diagnostic threshold.

Methods: 136 adults (58 with an independent autism diagnosis) completed an online questionnaire about their experiences using social compensatory strategies and a measure of autistic traits, AQ10 (Allison et al., 2012). Qualitative thematic analysis was conducted using Braun and Clarke's (2006) procedure and data were analysed in an inductive (i.e., data-driven) manner.

Results: Eight themes and 19 subthemes were identified. The eight themes were: 1) 'secondary route', which depicts compensation as a secondary,

slower route to social problem solving, when intuitive social understanding is limited, 2) 'cognitive compensation', which describes compensation as cognitive strategies supporting typical social interaction, 3) 'behavioural masking', which encompasses minor behavioural modifications that do not support social interaction, 4) 'internal factors', which are internally-driven mechanisms influencing compensation (e.g., social motivation), 5) 'external factors', which are externally-driven mechanisms (e.g., pressure to conform), 6) 'diagnosis and support', which outlines how lifetime compensatory strategy use may delay individuals receiving appropriate support, 7) 'quality of life', which depicts the (positive and negative) effects of compensation on health, employment and social relationships, and 8) 'trajectories and attitudes', which refers to individual differences in strategy success over the lifetime, ranging from "things have got better" to compensation being "an ongoing challenge".

Conclusions: The results highlight important cognitive characteristics, drivers and clinical outcomes of social compensation in autism. They also suggest that social compensatory strategy use is not limited to diagnosed individuals. More broadly, the results highlight the importance of considering the phenomenon of social compensation when aiming to understand the mechanisms driving 'typical' social behaviour in autism, in both research and clinical settings.

336 **119.336** Biological Motion Perception in Autism Spectrum Disorder: A Meta-Analysis

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Background: The motion of others – biological motion, conveys to the observer information that allows the identification of both affective states and intentions. As biological motion plays an important part in social functioning, its investigation in autism spectrum disorder (ASD) has received more attention in recent years. However, the findings tend to be mixed as some studies suggest no difference between neurotypically developing (NT) individuals and ASD individuals, whilst others show worse performance in the ASD group. A few questions stem from the existing literature: Are individuals with ASD able to perceive and interpret biological motion and what factors can explain the variability in the data?
Objectives: We aimed to create a quantitative summary of previous findings and investigate potential factors, which could lead to the variable and often contradictory results in the field.

Methods: We included papers, which compared ASD and NT individuals, and focused on biological motion perception (detection, action and emotion perception). An electronic search from Dissertations & Theses A&I, Dissertation & Theses: UK & Ireland, Web of Science, PsycINFO and MEDLINE yielded 37 eligible papers. We included behavioural, eye-tracking, EEG and fMRI studies. The overall sample size across categories was 730 autistic individuals and 932 neurotypical individuals across three age groups (children, adolescents and adults). In all included studies, the face of the stimuli was not visible. We used a three-level random effects meta-analytic approach to analyse the 34 papers eligible for a quantitative summarisation.

Results: Overall results suggest a general difficulty for individuals with ASD in perceiving and interpretuing biological motion (g=0.7287, 95% CIs: 0.4906, 0.9669). However, results suggest that greater differences occur when higher order information, such as emotion is required (g=1.2840, 95% CIs: 0.8388, 1.7293). Additionally, age also influences the size of the difference between the two populations. The difference between ASD and NT children was significantly greater than the ASD-NT difference in adults in action recognition paradigms (g=0.8362, 95% CIs: 0.1545, 1.5179). When emotion understanding is tested, the ASD-NT difference in children was not significantly different from the difference in adults (g=-0.7404, 95% CIs: -1.6191, 0.1382). No effect of either gender or IQ was found on the results.

Conclusions: To summarise, there appears to be a general difficulty in ASD in perceiving and interpreting biological motion. However, the size of the effect appears clearly modulated by both age and the type of paradigm. The results suggest a delayed development in the skills required to interpret biological motion and the largest effects are found when emotional understanding is required. Most importantly, clear distinctions need to be made between the age groups and the paradigms utilised, when trying to interpret differences between these two populations.

337 **119.337** Camouflaging Predicts Internalizing Problems in Young Adults without Autism

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Background: Camouflaging refers to deliberate attempts made by individuals to hide or compensate for autistic symptoms in order to 'fit in' with their non-autistic peers (Hull et al., 2018; Lai et al., 2016). Reports from autistic individuals indicate that there may be a link between camouflaging and internalizing problems, including symptoms of depression and anxiety (Cage et al., 2018; Hull et al., 2017, 2018; Lai et al., 2017). Poor social competence in autistic youth has also been associated with increased internalizing problems (Johnston & Iarocci, 2017), as has older age and higher IQ (Vickerstaff et al., 2007). Given camouflaging appears to reflect an attempt to compensate for poor social skills, it is of interest to determine whether camouflaging is also associated with increased internalizing problems in individuals without autism.
Objectives: The aims of this study were: 1) to examine the relationship between camouflaging and social competence in young adults without autism, and 2) to investigate whether camouflaging was associated with internalizing problems after accounting for social competence and autistic traits (as well as age, IQ, and gender) in young adults without ASD.

Methods: We collected data from 76 university students (aged 17 to 23; 59 female). Participants completed questionnaires including the Autism-Spectrum Quotient (AQ; Baron-Cohen et al., 2001), the Multidimensional Social Competence Scale (MSCS; Yager & Iarocci, 2013), the Camouflaging Autistic Traits Questionnaire (CAT-Q; Hull et al., 2018), and the college-level Behavior Assessment System for Children (BASC2 SRP-COL; Kamphaus & Reynolds, 2004). Additionally, we assessed participants' IQ using the Wechsler Abbreviated Scale of Intelligence (WASI-2; Wechsler, 2011).

Results: Pearson's correlations indicate that total CAT-Q scores were significantly positively correlated with overall AQ scores (r=.47, p<.001) and significantly negatively correlated with overall MSCS scores (r=-.46, p<.001). Scores on the Internalizing Problems subscale of the BASC-2 were also significantly positively correlated with total CAT-Q (r=-.55, p<.001) and AQ scores (r=.51, p<.001), and significantly negatively correlated with total MSCS scores (r=-.48, p<.001). Age, IQ, and gender were not significantly correlated with any of the variables.

Results of a hierarchical multiple regression analysis indicated that the full model of total AQ scores, age, IQ, and gender to predict scores on the Internalizing Problems subscale of the BASC-2 (Model 1) was statistically significant (R^2 =.325, F(4,71)=8.535, p<.001). The addition of total MSCS scores (Model 2) accounted for an additional 5% of the variance in Internalizing Problems scores (ΔR^2=0.054, $\Delta F_{(1,70)}$=6.078, p=.016) and the addition of CAT-Q scores (Model 3) accounted for an additional 12% of the variance in Internalizing Problems scores beyond all previous predictor variables

(ΔR^2=0.116, $\Delta F_{(1,69)}$=15.800, p<.001).

Conclusions: Results indicate that among non-autistic young adults, those with greater social skills reported less camouflaging, suggesting that increases in camouflaging behaviour is associated with poorer social competence. Additionally, camouflaging predicted internalizing problems over and above social competence, autistic traits, age, IQ, and gender. These results are consistent with previous reports that camouflaging is associated with poorer mental health outcomes in autistic individuals (e.g., Hull et al., 2018), and extends these findings to young adults without autism.

338 **119.338** Coordination Is Key: Joint Attention and Vocalizations in Infant Siblings of Children with Autism Spectrum Disorder

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Background:

Infants at heightened risk (HR) for autism spectrum disorder (ASD) and who later receive an ASD diagnosis exhibit delays in joint attention (JA), shared attention to objects with social partners, and pre-linguistic vocalization development (Goldberg et al., 2005; Paul et al., 2011). Vocalizations develop concurrently with JA and are used to engage caregivers (Wu & Gros-Louis, 2014). Previous studies have focused on JA and vocalization development separately; the coordination of these behaviors as well as their frequency remains to be explored.

Objectives:

To examine JA (e.g., gaze shifts, gestures), vocalizations, and their coordination in infants with older siblings with ASD.

Methods:

In a prospective longitudinal study, 50 (30 Male) HR infants were observed at 14, 18 and 24 months during the Early Social Communication Scales (ESCS; Mundy et. al., 2003), a semi-structured task designed to elicit JA behaviors. At 36 months, infants were classified into one of three outcome groups: Autism Spectrum Disorder (ASD; n=9), Language Delay without ASD (LD; n=15) or No Diagnosis (ND; n=25). ESCS sessions were videotaped and coded offline by naive coders for initiating joint attention (IJA: e.g., gaze shifts, showing) and initiating behavioral requests (IBR: e.g., reaching, pointing, giving) according to the ESCS manual (Mundy et. al., 2003). Each vocalization was identified and coded as vowel only (VO), syllabic (i.e. containing a consonant), or word. Coordination of these behaviors was identified any time a vocalization overlapped with a JA behavior.

Results:

Repeated measures ANOVAs were conducted for all analyses. Examining JA, a significant main effect of outcome was found only for higher level IJA behaviors F(2,47) = 14.430, p<.001, η^2_p = 0.38, no main effects or interaction were found for production of low IJA, high IBR or low IBR. For vocalizations, a 3 (vocalization type) x 3 (age) x 3 (outcome) repeated measures ANOVA revealed a significant 3-way interaction F(8, 188) =8.613, p <.001, η^2_p= 0.27. Follow-up ANOVAs indicated a significant interaction between age and vocalization type for ND F(4, 100) =71.71, p <.001, η^2_p= 0.74 and LD F(4, 56) =10.61, p < .001, η^2_p= 0.43 infants, but not ASD infants F(4, 32) =.657, p =0.63, η^2_p= 0.08 (see Figure 1). Infants later diagnosed with ASD consistently produced fewer vocalizations of all three types and had no age-related changes. Finally, examining the coordination of JA and vocalizations, a main effect of outcome for IJA + vocalizations and IBR + vocalizations was found. Infants who later received an ASD diagnosis coordinated JA and vocalizations less frequently than their ND and LD peers (see Figure 2).

Conclusions:

HR infants who later receive an ASD diagnosis produced fewer higher level IJA behaviors, fewer vocalizations, and more vowel only vocalizations across all three-time points. Additionally, these infants had specific difficulty in coordinating these behaviors. These differences in the coordination of early communicative behaviors may have cascading effects on social and language development in infants who later receive an ASD diagnosis as coordination of JA and vocalizations likely enhances communicative quality and engagement with others.

339 **119.339** Cognitive Predictors of Autistic Teenagers' Social Camouflaging

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Background:

In recent years there has been increasing interest in social camouflaging of autism; the use of conscious or unconscious strategies to mask or compensate for autistic characteristics during social interactions. Although camouflaging may be motivated by desires to fit in and form relationships with others, it has been associated with poor mental health and suicide amongst adults.

Currently there has been limited research into the cognitive abilities which may drive social camouflaging, although it has been suggested that executive function, theory of mind abilities, and social motivation may play a role. Most previous research has also focused on camouflaging in autistic adults, therefore little is currently known about whether and how autistic teenagers camouflage their autism.

Objectives:

This study aimed to identify cognitive characteristics associated with self-reported and parent-reported camouflaging in autistic teenagers, controlling for age and IQ.

Methods:

22 teenagers with a diagnosis of autism (10 female, 12 male; mean age 14.23 years; mean IQ = 106.64) completed a self-report measure of camouflaging (CAT-Q; Hull et al., 2018) and measures of theory of mind (Strange Stories; Happé 1994), and social motivation (Friendship Questionnaire; Baron-Cohen & Wheelwright, 2003). Parents of all teenagers completed the parent-report CAT-Q and measures of social difficulties (SRS; Constantino & Gruber, 2007) and executive function difficulties (BRIEF2; Gioia, Isquith, Guy & Kenworth, 2000). Data collection is ongoing and we expect the sample to have at least doubled in size by the time of presentation.

Two multiple regressions were run, the first with age, IQ, theory of mind, social motivation, social abilities and executive function predicting self-reported CAT-Q score. The second repeated this analysis with parent-reported CAT-Q score as the outcome.

Results:

The self-report CAT-Q and parent-report CAT-Q were moderately positively correlated (r = 0.45, p = .03). Executive function difficulties were a significant predictor of self-reported camouflaging (β = -0.65, p = .02) and parent-reported camouflaging (β = -0.56, p = .04). In preliminary analyses, no other variables significantly predicted camouflaging as reported by either parent or child.

Conclusions:

Parents' perceptions of their child's camouflaging behaviours differ somewhat from their child's reported behaviours. This may reflect camouflaging behaviours performed by the child which the parent is not aware of; alternatively it may be that some autistic young people have limited insight into their own camouflaging behaviours.

Executive function plays an important role in both parent and child-reported social camouflaging behaviours in autistic teenagers. Young people with more executive function difficulties report camouflaging their autism less, and their parents also report lower levels of camouflaging by their child. This suggests that executive function difficulties may limit a teenager's ability to camouflage, as well as their ability to identify their own camouflaging behaviours.

340 **119.340** Cognitive and Emotional Empathy in Autism: Explicit and Implicit Perspectives

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Background: Individuals with autism spectrum disorders (ASD) show varied responses in task-based self-ratings of empathy, including impaired cognitive empathy (emotion recognition) but intact emotional empathy (self-ratings of emotional relatedness) (Dziobek et al., 2008). However, response bias may influence self-ratings of emotional empathy. Further, the role of emotional valence in self-rated empathy tasks is not well understood. Spontaneous facial mimicry (SFM) is a reflexive mirroring of emotional faces that reflects social reward (Sims, Van Reekum, Johnstone, & Chakrabarti, 2012), can be measured separately for positive and negative emotional valence, and may provide a bias-free index of emotional empathy. To date, no studies have used both self-ratings and SFM to assess empathy in individuals with ASD.
Objectives: Our study aimed to explore effects of autism diagnostic status and emotional valence on (1) task-based cognitive and emotional empathy, (2) SFM in response to emotionally charged stimuli, and (3) correlations between mimicry (implicit) and empathy (explicit) scores.

Methods: 51 individuals (ASD = 25, typically developing (TD) = 26) performed the multifaceted empathy test (MET) consisting of 32 static images depicting people in emotionally charged conditions. Cognitive empathy was assessed by multiple choice emotion recognition, while emotional empathy was assessed by self-rating on a scale of 0-9. Separate mixed effects models were used for cognitive and emotional empathy scores to assess the influence of emotional valence of the stimuli and diagnostic group status. Participants' facial expressions were recorded while performing the task and analyzed with iMotion's FACET algorithm for emotion classification and scoring. Mean percent accuracy in emotion labeling (cognitive task), mean empathy scores (emotional empathy), median SFM across time, and correlations between facial expression emotion and empathy scores were compared between groups.

Results: For cognitive empathy, there were significant main effects of diagnostic group ($p < .05$) and valence ($p=.001$), but no significant interaction between the two. Post-hoc comparisons revealed that the TD group was significantly more accurate than the ASD group ($p < .001$) and that accuracy was significantly lower for negative valence stimuli than for positive. There were no group differences in self-rated emotional empathy, consistent with previous findings (Dziobek et al., 2008). Facial expression analysis revealed no group differences in overall Joy or Sadness scores during cognitive or emotional empathy presses. Between group differences (TD > ASD, $p < .01$) were found in participants' Joy scores when responding to images with positive valence during both the cognitive and emotional presses. No group differences were found in participants' Sadness scores when responding to images with negative valence for either press. No correlations between SFM and empathy scores were significant.

Conclusions: These results replicate previous findings of impaired emotion recognition but intact self-ratings of empathy in individuals with ASD, but suggest the following new ideas: 1) emotional valence should be considered when assessing empathy, 2) spontaneous facial mimicry may be a more sensitive measure of emotional empathy and detected group differences for positive emotions, 3) Self-report and SFM may be indexing very different aspects of emotional empathy given their lack of correlation.

341 **119.341** Cohort Differences in the Social Participation of Youth on the Autism Spectrum Receiving Special Education Services

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Background: Rates of intellectual disability and mean impairment severity among children identified in surveillance studies of autism have been steadily declining for over a decade. No studies have investigated whether there have been historical changes in rates of social participation (measured here as extracurricular activities and friendship with peers) among youth on the autism spectrum.
Objectives: Compare rates across two cohorts of social participation in youth on the autism spectrum receiving special education services. Hypothesis 1: Social participation rates would be higher in the more-recent cohort. Hypothesis 2: Low parental education, low household income, low independent functioning and severely impaired communication ability would all be associated with lower rates of social participation in the more-recent cohort.

Methods: We used secondary data from two related cohort studies that were funded by the U.S. Department of Education and conducted 10 years apart: Wave 1 (2001-2002) of the National Longitudinal Transition Study-2 and the National Longitudinal Transition Study-2012. Both studies were designed to yield nationally representative estimates of the characteristics and experiences of youth with special needs who received special education services. The goal of valid cross-cohort comparison was designed into the 2012 study by using similar sampling methods and identical question wording for many items. We limited analyses to youth who were ages 13 to 17 years. Our outcomes were dichotomous indicators of a) any participation in any kind of extracurricular school activities (e.g., sports teams, band or chorus, school clubs, or student government) during the prior 12 months, and b) never saw friends at all during the prior 12 months. We used a cohort dummy variable in logistic regression to estimate the differences between cohorts adjusting for covariates (youth and household demographics, indicators of impairment severity and disability

characteristics), weights and sampling method.

Results: The rates of any extracurricular school activities were 27% (95% CI: 22,34) for the 2001 cohort and 60% (95% CI: 56,65) for the 2012 cohort. The rates of never seeing any friends in the past 12 months were 41% (95% CI: 33,49) for the 2001 cohort and 36% (95% CI: 32,41) for the 2012 cohort. Extracurricular participation was significantly higher in the 2012 cohort after adjusting for covariates (odds ratio: 4.6; 95% CI: 3.0,6.9). There was no significant adjusted difference between cohorts on the rate of never seeing friends (OR: 0.8; 95% CI: 0.5,1.3).

Conclusions: We found higher rates of participation in structured extracurricular activities but no significant differences in the rate of unstructured meeting with friends. Structured extracurricular activity participation is associated with better young adult outcomes in typically developing samples. Whether such participation enhances postsecondary outcomes for youth on the autism spectrum should be investigated. Schools need to prepare for growing numbers of youth on the autism spectrum participating in structured activities. Research should also focus on ways to support friendship development and reduce social exclusion.

342 **119.342** Comparing Child Verbalisations during Robot-Assisted and Adult-Led Conditions of an Emotion-Recognition Teaching Programme

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Background:

Robot-assisted interactions have the potential to be beneficial for autistic children within an educational environment. Robots are more predictable in their actions than humans and, as such, are thought to place lower levels of cognitive and social demands on autistic children. In the context of a more predictable social environment, children may interact with robots differently than they do with adults, including with regard to *verbalisations*, or voiced utterances (words and non-words).

Objectives:

We sought to describe and compare the number and type of child verbalisations and the presence of autism-related vocal-features within these verbalisations, during robot-assisted and adult-led interactions, in a group of autistic children with additional intellectual disabilities and limited spoken communication.

Methods:

Twenty-four autistic children aged between 5 and 12 years (7 female) took part in a robot-assisted (n=12; M age = 8.0 years; SD = 2.7) or adult-led (n=12; M age = 8.2 years; SD = 2.4) condition of an emotion recognition teaching programme (Howlin, Baron-Cohen & Hadwin, 1999). There were no significant group differences in the two teaching conditions in terms of age (p=0.88), autism severity (as measured by CARS2-ST, p=0.28) and verbal language scores (using a bespoke measure; p=0.11). Children participated in multiple video and audio recorded sessions over the course of one week, ranging from one to five sessions (M=3.7 sessions; SD=1.0). Three researchers independently annotated child verbalisations in audio and video recordings to determine the *type of verbalisation* (e.g., speech, shout, non-speech) and the presence of *autism-related vocal features* (e.g., echolalia, stereotyped speech). A simple "majority voting" method was used to determine a final dataset with agreed labels for verbalisations.

Results:

Of the 17,265 verbalisations from all (adult, robot, child) speakers, 5,209 (30.2%) were child verbalisations. Speech was the most commonly labelled type of child verbalisation in each teaching condition, although there was no significant difference between conditions (robot-assisted: 43.7% of verbalisations; adult-led: 46.8% verbalisations). There were also few significant differences in the type of child verbalisations: while there were more 'shouting' verbalisations in the adult-led compared to the robot-assisted condition (p=0.04), there were no significant group differences in the number of autism-related vocal features (i.e., echolalia, pronoun errors). Furthermore, most of the verbalisations (89.7%) across teaching conditions were judged not to contain any autism-related vocal features.

Conclusions:

Overall, and unexpectedly, the number and type of child verbalisations in adult-led and robot-assisted interactions were very similar. In the context of a more predictable social environment, there was no difference in the number of child verbalisations or the amount of autism-related vocal features present in robot-assisted compared to adult-led interactions. Perhaps surprisingly for a participant group with limited verbal language, most of the verbalisations in both teaching conditions were judged not to contain any autism-related vocal features. Future work will focus on examining the function and content of verbalisations, including the coding of unusual affect within robot-assisted and adult-led interactions.

343 **119.343** Comparing Parent-Report of Non-Intellectually Disabled Asian-American Youth with ASD and ADHD to Their White Peers

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Background: Over the last few decades, there have been considerable advancements in the understanding of developmental disorders such as autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD). Yet, there is still a dearth of research evaluating differences in functioning in these disorders across ethnicity, particularly among those without intellectual disability (ID) (Morgan et al., 2013; Wallis & Pinto-Martin, 2008). Even less research exists on the manifestation of these disorders in Asian-American youth. Even CDC prevalence rates rarely include national averages for this group, due to wide variability across sites, with some reporting prevalence well below national averages, and others reporting much higher rates (CDC Community Report on Autism, 2018; Coker et al., 2016). Differences in parental perceptions and reporting of symptoms may contribute to differences in clinical ascertainment of ASD and ADHD in this population.

Objectives: This study investigated ethnic differences in parent-reported impairment in adaptive behavior and social-emotional functioning in non-intellectually disabled Asian and White youth with ASD and ADHD.

Methods: From a large clinic-referred and research database of over 2,000 individuals, a sample of White (N=502) and Asian (N=50) youth with ASD

and/or ADHD without ID were selected. The case control matching procedure in SPSS v25 was used to generate a sample of White and Asian youth (n=96; ages 6-17), matched on age (within 1 year) and full-scale IQ (within 5 points). Both unmatched groups and matched groups were compared on parent-reported adaptive behavior and social-emotional functioning. A series of one-way ANOVAs was used to analyze differences between ethnic groups on subdomain scores of the Vineland-II (communication, daily living skills, socialization) and on selected subscales of the Child Behavior Checklist (CBCL; anxiety, withdrawn/depressed, social problems, thought problems, attention problems, internalizing, externalizing, anxiety).

Results: Both the unmatched and matched samples were comparable on age, full-scale IQ, and maternal education (Tables 1 & 2). Among the unmatched sample, Asian and White youth had significantly different levels of parent-reported impairment on the Thought Problems subscale of the CBCL. No other subscale of the CBCL or any subscale of the Vineland-II were significantly different in the unmatched sample (Table 1). Among the matched sample, Asian and White youth did not have significantly different levels of parent-reported impairment on any subdomain of the Vineland-II or subscale of the CBCL (Table 2).

Conclusions: Among a clinically-diagnosed sample of children with ASD and ADHD, overall daily functioning was comparable among Asian American and White youth, according to parent response to questionnaires. However, a significant difference in parent-reported thought problems highlights a discrepancy between groups. Overall, findings support the theory of cultural invariance of the manifestation of ASD, as a neurodevelopmental disorder. These data suggest families of each group are assessing their children's functioning in similar ways. These results are particularly interesting in the context of research describing variable discrepancy rates of assessment and diagnoses among these ethnic groups. Further studies are needed to explore symptoms in undiagnosed Asian American youth, to determine if suspected under-diagnosis is attributable to parent perceptions versus clinician bias.

344 **119.344** Evaluation of Social Cognition in Children with Autism Spectrum Disorders: Instruments in the Clinical Context. a Systematic Review

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Background:

Autism spectrum disorders (ASD), characterized as an early disorder of social interactions, stand out as the central feature to define this condition. The understanding of the difficulties in social interaction in ASDs requires a broad and integrating vision of these difficulties, which includes various socio-cognitive skills necessary to achieve satisfactory social interactions.

Several authors have proposed this approach is possible from the concept of social cognition (SC) . From neurocognitive studies to clinical reality, there are methodological and practical gaps in the application of valid instruments for the systematic evaluation of SC in clinical contexts.

Objectives:

General: Identify, analyze and synthesize the available evidence on tools that can be applied in clinical contexts for the systematic evaluation of SC of children with ASD.

Specific: a) describe the main characteristics of the identified instruments; b) describe the subfactors or dimensions of the SC evaluated by each instrument; e) perform an analysis of its applicability in clinical contexts; d) make suggestions or contributions to providers that work with children with ASD regarding these instruments.

Methods:

A search and systematic review of the literature with SC measurement instruments in ASD children was carried out, following the PRISMA guidelines and recommendations (Moher et al., 2015). In the design phase, a systematic review protocol was carried out (not registered).

The eligibility criteria were: original studies, published in peer-reviewed journals until 2017, where the participants included children with ASD evaluated with SC instruments. The SC instruments were applied in clinical contexts or are susceptible to be applied in those contexts . In addition, they should have evidence of its validity in children with ASD.

The search was made in June 2018 and was carried out in three sources of information: Web of Sciencie (Core Collection), Scopus and PubMed. The data was exported through the bibliographic manager EndNoteX8. The process of selecting the studies followed the PRISMA recommendations (Moher et al., 2015).

Results:

292 articles were identified. After the identification, screening and eligibility procedures, *17 articles were included in the analysis*.

The sample includes n = 2024 participants. The average age of the sample was 9.65 years. Four of the articles included exclusively TEA children in the sample, without making comparisons with other conditions.

The main characteristics of *22 instruments* were identified and reported. 16/22 of the identified instruments, evaluate some dimension of Theory of Mind (ToM). The most commonly used SC measurement instrument was the "Reading the Mind in the Eyes" Test -Child Version (RMET-ChildVersion) (Table 1.)

Conclusions:

The present review gives the specialists in child development, evidence for the systematic evaluation of CS in children with ASD.

Although the SC includes the interaction of diverse cognitive abilities, most of the instruments studied evaluate the TdM dimension exclusively.

Only one of the instruments identified has a validated version in Spanish, which suggests guidelines for future research in Spanish-speaking countries.

Oral Session - 1A
Biomarkers (molecular, phenotypic, neurophysiological, etc)
121 - Biomarkers 1 - Eyetracking
1:30 PM - 2:25 PM - Room: 517A

1:30 **121.001** Eye Tracking Test-Retest Reliability As an Effect of Diagnosis and Delta Time: Results from the ABC-CT Interim Analysis

K. J. Dommer[1], *F. Shic*[2,3], *C. Sugar*[4], *M. Sabatos-DeVito*[5], *M. Murias*[6], *G. Dawson*[7], *T. Howell*[8], *R. Bernier*[9], *C. Brandt*[10], *K. Chawarska*[11,12], *J. Dziura*[10], *S. Faja*[13], *S. Jeste*[4], *A. Naples*[11], *C. A. Nelson*[13], *S. J. Webb*[9] *and J. McPartland*[11], *(1)Seattle Children's Research Institute, Seattle, WA, (2)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (3)Pediatrics, University of Washington School of Medicine, Seattle, WA, (4)University of California, Los Angeles, Los Angeles, CA, (5)Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (6)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (7)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (8)Psychology and Neuroscience, University of North Carolina at Chapel Hill, Chapel Hill, NC, (9)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (10)Yale University, New Haven, CT, (11)Child Study Center, Yale University School of Medicine, New Haven, CT, (12)Child Study Center, Yale School of Medicine, New Haven, CT, (13)Boston Children's Hospital, Boston, MA*

Background: A core aim of the Autism Biomarkers Consortium for Clinical Trials (ABC-CT) is to identify biomarkers which can reliably measure treatment effects in autism spectrum disorder (ASD). There are many qualifying characteristics to the ideal biomarker, including robustness across a heterogeneous population and reliability across time. To address reliability, the project collected mirrored data at three different timepoints. This study analyzes the first two. ABC-CT protocols targeted Timepoint 2 (T2) to be scheduled 28-56 days after T1. However, 12.4% of participants had their T2 outside the standard range (Table 1).

Objectives: To evaluate the effect of the time between visits (Δdays) on T1 to T2 relationships on eye-tracking (ET) biomarker variables for typically-developing (TD) participants and participants with ASD.

Methods: Participants were 225 6- to 12-years-old children (TD: *n*=64; ASD: *n*=161). There was no average between-group difference in Δdays (p>.05). However, more scheduling deviations occurred in the ASD group (p=.03).

Participants viewed a battery of ET paradigms including activity monitoring (AM), biomotion (BM), pupillary light reflex (PLR), social interaction (SI), static scenes (SS), and visual search (VS). Outcome variables included total valid looking percent per paradigm (ValidLooking%) and the ratios of valid looking time spent looking at social information versus non-social or background information.

Reliability was tested by calculating Pearson's correlations between T1 and T2 for each variable. Effects of Δdays was examined in a linear model: T2 ~ T1 * group * Δdays. We also examined effects of time as a categorical variable by separating the extreme 10th percentiles as Earlier (< 30 days) and Later (>55 days) scheduling for Δdays.

Results: (Table 2) Correlations from T1 to T2 performance were highly significant (p < .001) for all variables across the entire sample and within ASD; most variables (86%) were correlated within TD.

Similarly, linear models showed all T2 outcomes were strongly associated with initial T1 performance even when controlling for the other variables. Six variables showed significant main effects of diagnosis beyond the influence of T1 performance. Among these, five were ValidLooking% variables, generally consistent with diminished looking by children with ASD in T2.

Most variables showed non-significant main effects and higher order interactions for either time variable except for AM_head% (T1*dx*Δdays) and BM_affective% (dx*Δdays_categorical) suggesting these two variables demonstrate more complex relationships between group and time between testing.

Conclusions: Strong correlations combined with the highly significant effect of T1 results on T2 outcome demonstrate the variables' reliability as well as robustness across heterogeneous populations.

Significant diagnosis effects suggested that individual paradigms affected attentional patterns during second viewings differently per diagnostic group. The fact that the majority of diagnostic effects are seen in ValidLooking% suggests variables normalized by total looking duration may be more stable in ASD.

Overall, these analyses demonstrate that the vast majority of ABC-CT's variables have strong test-retest characteristics which remain reliable across a-priori time ranges and are additionally unaffected by linear effects of scheduling time variation as measurable by the current sample's level of variability.

1:42 **121.002** Performance of Eye-Tracking-Based Assays for Early Identification and Prediction of Developmental Functioning in ASD

W. Jones[1], *A. Klin*[2], *S. Richardson*[3], *M. Lambha*[4] *and C. Klaiman*[2], *(1)Pediatrics, Emory University, Atlanta, GA, (2)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (3)Marcus Autism Center, Atlanta, GA, (4)Marcus Autism Center/Children's Healthcare of Atlanta, Atlanta, GA*

Background: Autism Spectrum Disorder (ASD) is a common neurodevelopmental disorder with widespread and often debilitating impact. Although early detection is considered one of the strongest positive predictors of improved long-term outcome, average age of diagnosis in the US remains stubbornly delayed—until after 4 years in 3 consecutive CDC surveillance cohorts—primarily because of limited access to expert clinicians. Objectives: The goal of this study was to test the extent to which performance-based objective measures of a child's social visual engagement, collected via eye-tracking technology between the ages of 16 and 30 months, could (a) match the diagnostic determination of expert clinicians using gold standard diagnostic instruments (*ADOS*), and (b) could quantify varying levels of autism symptom severity, verbal ability, and nonverbal ability relative to standardized assessments (*ADOS* and *Mullen Scales of Early Learning*).

Methods:

In N=326 toddlers between the ages of 16-30 months, including those referred for clinical concerns for ASD and those without suspected concerns for ASD, we conducted a prospective, double-blinded, within-subject comparison study of the performance of eye-tracking-based assays as diagnostic classifier (ASD vs Non-ASD) and as predictors of developmental function. The sample was split into training sample (N=218) and independent testing sample (N=108). Eye-tracking measures quantified moment-by-moment visual scanning to scenes of peer social interaction.

Results: In the independent testing sample, ASD status was classified with 80.4% sensitivity and 80.6% specificity; positive predictive value was 75.5%, negative predictive value was 84.7%, accuracy was 80.6%, and AUC was 0.87. Eye-tracking assays were significantly predictive of levels of social disability (*R*=-0.735, p<0.001, relative to *ADOS* total score) and of both verbal and nonverbal cognitive ability (*R*=0.573, p<0.001 and *R*=0.390, *p*=0.030, respectively, relative to scores on the *Mullen*).

Conclusions: For optimizing long-term outcomes in ASD and attenuating long-term burdens, two of the most important factors are early diagnosis

and early intervention. Because the majority of parents are concerned about the developmental status of their children by two years, and because reliable and stable diagnosis can be made at that time, the American Academy of Pediatrics recommends universal screening at months 18 and 24; however, population-based studies find that the median age of identification in the U.S. is far later. One key factor in that delay is limited access to experienced clinicians, because current screening and assessment tools depend on qualitative judgments regarding the presence or absence of social-communicative symptoms, symptoms which can vary in both onset and severity and which can be masked by spurts in cognitive and language function. The present results show that performance-based objective measures of a child's social visual engagement, collected via eye-tracking technology, can effectively match the diagnostic determination of expert clinicians and can quantify variation in autism symptom severity, verbal ability, and nonverbal ability. These results represent an important first step in advancing cost-effective procedures to augment access to diagnostic services where these are not readily available, thus promoting the goal of community-wide earlier identification of ASD, a key factor in promoting optimal long-term outcome.

1:54 **121.003** Use of Prospective Longitudinal Gaze Measurements in Defining Regression

D. N. Gangi[1], *S. Boterberg*[2], *A. J. Schwichtenberg*[3], *E. Solis*[1], *G. S. Young*[4], *A. M. Iosif*[5] *and S. Ozonoff*[4], *(1)UC Davis MIND Institute, Sacramento, CA, (2)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium, (3)Purdue University, West Lafayette, IN, (4)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA, (5)Public Health Sciences, University of California Davis, Davis, CA*

Background: Prospective studies of infants at risk for ASD provide an objective measurement of symptom onset that is not subject to limitations like recall bias. Such studies suggest that declining development in children later diagnosed with ASD may be more common than estimates based on retrospective methods. Prospective studies analyzing coded social-communication behavior and ratings of social engagement, including gaze to faces, have found that infants later diagnosed with ASD exhibit a pattern of decline over the first years of life (Ozonoff et al., 2010), with a majority—over 80%—exhibiting such patterns of regression (Ozonoff et al., 2018). Examining developmental trajectories of subtle social-communicative behaviors like gaze may be an especially helpful method of defining onset patterns.
Objectives: To investigate developmental trajectories of gaze to an examiner's face in two independent samples of infants with and without an older sibling with ASD.

Methods: Participants were assessed at up to 7 ages (6, 9, 12, 15, 18, 24, and 36 months). They were classified into one of three groups based on diagnostic assessment at 36 months: Typically Developing (TD), Non-TD (i.e., lower Mullen Scales of Early Learning [MSEL] or elevated ADOS scores), or ASD. Gaze to faces was examined in two contexts: in Cohort 1 (TD *n*=80, Non-TD *n*=55, ASD *n*=20) during administration of the MSEL and Cohort 2 (TD *n*=66, Non-TD *n*=34, ASD *n*=26) during play interaction with an examiner. Infant gaze was coded during the first 6 minutes of the Mullen Visual Reception subtest (Cohort 1) and during the 3-minute play interaction (Cohort 2). Frequency of gaze to examiner's face was coded following procedures in Ozonoff et al. (2010) and divided by the total duration coded to create rates per minute in each context. Statistical analyses were conducted using log10 transformed rates.

Results: Mixed-effects linear models (Laird & Ware, 1982) were used to examine developmental trajectories. For each cohort, we fit a model with fixed effects for outcome group, linear, quadratic, cubic, and quartic effects of time (months), and interactions between the effects of time and group, as well as random intercept and slopes, to account for within-person correlations. Terms that did not add significantly to the model were sequentially removed. In Cohort 1, the ASD group exhibited significantly lower levels of gaze at 6 months, and gaze levels decreased over time, compared to the TD group. In Cohort 2, the ASD group exhibited significantly lower levels of gaze by 12 months, and gaze levels decreased over time, compared to the TD group. See Table 1 for parameter estimates.

Conclusions: Using prospective methods, children who developed ASD exhibited declines in gaze to an adult's face, with differences evident by 12 months. These findings replicate declines previously reported by Ozonoff et al. (2010, 2018) in two independent samples, across two interactive contexts, strengthening the conclusions that 1) behavioral signs of ASD emerge over the first two years of life and 2) declining trajectories, consistent with regression, are common in samples of children developing ASD when prospective methods are used.

2:06 **121.004** The Temporal Dynamics of Social Attention and Emergence of Autistic Group Differences

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Background:
Many eye-tracking studies indicate that individuals with autism spectrum conditions (ASC) exhibit reduced attention to social stimuli relative to Neurotypical (NT) observers *(Tegmark et al, Res Dev Disabil, 2015)*. However, despite the rich, time-varying gaze data produced by eye-tracking, almost no work has been conducted to provide models that quantitatively predict social gaze behavior over time in individuals with and without an ASC diagnosis. Instead, social gaze behavior is typically described by summary metrics, collapsed across time (e.g. total gaze duration) that neglect substantial information contained within the gaze time series. Recently, we demonstrated the explanatory power of exploring gaze time series: we found that individual differences in trait empathy predict the temporal evolution of social gaze behavior - empathy maintains social attention after prolonged viewing (*Proc Roy Soc B, in press*). Previous research indicates that ASC is associated with differences in some empathy-related processes (*Baron Cohen et al, J Aut Dev Dis, 2004*). We adopted a model-driven, time-series approach to characterise differences in the temporal structure of social attention between individuals with and without an ASC diagnosis.

Objectives:

i) Characterise the temporal structure of social gaze behavior across participants.

ii) Characterise how this temporal structure varies between ASC and NT observers.

iii) Characterise the influence of individual level social trait characteristics on social gaze bias over time.

Methods:

53 observers (31 neurotypical, 22 with an ASC diagnosis) observed 60 competing pairs of social and nonsocial reward stimuli for 5 seconds in an unconstrained free-viewing task. Gaze was recorded via a tobii T60 eye tracker. All observers completed social trait measures designed to measure

empathic (Empathy Quotient, EQ) and autistic traits (Autism Quotient, AQ).

Results:

Consistent with previous literature, ASC observers exhibited a generalised decrease in social attention. Critically, the groups also differed with respect to the temporal structure of their social gaze behavior. NT observers demonstrated *i)* an initial increase in social attention, *ii)* a gradual decline and *iii)* partial recovery towards the end of the trial. However, this latter recovery component was not observed in ASC observers. Accordingly, a divergence analysis revealed that the difference in social attention between groups increased over time.

Moreover, this increased divergence between groups over time was mirrored by a corresponding increasing influence of EQ and AQ on gaze behavior over time. Replicating previous work, we found that higher EQ/ low AQ sustained gaze towards social images after prolonged viewing.

Conclusions:

Considering our data with previous literature, we speculate that empathy enhances the value of social rewards, potentiating a 'gaze cascade' type effect that maintains enhanced perceptual selection of social inputs over time. This provides a plausible mechanism for the social attention deficits observed in ASC. In general, our analyses demonstrate that considering the temporal structure of gaze signals provides more refined quantitative endophenotypes for conditions marked by deficits in one or more empathy related processes (e.g. ASC, Psychopathy).

Oral Session - 1B
Biomarkers (molecular, phenotypic, neurophysiological, etc)
122 - Biomarkers 2 - Predicting Outcomes
2:30 PM - 3:25 PM - Room: 517A

2:30 **122.001** Atypical Habituation of Early Brain Responses to Sensory Stimuli Predict Self-Reported Levels of Anxiety in Autism.

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Background: An estimated 40-50% of autistic children, adolescents and adults suffer from clinically significant levels of anxiety that exacerbate core clinical characteristics and impact upon the quality of life of the individual and those caring for them. Recent studies suggest that the sensory processing differences that form part of the clinically defining characteristics of autism (ASD) play a significant role in the development and maintenance of anxious symptoms. Specifically, such sensory differences are thought to contribute to the heightened levels of *Intolerance of Uncertainty* that are consistently reported by autistic individuals and that constitute one of the proximal causes of anxiety in ASD.
Objectives: The current study further examines the role of sensory processing differences as a contributing factor to anxiety in autism by moving beyond mere self-report and examining basic brain mechanisms of sensory habituation through an auditory roving oddball paradigm.

Methods: 15 ASD and 13 age, and ability matched typical developing (TD) participants passively listened to a series of auditory tones whilst performing an unrelated change-detection visual task. The frequency of the tone changed pseudo-randomly following between 1 and 10 repetitions, and event-related potentials, time-locked to each tone, were monitored continuously using EEG (64-channels). Early (P50) and later (Mismatch negativity; MNN) markers of auditory processing were of most interest, which were derived by calculating the amplitude differences between 'standard' tones that had repeated at least 6 times and 'deviant' tones, which were the first tones in a new set. Participants also completed self-report measures of anxiety, sensory processing differences and intolerance of uncertainty.

Results: Groups differed in their early (P50) but not later (MNN) responses. Specifically, whilst P50 amplitudes to standards were attenuated compared to responses to deviants in the TD group ($t = 2.10$; $df = 12$; $p = .057$), no such difference was apparent in the ASD group ($t = 0.53$; $df = 14$; $p = .60$). Moreover, the extent to which P50 responses differentiated between standard and deviant tones correlated with self-reported levels of anxiety ($r = -.40$; $p = .03$), auditory hyper-sensitivity ($r = -.42$; $p = .03$) and intolerance of uncertainty ($r = -.42$; $p = .03$). More precisely, participants whose P50 differentiated more between standards and deviants reported lower levels of anxiety, sensory sensitivity and intolerance of uncertainty.

Conclusions: Our results provide further confirmation that sensory processing differences (in particular hypersensitivities) play an important role in the increased levels of anxiety that are reported by autistic individuals. Our observations suggest that abnormalities in very early sensory gating processes result in a lack of habituation to sensory signals in ASD, which leads autistic individuals to experience sensory signals as more intense than would typically be the case. In turn, the resulting hyper-sensitivity contributes to heightened levels of anxiety. Future studies will need to clarify how atypical sensory gating leads to increased levels of intolerance of uncertainty and why sensory gating processes are compromised in the first instance.

2:42 **122.002** Infant ERP Responses and Later Emerging Symptoms of ASD in Etiologically-Distinct High-Risk Groups

***M. Guy**[1], A. L. Hogan[2], J. E. Richards[3] and J. E. Roberts[4], (1)Loyola University Chicago, Chicago, IL, (2)Department of Psychology, University of South Carolina, Columbia, SC, (3)University of South Carolina, Columbia, SC, (4)Psychology, University of South Carolina, Columbia, SC*

Background: Past research has shown that etiologically-distinct groups of 12-month-old infants at high-risk of autism spectrum disorders (ASD), including infant siblings of children with autism (ASIBs) and infants diagnosed with fragile X syndrome (FXS), demonstrate differences in event-related potential (ERP) responses to social and non-social stimuli (Guy, Richards, Tonnsen, & Roberts, 2018). Additionally, ERPs measured in 9-month-old ASIBs in response to faces have been associated with continuous measures of behavioral symptom severity at 36 months of age (Elsabbagh et al., 2011).
Objectives: This study aimed to increase understanding of how ERP responses in ASIBs and infants diagnosed with FXS are associated with ASD outcomes in early childhood, as indicated by continuous scores of symptom severity.

Methods: Fifty participants completed the study. At 12 months of age, 18 ASIBs (15 M), 14 infants with FXS (7 M), and 18 low-risk control (LRC)

infants (14 M) viewed photographs of faces and toys while EEG was recorded. At approximately 36 months of age, the Autism Diagnostic Observation Schedule-2nd Edition (ADOS-2) was assessed. In replication and extension of methods utilized in past research (Elsabbagh et al., 2011; Guy et al., 2018), amplitude of the N290, P400, and Nc ERP components were examined in association with Overall, Social Affect (SA), and Repetitive Behavior (RB) calibrated severity scores using ANCOVAs and regressions.

Results: Analyses revealed significant effects of infant risk group and ADOS-2 scores for the N290 and P400 ERP components. There was a significant interaction between group, stimulus type, and Overall score, $F(2, 4680) = 11.02$, $p < 0.0001$, as well as SA score, $F(2, 4680) = 13.45$, $p < 0.0001$, on N290 amplitude. For ASIBs, more negative amplitude N290 was associated with higher Overall scores and higher SA scores. Participants with FXS showed more negative amplitude N290 to faces associated with higher Overall scores. Participants in the LRC group showed the opposite pattern of results. There was also a significant interaction between participant group, stimulus type, and Overall score, $F(2, 3898) = 5.64$, $p = 0.0036$, as well as SA score, $F(2, 3898) = 3.57$, $p = 0.0282$, on P400 amplitude. Participants with FXS showed greater P400 responses associated with higher Overall scores and higher SA scores. For ASIBs, decreased P400 responses to toys were associated with higher Overall scores and higher SA scores. In LRC participants, decreased P400 to faces was associated with higher Overall scores.

Conclusions: Results revealed relations between ERP responses at 12 months of age and ADOS-2 scores in early childhood, which differed across groups based on ASD risk as determined in infancy. Research has indicated that infants with FXS show enhanced ERP activity to faces relative to ASIB and LRC groups, while ASIBs showed more muted responses (Guy et al., 2018). The current study reveals that increased ERP amplitude exhibited in infants with FXS may be associated with later emerging ASD symptoms. The relations between infant ASIBs' ERP responses and later ASD symptoms are less straightforward and do not show the face specificity of the FXS group.

2:54 **122.003** Language Development and Brain Functional Connectivity in Infants and Toddlers at Risk for ASD

N. Marrus[1], *M. Swanson*[2], *A. Eggebrecht*[1], *A. Todorov*[1], *J. T. Elison*[3], *J. Wolff*[3], *A. Snyder*[1], *M. B. Nebel*[4], *J. Parish-Morris*[5], *A. Estes*[6], *L. Zwaigenbaum*[7], *K. Botteron*[1], *R. C. McKinstry*[8], *J. N. Constantino*[1], *A. C. Evans*[9], *H. C. Hazlett*[2], *S. R. Dager*[6], *J. Pandey*[5], *S. Paterson*[10], *R. T. Schultz*[5], *M. Styner*[11], *G. Gerig*[12], *B. Schlaggar*[13], *J. Piven*[11], *J. Pruett*[1] *and .. The IBIS Network*[2], *(1)Washington University School of Medicine, St. Louis, MO, (2)University of North Carolina, Chapel Hill, NC, (3)University of Minnesota, Minneapolis, MN, (4)Center for Neurodevelopmental and Imaging Research, Kennedy Krieger Institute, Baltimore, MD, (5)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (6)University of Washington, Seattle, WA, (7)University of Alberta, Edmonton, AB, Canada, (8)Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis, MO, (9)Montreal Neurological Institute, McGill University, Montreal, QC, Canada, (10)Department of Psychology, Temple University, Philadelphia, PA, (11)*Co-Senior Authors, IBIS Network, University of North Carolina, Chapel Hill, NC, (12)New York University, New York, NY, (13)Kennedy Krieger Institute, Baltimore, MD*

Background: Language delay, which is associated with familial ASD risk, frequently co-occurs with ASD and can be responsive to early ASD interventions. Characterizing brain-behavior relationships for aspects of language during the first two years of life, when core autistic symptoms arise, may therefore elucidate neurodevelopmental mechanisms of ASD.
Objectives: To test whether correlations between language function and ROI-ROI functional connectivity (fc) are enriched within specific brain networks and differ for ages 12 and 24 months.

Methods: *Participants:* The Infant Brain Imaging Study is a prospective study of infants at high-risk (HR: has ASD-affected sibling) and low-risk (LR: has unaffected sibling) of ASD. Included participants had fcMRI and behavioral data at 12 (n=130; HR+/HR-/LR-=11/72/36) and/or 24 months (n=102; HR+/HR-/LR-=17/59/23). A clinical best estimate ASD diagnosis was assigned at 24 months.
Imaging: Resting state fcMRI data were acquired on identical 3T Tim Trio scanners at 4 sites with up to 3 BOLD runs (130 frames each run with TR=2.5 seconds). Data processing included motion scrubbing at a framewise displacement level of 0.2 mm. One-hundred-fifty frames of clean data were used per subject. Time traces were correlated between 230 functionally-defined regions of interest (ROI) to yield fc values. ROIs were sorted into putative functional networks using the Infomap community detection algorithm on longitudinal fcMRI data from 48 subjects (Fig. 1).
Measures: Receptive and expressive language, distinct language modalities shown to be differentially affected in ASD, were indexed by raw scores on the Mullen Scales of Early Learning.
Brain-behavior analysis: Networks and pairs of networks were identified as significantly enriched for connections whose fc values strongly correlated with concurrent behavior (set at an uncorrected threshold of $p<.05$). $\chi 2$ tests and hypergeometric tests established whether network enrichment exceeded that expected by chance. A 5% false-positive rejection rate was determined by permutation. McNemar tests assessed enrichment differences between 12 and 24 months.

Results: At age 12 months, fc between anterior frontoparietal and dorsal attention networks positively correlated with receptive language (Fig.2a). For expressive language, a positive fc-behavior relationship was observed for visual and temporal default mode networks, whereas a negative correlation was observed for temporal default mode and cingulo-opercular networks (Fig.2b). At age 24 months, fc in default mode, posterior frontoparietal, and somatomotor networks correlated with receptive and expressive language (Fig.2c,d). One network pair, involving somatomotor and posterior frontoparietal networks, showed a positive fc-behavior relationship for both receptive and expressive language. ROIs contributing to network enrichment included regions highlighted in classic adult brain models of language, e.g., superior temporal gyrus and inferior frontal gyrus, as well as motor and cerebellar regions more recently implicated in language function.

Conclusions: Specific network-level relationships were observed for receptive and expressive language, which differed across age during early development. Implicated networks suggest broadly distributed brain involvement in early language development, while ROIs within networks suggest some developmental continuity for regions underlying language function. Future directions include comparing brain-behavior relationships for language in children with and without ASD and investigating whether brain-behavior relationships underlying language development correlate with ASD-related outcomes.

3:06 **122.004** Cortical Shape and CSF at 6 Months of Age Predict Later Autism Diagnosis

M. D. Shen[1], *M. Mostapha*[1], *H. C. Hazlett*[1], *J. Pruett*[2], *M. Swanson*[1], *J. T. Elison*[3], *J. Wolff*[3], *J. B. Girault*[1], *R. C. McKinstry*[4], *S. H. Kim*[1], *J. C. Chappell*[1], *J. Pandey*[5], *T. St. John*[6], *V. S. Fonov*[7], *D. L. Collins*[7], *G. Gerig*[8], *A. C. Evans*[7], *J. N. Constantino*[2], *K. Botteron*[2], *S. R. Dager*[6], *A. Estes*[6], *R. T. Schultz*[5], *L. Zwaigenbaum*[9], *J. Piven*[10] *and M. Styner*[10], *(1)University of North Carolina, Chapel Hill, NC, (2)Washington University School of Medicine, St. Louis, MO, (3)University of Minnesota, Minneapolis, MN, (4)Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis, MO, (5)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (6)University of Washington, Seattle, WA, (7)Montreal*

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Background:
Diagnosis of autism spectrum disorder (ASD) is generally not made until 24-36 months of age when behavioral symptoms consolidate into the full syndrome. Efforts to identify early markers of ASD have benefitted from the prospective study of younger siblings of children with ASD, who are at 15-fold higher risk of developing ASD than the general population. Our group previously identified brain alterations in the first year of life that predicted which high-familial risk (HR) infants would later develop ASD. Here we demonstrate a novel approach using neuroimaging at 6 months to predict later ASD diagnosis.

Objectives:

To combine multiple measures of infant brain anatomy from a conventional structural MRI scan at 6 months to improve the accuracy of predicting ASD diagnosis at 24 months in HR infants.

Methods:

N=226 infants participated in the Infant Brain Imaging Study (IBIS) and underwent a structural MRI scan at 6 months, and diagnostic and behavioral assessments at 24 months, yielding three groups: [1] N=30 HR infants later diagnosed with ASD (HR-ASD; 27M/3F); [2] N=121 HR infants not diagnosed with ASD (HR-Neg; 66M/55F); [3] N=75 low-risk infants with no family history of ASD/psychiatric disorders and who were not diagnosed with ASD (LR-Neg; 47M/28F).

Four features of infant brain anatomy were generated from the 6-month MRI scan: [1] extra-axial CSF (EA-CSF); [2] cortical shape; [3] surface area; and [4] cortical thickness. **(Figure 1.)** Anatomically-precise measures of each brain feature were generated at 80,000 points along the cortical surface and entered into a fully cross-validated, 10-fold deep learning prediction algorithm to classify ASD. Sex was included as a predictor in all analyses. All analyses were blinded to sex and group. The prediction framework employed a data-driven approach to find the optimal combination of brain features at 6 months that yielded the most accurate prediction of ASD at 24 months.

Results:

Three primary results were observed: [1] The combination of cortical shape and EA-CSF at 6 months **(Figure 2)** accurately predicted which HR infants would develop ASD at 24 months with 89% sensitivity, 96% specificity, 85% positive predictive value, and 97% negative predictive value. [2] Cortical shape + EA-CSF at 6 months predicted individual differences in social ability exhibited by HR-Neg infants at 24 months (*z=2.71; p=0.007*). [3] Applying the identical classifier to the LR-Neg group at 6 months correctly predicted these infants would be negative for ASD at 24 months with 99% accuracy.

Conclusions:

The prediction classifier demonstrated the ability to use 6-month MRI measures to predict both categorical diagnoses and continuous outcomes at 24 months. These results improve upon our previous methods by achieving higher accuracy, at an earlier age, in predicting later ASD diagnosis using a conventional structural MRI scan at 6 months. Neuroimaging at 6 months of age may provide a clinically-useful method to aid in the detection of ASD during a pre-symptomatic period in infancy, prior to the complete manifestation of the disorder. Early detection of ASD would enable the feasibility of pre-symptomatic intervention and facilitate the development of earlier and more efficacious treatments for ASD.

Oral Session - 2A
Neuroimaging
123 - Functional Imaging
1:30 PM - 2:25 PM - Room: 517B

1:30 **123.001** Heterogeneity and Reproducibility of Functional Connectivity in Autism

J. S. Anderson[1], *J. B. King*[2], *M. B. Prigge*[2], *C. K. King*[2], *J. Morgan*[1], *F. Weathersby*[1], *C. Fox*[3], *D. C. Dean*[4], *A. Freeman*[4], *J. Villaruz*[4], *K. Kane*[4], *E. Bigler*[3], *A. L. Alexander*[4], *N. Lange*[5], *B. A. Zielinski*[2] *and J. E. Lainhart*[4], *(1)Radiology and Imaging Sciences, University of Utah, Salt Lake City, UT, (2)University of Utah, Salt Lake City, UT, (3)Brigham Young University, Provo, UT, (4)University of Wisconsin - Madison, Madison, WI, (5)McLean Hospital, Cambridge, MA*

Background: Autism is hypothesized to represent a disorder of brain connectivity, yet patterns of atypical functional connectivity show marked heterogeneity across individuals.
Objectives: 1) Which functional connectivity features are reproducible across a large multisite sample of participants with autism? 2) Can consensus features of autism that are heterogenous across sites be identified within a single sample using high temporal resolution, long-duration modern acquisition techniques? 3) To what extent do distinct functional connectivity features track together in the same participants vs. representing different aspects or endophenotypes of autism?

Methods: We used a large multi-site dataset (ABIDE 1+2) comprised of a heterogenous population of individuals with autism and typically-developing individuals to compare a number of resting-state functional connectivity features of autism. ABIDE data were aggressively screened for image quality and head motion leaving 1402 subjects from 25 sites, then processed using SPM12 software with motion realignment, coregistration to anatomic image, normalization to MNI space, and regression of realignment parameters and derivatives, white matter, CSF, and soft tissues of the face to mitigate physiological artifacts, followed by volume censoring (scrubbing) for mean head motion greater than 0.3 mm. These features were also tested in a single site sample (n=90) that utilized a high temporal resolution (multiband, multiecho), long-duration (30 min per subject) resting-state acquisition technique, analyzed using AFNI software with multiecho ICA approach for artifact rejection.

Results: Of over 1200 features tested that demonstrated uncorrected $p<0.05$ across the combined ABIDE sample, no single method of analysis provided reproducible results across research sites, ABIDE 1 and ABIDE 2 samples, and the high-resolution dataset, using a model that included site, age, sex, and mean head motion as covariates. Distinct categories of functional connectivity features that differed in autism such as homotopic, default network, salience network, long-range connections, and corticostriatal connectivity, did not align with differences in clinical and behavioral traits in individuals with autism. Features that emphasized temporal relationships such as lag-based functional connectivity were

not correlated to other methods in describing patterns of resting-state functional connectivity and their relationship to autism traits. High temporal resolution single-site sample showed qualitatively similar results across feature types to combined ABIDE (n=1402 subjects) sample.

Conclusions: Overall, functional connectivity features predictive of autism demonstrated striking heterogeneity across sites, with consistent results only for large samples. Different types of functional connectivity features do not consistently predict different features of autism. Rather, specific features that predict autism severity and social dysfunction are distributed across feature types. Findings suggest a need for longer-duration, higher temporal resolution acquisition strategies to improve single subject reproducibility, emphasis on temporal domain of brain function, investigation of cohorts with lower cognitive and verbal abilities, and models that combine many imaging and genetic features to identify clinical subphenotypes.

1:42 **123.002** Basal Ganglia Functional Connectivity and Repetitive Behaviours in Children with Neurodevelopmental Disorders: Data from Pond Network

E. J. Choi[1], *M. M. Vandewouw*[2], *M. J. Taylor*[3], *J. P. Lerch*[4] *and E. Anagnostou*[1], *(1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Diagnostic Imaging, Hospital for Sick Children, Toronto, ON, Canada, (3)The Hospital for Sick Children, Toronto, ON, Canada, (4)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada*

Background: Repetitive behaviour is a core feature of autism spectrum disorder (ASD), but exists along a continuum in other neurodevelopmental disorders (NDDs), such as obsessive-compulsive disorder (OCD) and attention-deficit/hyperactivity disorder (ADHD). It has been shown that structural and functional atypicalities of the basal ganglia (BG) are linked to the severity of repetitive behaviours, but little is known about the extent and how the BG network is linked to repetitive behaviours across disorders.

Objectives: In the present study, we compared BG network connectivity in resting-state fMRI across three groups of NDDs together, including typically developing population and correlated them with subjects' repetitive behaviour scores.

Methods: Resting-state fMRI data and anatomical T1-weighted images on a Siemens 3T MRI were collected from 315 children and adolescents with NDDs and typically developing controls (TD) (ASD=151, ADHD=65, OCD=44, TD=55) (mean age/SD = 11.81/3.80). All resting-state volumes were corrected for slice-timing and head motion, smoothed, and bandpass filtered (0.01 and 0.2 Hz). Nuisance signals from white matter and CSF were regressed out. Volumes with a maximum displacement exceeding 2mm (less than one voxel) were omitted and data from participants who lost more than 1/3 of the volumes were excluded. The subcortical network connectivity was investigated using seed-based analysis with left and right putamen and caudate seeds using FSL's FEAT program. Statistical images were thresholded using clusters determined by Z >2.3 and a corrected cluster significance threshold of p = 0.05. Subjects' repetitive behaviours were assessed using Repetitive Behaviors Scale (RBS-R).

Results: The behavioural results indicated children with ASD and OCD showed significantly higher scores in repetitive behaviours than children with ADHD and TD (Mean/SD: ASD = 31.63/20.33; ADHD = 12.34/10.73; OCD = 26.27/20.08; TD = 2.62/5.54; F=42.18, p=0.00). All three groups of NDDs shared increased BG network connectivity overall in widespread regions of brain compared to the TD group. Subsequent pairwise comparisons between NDDs indicated that the increased patterns in BG network were slightly different across NDDs. Of those findings, the increased connectivity in BG network was found with the right anterior insula in ASD, but with cerebellum and primary somatosensory regions in OCD. Across all participants, connectivity strength of primary somatosensory region in the BG network was positively correlated with self-injurious and compulsive behaviour scores, while connectivity strength of the right anterior insula in the BG network was positively correlated all sub-scores and total score in RBS, except the self-injurious behaviour score.

Conclusions: The present study demonstrated that the NDD group shares increased BG network functional connectivity, suggesting underlying neural correlates of overlapped symptoms in repetitive behaviours across disorders. The patterns in increased BG network in each condition may reflect a variance in repetitive behaviours exiting along a continuum. Increased connectivity with primary somatosensory regions in the OCD group may be linked to more sameness and compulsive pattern of behaviours in their everyday routines and rituals. Increased connectivity with anterior insula in the ASD group implicates atypical interoceptive processing integrating external sensory stimuli with internal states, resulting in increased repetitive behaviours in this condition.

1:54 **123.003** Individual Differences in Intrinsic Brain Networks Predict Symptom Severity Variation in Autism Spectrum Disorders (ASD)

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Background:

The neurobiology of heterogeneous neurodevelopmental disorders such as autism spectrum disorders (ASD) is still unknown. Specifically, the link between altered neurodevelopment and ASD symptomatology has not yet been identified. As the phenotypic expression of ASD is highly heterogeneous, findings across multiple studies are unreliable and often fail to replicate.

Recent work has suggested that heterogeneity in ASD is likely related to subject-specific differences in brain structure and function in this population. A roadblock to current knowledge of the condition is thus the high degree of individual variation in symptom-related neurobiology of ASD.

Objectives:

In this study, we hypothesized that individual differences in intrinsic brain networks were important features that could predict individual variation in ASD symptom severity. We developed a novel subject-level distance-based method to investigate if subject-specific features of functional organisation in the brain based could accurately predict individual differences in ASD symptom severity. To ensure that findings were reproducible and generalizable, we repeated analyses in independent singleton and monozygotic cohorts for validation.

Methods:

Task-free functional magnetic resonance imaging (fMRI) data was acquired from multiple imaging centres in singleton ASD cohorts matched to controls on age, sex, IQ and image acquisition site (ASD: n=100, age=11.43 years, IQ=110.58, 84 males; controls: n=100, age=11.43 years, IQ=110.70, 84

males). We extracted intrinsic brain network components using projective non-negative matrix factorization, an unsupervised machine learning method for network decomposition. Within each matched case-control pair, the intrapair Euclidean distance in network component strength was used to predict within-pair differences in severity of social dysfunction (Social Responsiveness Scale). To ensure reproducibility of findings, analysis was repeated in an independent locally recruited monozygotic twin sample concordant or discordant for ASD (n=12; age range, 5 to 18 years).

Results:

Across all paired subjects from a large multi-cohort dataset, within-pair differences in strength of a subnetwork was robustly associated with individual differences in social impairment severity (Figure 1A; T=2.206, p=0.0301). Specifically, as individual differences in subnetwork strength increased, differences in symptom severity between case-control pairs became more extreme. Subject-level variation in the subnetwork robustly predicted individual differences in symptom severity, such that ASD subjects demonstrated weaker subnetworks and more severe symptoms (Figure 2). The subnetwork comprised of hubs of the salience network (SN) and the occipital-temporal face perception network. Remarkably, the same subnetwork was reproducible in the independent twin cohort as a predictor of individual variation in social dysfunction severity (Figure 1B; T=-4, p=0.016, R^2=0.75). Further validation analyses were performed across different experimental parameters.

Conclusions:

We identified an intrinsic brain subnetwork of salience attribution and face perception underlying social dysfunction in ASD. Importantly, results were replicated across multiple cohorts, singleton and twin populations, and experimental parameters. Because monozygotic twins share identical genes and environmental influences, non-shared environmental exposures as risk factors are implicated in twin differences in the expression of ASD within-pairs.

The robustness of findings provide a critical step forward in the reliable identification of candidate brain biomarkers in ASD, and provide new insights into individual differences in the neurobiology and symptom expression of the condition.

2:06 **123.004** Knowing about Others Versus Feeling about Others: Neural Basis of Understanding the Meaning of Socio-Affective Touch in Adults with Autism Spectrum Disorders

H. Lee Masson[1,2,3], *I. Pillet*[2], *S. Amelynck*[1], *S. Van De Plas*[2], *M. H. Hendriks*[2], *H. Op de Beeck*[2] *and B. Boets*[1,3], *(1)Center for Developmental Psychiatry, KU Leuven, Leuven, Belgium, (2)Department of Brain and Cognition, KU Leuven, Leuven, Belgium, (3)Leuven Autism Research Consortium (LAuRes), KU Leuven, Leuven, Belgium*

Background:

Humans can grasp the socio-affective implications of touch during mere observation. This ability can be explained by the theory of mind (ToM) and embodied resonance account. Individuals with autism spectrum disorder (ASD) exhibit impairments in the use of nonverbal communication such as social and reciprocal touch. Despite the importance of interpersonal touch in social communication and the pervasiveness of touch aversion in ASD, the neural basis underlying these difficulties is largely unknown.

Objectives:

The purpose of the current study is to identify the neural basis of social impairment related to socio-affective touch processing in individuals with ASD. In particular, we examined the involvement of the ToM and somatosensory resonance system in observed touch processing.

Methods:

Twenty-one individuals with ASD and twenty-one age-, gender-, and IQ-matched neuro-typical (NT) participants took part in the current study. They assessed the valence and arousal of 75 video clips showing social and non-social touch events, followed by participating in fMRI scanning sessions during which they watched the same videos. Also, we stimulated each participant's arm with pleasant and unpleasant touch materials during fMRI sessions in order to select an individual's touch-sensitive area as a part of regions of interest (ROI). Other ROIs implicated in visual processing and social cognition, including the core ToM region (i.e., the temporoparietal junction (TPJ)), were also functionally defined and included as ROIs. Using multi-voxel pattern analysis (MVPA) methods, we created a group averaged neural representational dissimilarity matrix (RDM) for each ROI in each group. We predicted each neural RDM based on the perceived overall affect (a combination of valence and arousal ratings) of stimuli with multiple regression analysis while controlling for the effects of low-level visual features. Lastly, we measured the relationship between the strength of affective representations in touch-selective regions and individual differences in autistic traits and attitudes toward social touch.

Results:

The results from valence ratings suggest that positive touch was perceived as pleasant, negative touch as negative, and non-social touch as neutral. Concerning arousal ratings, both groups perceived social touch as exciting and non-social touch as calm. Despite the high similarity in their judgments, we observed that individuals with ASD perceived positive touch slightly less pleasant. At the brain level, the overall affective meaning of touch was well represented in TPJ in both groups (Figure 1). Conversely, we found significant group differences in the somatosensory regions as individuals with ASD did not show affective representations in these areas (Figure 1). Lastly, we found a link between the absence of affective representations in the somatosensory regions and individual characteristics (high scores on autistic traits and more negative attitudes toward social touch).

Conclusions:

Our findings reveal the involvement of the ToM mechanism in interpreting the socio-affective meaning of observed touch in both individuals with and without ASD, implying intact ToM ability in ASD. Individuals with ASD, on the other hand, did not show embodied resonance in relation to somatosensory experiences of others, which may be related to social touch aversion and impaired social functioning in daily life.

Oral Session - 2B
Neuroimaging
124 - Structural Imaging
2:30 PM - 3:25 PM - Room: 517B

2:30 **124.001** Genetic and Environmental Influences on Structural Brain Measures in Twins with Autism

J. P. Hegarty[1], *L. C. Lazzeroni*[1], *M. M. Raman*[1], *J. F. Hallmayer*[1], *S. C. Cleveland*[1], *O. N. Wolke*[2], *J. M. Phillips*[1], *A. L. Reiss*[1] *and A. Y. Hardan*[1], *(1)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, (2)Anesthesiology, Stanford University, Palo Alto, CA*

Background: Atypical growth patterns of the brain have been reported in autism spectrum disorder (ASD) but these alterations are heterogeneous across individuals, which may be associated with the variable effects of genetic and environmental influences on the development of different brain structures.

Objectives: The primary objective of this investigation was to examine structural similarities and differences across the brain in twins with and without autism to determine whether variation in brain structure is associated with genetic or environmental factors in ASD.

Methods: Monozygotic (MZ) and dizygotic (DZ) twin pairs with and without ASD (aged 6-15 years) participated in this study. T1-weighted MRIs were processed with FreeSurfer to evaluate structural brain measures. Intra-class correlations were examined within twin pairs and compared across groups. ACE modeling for broad sense heritability (a^2= additive genetics) and environmental influences (c^2= shared family environment, e^2= unique environment) were calculated to provide an estimate of the proportion of variation associated with genetic and environmental factors. Pearson's correlations of within twin pair differences in structural measures and symptom severity, as assessed with the Social Responsiveness Scale (SRS), were also examined to evaluate genetic and environmental influences on brain-behavior relationships.

Results: Good quality data were available for 164 twins [48 ASD twin pairs (19 MZ, 29 DZ); 34 TD twin pairs (20 MZ, 14 DZ)]. All structural brain measures that were assessed were best fit with either AE or CE models. Cerebral structure was primarily genetically-mediated in TD twins (a^2= 0.60 – 0.89), except for global mean curvature (c^2= 0.67 [0.41, 0.92) and cortical thickness of the temporal (a^2= 0.33 [0.04, 0.63]) and occipital lobes (c^2= 0.61 [0.45, 0.77). Cerebral structure was also predominantly genetically-mediated in twins with ASD (a^2= 0.70 – 1.00); however, cerebellar white matter (WM) (c^2= 0.48 [0.11, 0.85]) and frontal lobe grey matter (GM) volume (c^2= 0.79 [0.63, 0.95]) as well as cortical thickness of the frontal (c^2= 0.81 [0.71, 0.92]), temporal (c^2= 0.77 [0.60, 0.93]), and parietal lobes (c^2= 0.87 [0.77, 0.97]) were primarily associated with environmental factors. Conversely, occipital lobe thickness (a^2= 0.93 [0.75, 1.11]) did not exhibit similar environmental influences in twins with ASD compared to TD controls. Twin pair differences in brain structure were also associated with differences in symptom severity, such as the relationships between social communication impairments (SRS) and GM volume of the frontal (r= 0.52 [0.18, 0.75]), temporal (r= 0.61 [0.30, 0.80]), and parietal lobes (r= 0.53 [0.19, 0.76]) in DZ twins with ASD.

Conclusions: Our findings suggest that environmental and genetic factors differentially affect brain structure in ASD. Although the majority of structural brain measures were primarily genetically-mediated in twins with ASD, it appeared that environmental factors may influence cerebellar WM and cortical thickness to a larger extent, with a more pervasive pattern compared to TD controls. Future studies should examine the periods of increased susceptibility to environmental factors and track changes in neurobiological profiles in relation to symptom presentation to increase the potential for neurobiological stratification in the future.

2:42 **124.002** Patterns of Cortical Gyrification in Individuals with Idiopathic Autism Spectrum Disorder and 22q11.2 Deletion Syndrome

C. Mann[1], *M. Gudbrandsen*[2], *A. Bletsch*[1], *E. Daly*[2], *C. M. Murphy*[2], *R. H. Wichers*[2], *V. Stoencheva*[2], *E. Perry*[2], *D. S. Andrews*[3], *C. E. Blackmore*[2], *M. Rogdaki*[4], *L. Kushan*[5], *C. Bearden*[5], *D. G. Murphy*[6], *M. Craig*[2,7] *and C. Ecker*[1,2], *(1)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Goethe-University Frankfurt am Main, Frankfurt, Germany, (2)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (4)Psychiatric Imaging Group, MRC London Institute of Medical Sciences, Imperial College, London, United Kingdom, (5)University of California, Los Angeles, CA, (6)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (7)National Autism Unit, Bethlem Royal Hospital, London, United Kingdom*

Background: 22q11.2 deletion syndrome (22q11.2DS) is a genetic condition accompanied by a range of physical symptoms, including cardiac defects, cleft palate, and immunodeficiency (McDonald-McGinn et al., 2015). Additionally, children with 22q11.2DS are at increased risk of developing behavioural symptoms similar to those observed in autism spectrum disorder (ASD) (Fine et al., 2005). To date, only a few structural neuroimaging studies have examined neuroanatomical differences in the brain of individuals with 22q11.2DS. Studies report significant differences in amygdala volume (Jalbrzikowski et al., 2017), cortical thickness, and surface area between 22q11.2DS individuals with and without ASD symptomatology (Gudbrandsen et al., 2018). Additionally, 22q11.2DS has been associated with decreases in cortical folding compared to healthy controls, in particular in frontal, parietal and midline structures (Schmitt et al., 2015; Srivastava et al., 2012; Bakker et al., 2016; Kunwar et al., 2012). However, no studies to date have examined cortical folding in 22q11.2DS individuals with ASD symptomatology. Thus, the neuroanatomical underpinnings of autistic symptoms in 22q11.2DS individuals remain poorly understood.

Objectives: The present study aimed to establish (1) whether similar behavioural symptoms across disorders are mediated by shared or distinct patterns of cortical folding, and (2) whether local gyrification in ASD is significantly modulated by the 22q11.2DS microdeletion.

Methods: Our sample consisted of four groups including 25 idiopathic ASD patients, 25 22q11.2DS patients with ASD symptomatology, 25 22q11.2DS patients without ASD symptomatology, and 51 neurotypical controls (6-25 years, FSIQ≥60, 66 males and 60 females; all groups were matched for age and gender). For all 126 participants, high-resolution structural T1-weighted images were acquired. Vertex-based estimates of the local gyrification index (*l*GI) were derived by regression of a general linear model with (1) a main effect of ASD, (2) a main effect of 22q11.2DS, (3) an ASD-by-22q11.2DS interaction effect, and (4) gender, site, age, IQ, and total brain volume as covariates. Pearson correlation coefficients between significant *l*GI measures across all individuals showing ASD symptoms, and measures of symptom severity (ADI-R and ADOS scores) were assessed.

Results: Following correction for multiple comparisons, we found significant differences in cortical folding between all individuals with 22q11.2DS compared to all individuals without the deletion in several large clusters distributed across the cortex. Moreover, based on the main effect of ASD, we established that individuals with ASD symptomatology showed distinct patterns of *l*GI from those without. Notably, we identified significant ASD-by-22q11.2DS interaction effects in two cortical regions: (1) the left precentral and postcentral gyrus, and (2) the right lateral orbitofrontal cortex and insula (see Figure 1). Across all individuals with ASD symptomatology, we observed a significant positive correlation between *l*GI of cluster 1 and symptom severity in the ADI-R subscale of restricted and repetitive behaviour (r = 0.4, p < .05) (see Figure 2).

Conclusions: Our findings imply that the patterns of cortical folding differ between individuals with the microdeletion and those without.

Although sharing similar behavioural symptomatology, significant ASD-by-22q11.2DS interactions indicate that the neuroanatomical underpinnings of autistic symptoms could be separated from the neuroanatomical consequences resulting from the microdeletion.

2:54 **124.003** Atypical Scaling between the Inner and Outer Curvature of the Brain in Autism Spectrum Disorder

T. Schäfer[1], *C. Mann*[1], *A. Bletsch*[1], *E. Loth*[2], *D. G. Murphy*[3], *J. K. Buitelaar*[4], *T. Charman*[5], *T. Banaschewski*[6], *S. Baron-Cohen*[7], *S. Bolte*[8], *S. Durston*[9], *L. G. EU-AIMS*[10] *and C. Ecker*[1,11], *(1)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Goethe-University Frankfurt am Main, Frankfurt, Germany, (2)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Department of Cognitive Neuroscience, Nijmegen, Netherlands, (5)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (6)Child and Adolescent Psychiatry, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany, (7)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (8)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (9)Department of Psychiatry, Brain Center Rudolf Magnus, University Medical Center Utrecht, Utrecht, Netherlands, (10)EU-AIMS Organization, London, United Kingdom, (11)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that is accompanied by an atypical brain development. Neuroanatomical abnormalities in ASD include differences in surface area and cortical thickness, as well as atypical patterns of cortical gyrification or folding (Ecker et al., 2015). Some evidence suggests that cortical gyrification is driven by a differential expansion of the upper and lower cortical layers (Richman et al., 1975), which is expected to affect the curvature of the inner and outer surface of the brain in an idiosyncratic fashion (Ronan et al., 2013). This hypothesis is also supported by (i) *post mortem* reports of an atypical cortical lamination in ASD (Avino et al., 2010), and (ii) genetic studies indicating that ASD-related genes are not equally expressed across all cortical layers but affect some cortical layers more than others (Parikshak et al., 2013; Willsey et al., 2013). However, this hypothesis has not yet been addressed *in vivo*.
Objectives: The present study aimed to establish whether the difference between the inner and outer curvature (D_{curv}) of the brain differs between individuals with ASD and neurotypical controls.

Methods: 166 males with ASD (inclusion based on ADI-R score and FSIQ³80) and 164 neurotypical controls, aged 7-31 years were assessed at six European sites as part of the EU-AIMS Longitudinal European Autism Project (LEAP) (Loth et al., 2017). For all 330 participants, high-resolution structural T1-weighted volumetric images were obtained. Cortical surface models were derived using the FreeSurfer v6.0 image analysis suite (http://surfer.nmr.mgh.harvard.edu/). The D_{curv} was calculated as the difference between the mean curvature on the inner and outer cortical surface and mapped to a common space template for group comparison. Parameter estimates for D_{curv} were derived using a general linear model (GLM) at each vertex with (1) group and site as categorical fixed-effects factors, (2) linear age, as well as an age-by-group interaction, as well as (3) cortical thickness and FSIQ as continuous covariates. Corrections for multiple comparisons were performed using random-field theory (RFT)-based cluster-corrected analysis for non-isotropic images using a p=0.05 (two-tailed) cluster significance threshold.

Results: There was no significant difference in age between groups [$t(328)$=0.322, p=0.747]. However the groups differed in FSIQ [$t(328)$=2.692, p=0.007]. In ASD, we established that the D_{curv} was significantly reduced relative to neurotypical controls predominantly in brain regions of the frontal and parietal lobes (RFT-based cluster corrected, p<0.05). A significant increase in D_{curv} in ASD was observed in the anterior and posterior cingulate cortex (see Figure 1). In the right prefrontal cortex, measures of D_{curv} were also negatively correlated with symptom severity in the ADI-R domain of social interaction (r=-0.18, p<.05), as well as in the domain of restricted and repetitive behaviours (r=-0.2, p<.05).

Conclusions: Our findings suggest that the scaling between outer and inner curvature of the brain may be atypical in ASD, possibly mediated by altered differential expansion of the inner and outer cortical layers. Measures of D_{curv} may thus be used to guide future studies into layer-specific cortical development, and to stratify ASD individuals into biologically more homogeneous subgroups.

3:06 **124.004** Cortical Surface Architecture Endophenotype and Correlates of Clinical Diagnosis of Autism Spectrum Disorder

Y. Aoki[1], *B. Yamagata*[2], *T. Itahashi*[3], *J. Fujino*[3], *H. Ohta*[3], *M. Nakamura*[3], *N. Kato*[3], *M. Mimura*[2], *R. Hashimoto*[4] *and O. Takashio*[1], *(1)Showa University, Tokyo, Japan, (2)Keio University, Tokyo, Japan, (3)Medical Institute of Developmental Disabilities Research, Showa University, Tokyo, Japan, (4)Tokyo Metropolitan University, Tokyo, Japan*

Background: Autism spectrum disorder (ASD) is a developmental disorder that shows cortical abnormality in the brain. Because of its genetic heritability, both individuals with ASD and their unaffected siblings present the endophenotype. Some prior MRI studies compared individuals with ASD, their unaffected siblings and typically developing (TD) people and recognized abnormalities shared by individuals with ASD and their unaffected siblings as the endophenotype.
Objectives: However, such prior studies have two major concerns. First, because they did not enroll siblings of TD people, they underestimated the difference between individuals with ASD and their unaffected siblings, which might have resulted in not identifying the difference for the diagnostic status. Second, although they demonstrated atypical gray matter characteristics, they did not clarify which aspect of gray matter presents the endophenotype. The aim of this cross-sectional study is to address these two concerns.

Methods: We recruited not only 15 pairs of adult male siblings with an ASD endophenotype but 15 pairs of TD siblings to account for the similarity between siblings. We focused on four gray matter parameters: cortical volume and three surface-based parameters (cortical thickness, fractal dimension, and sulcal depth [SD]). First, we sought to identify a pattern of an ASD endophenotype, comparing the four parameters. Then, we compared individuals with ASD and their unaffected siblings in the cortical parameters to identify neural correlates for the clinical diagnosis accounting for the difference between TD siblings.

Results: A sparse logistic regression with a leave-one-pair-out cross-validation showed the highest accuracy for the identification of an ASD endophenotype (73.3%) with the SD compared with the other three parameters. Focusing on SD, a bootstrapping analysis accounting for the difference in the SD between TD siblings showed a significantly large difference between individuals with ASD and their unaffected siblings in six out of 68 regions-of-interest accounting for multiple comparisons.

Conclusions: These findings suggest that an ASD endophenotype emerges in SD and that neural correlates for the clinical diagnosis can be dissociated from the endophenotype when we accounted for the difference between TD siblings.

Oral Session - 3A
Medical and Psychiatric Comorbidity
125 - Comorbidity 1
1:30 PM - 2:25 PM - Room: 524

1:30 **125.001** Influence of Depressive Symptoms on Adaptive Functioning in Children with ASD

***S. Duan**, M. Lee, T. Winkelman, M. R. Altschuler, D. Stahl, J. Wolf, A. Naples and J. McPartland, Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Individuals with autism spectrum disorder (ASD) often present with impairments in adaptive functioning. Individuals with ASD also present with greater rates of co-morbid psychiatric disorders, such as depression, that further impact their daily living skills. Prior work has demonstrated that certain domains of adaptive functioning in ASD are more affected in the presence of co-morbid psychopathology relative to ASD alone. Despite the high co-morbidity of depressive symptoms in children with ASD, few studies have investigated how depressive symptoms impact their adaptive functioning. Understanding the impact of depressive symptoms on adaptive functioning in children with ASD has implications for targeted assessment and clinical intervention in this population.
Objectives: To investigate the impact of depressive symptoms on adaptive functioning in children with ASD.

Methods: 114 children with ASD (29 females, mean age=12.82, mean IQ=102.07) and 66 children with typical development (TD; 31 females, mean age=13.14, mean IQ=107.13) between 5-18 years-old participated in the study. Participants' scores on the depression subscale of Child and Adolescent Symptom Inventory – Fifth Edition were used as a measure of depressive symptoms. Caregiver report on the Vineland Adaptive Behaviour Scales - Second Edition was used to measure participants' adaptive functioning. ASD diagnoses were confirmed according to gold-standard research criteria (ADOS + ADI-R, DSM-5). Intellectual ability was measured with the Differential Ability Scales - Second Edition.

Results: Independent sample *t*-tests indicated that children with ASD demonstrated significantly lower T scores than TD children across all domains of adaptive functioning (socialization: $t(173)=-12.28$, $p<.001$; daily living skills: $t(173)=-7.57$, $p<.001$; communication: $t(173)=-8.66$, $p<.001$; adaptive behaviour composite: $t(171)=-12.43$, $p<.001$). The same test showed that children with ASD ($M=65.44$) also had significantly higher depressive symptoms compared to TD children ($M=51.44$; $t(122)=4.58$, $p<.001$). Given selective observation of difficulties with adaptive functioning and increased depressive symptoms in children with ASD, stepwise multiple regression analyses were conducted in children with ASD in order to examine the relationship between their depressive symptoms and adaptive functioning. Age, IQ, gender and depressive symptoms were independent variables. T scores of adaptive behaviour composite and each domain of adaptive functioning were entered as dependent variables. After controlling for IQ, age and gender, the addition of depressive symptoms as a predictor resulted in significantly improved model strength for the socialization domain (ΔR^2 =.09-.21, p=.003,) and adaptive behaviour composite (ΔR^2=.10-.16, p=.038). Higher depressive symptoms predicted lower T scores in the socialization domain (β = -.0.36, p=.003), as well as lower adaptive behaviour composite (β = -.25, p=.038) in children with ASD.

Conclusions: The presence of depressive symptoms was associated with increased impairment in the socialization domain of adaptive functioning in children with ASD. In contrast, it was not related to the communication or daily living skills domain. This effect was independent of ASD children's IQ, age and gender. These findings highlight the importance of depression in impacting social function in ASD and emphasize the value of assessing depression in understanding social ability and planning treatment in children with ASD.

1:42 **125.002** Autism and Aces: Symptom Presentation of Children with Autism Spectrum Disorder after Adverse Childhood Experiences and Trauma.

***A. Barrett** and T. W. Vernon, University of California Santa Barbara, Santa Barbara, CA*

Background: Families affected by Autism Spectrum Disorder (ASD) experience several risk factors that increase their likelihood of experiencing Adverse Childhood Experiences (ACES), including increased parent stress, financial strain, isolation, and lack of social support (Benson, 2006; Dabrowska & Pisula, 2010; Singer, 2006). In addition, impairments in speech, language, and social skills can create a failure to report these experiences, limiting access to trauma-informed interventions (Levy et al., 2010; McEachern, 2012). Paradoxically, there are several characteristics of ASD that may exacerbate posttraumatic stress symptoms in this population, such as susceptibility to anxiety and poor emotion regulation abilities (Mazefsky et al., 2013). To date, very few studies have examined posttraumatic response in individuals with ASD.
Objectives: This study examined how children with ASD process and respond to ACES similarly or differently than (a) ASD children without ACES and 2) typically developing (TD) children with ACES.

Methods: Participants include a nationwide sample (n=150) of parents of children ages 3-12 years. The study gathered data from a culturally and socioeconomically diverse nationwide sample to measure social, emotional, and behavioral symptoms associated with posttraumatic stress response in children and symptoms commonly associated with an ASD diagnosis. Three study populations were recruited: children with ASD who experienced ACES, children with ASD who have not experienced ACES, and TD children who experienced ACES. Parents completed the Trauma Symptom Checklist for Young Children (TSCYC) to assess emotional-behavioral and posttraumatic stress symptoms, the Social Responsiveness Scale (SRS-2) to assess autism-related symptoms, and subtests of the Repetitive Behavior Scale (RBS-R) to assess self-injurious and compulsive behaviors. Two-way MANOVAs were conducted to assess for differences in symptom presentation between the three groups.

Results: Preliminary data suggest that ASD participants with ACES experience significantly higher symptoms of arousal ($p<.05$; ACES M=75.5(12.0), NoACES M=56.6(8.9)) and overall posttraumatic stress ($p<.05$; ACES M=71.8(19.1); No ACES M=51.3(5.5)) than ASD participants without ACES. Compared to TD peers who have experienced ACES, children with ASD who have experienced ACES demonstrate higher, clinically elevated levels of arousal (M= 75.5 vs M=59.4) and total posttraumatic stress response (M=71.8 vs 58.5). Lastly, results indicate that TD children with ACES demonstrate challenges in the use of appropriate reciprocal social behavior that fall in the Severe range (SRS-Total M=86.6(10.0)) similar to children with ASD

who have experienced ACES (M=92.8(6.0)) and children with ASD who have not experienced ACES (M=89.7(11.9)). Pending analyses will also explore if increased posttraumatic stress and ASD symptomatology are associated with (a) an increased number ACES, (b) additional comorbid diagnoses, and (c) decreased language abilities.

Conclusions: This investigation is one of the first studies to compare posttraumatic stress response between children with ASD and TD peers. Due to increased vulnerabilities and impaired social communication abilities, it is believed that individuals with ASD may be underreported victims of trauma and maltreatment. Therefore, it is hoped that these results will fill a significant gap in the literature regarding the unique posttraumatic symptom presentation in children with ASD, with the goal of increasing timely identification and professional intervention.

1:54 **125.003** Autism Spectrum Disorder and Suicidal Behaviors: Medications and Services Utilization

P. H. Lipkin[1], *J. K. Law*[1], *B. L. Baer*[2], *A. R. Marvin*[1], *H. C. Wilcox*[3], *L. Kalb*[4] *and R. A. Vasa*[5], *(1)Medical Informatics, Kennedy Krieger Institute, Baltimore, MD, (2)University of Maryland, College Park, MD, (3)Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD, (4)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (5)Kennedy Krieger Institute, Baltimore, MD*

Background: Individuals with autism spectrum disorder (ASD) have an elevated risk of mental health conditions, including suicidal behaviors. Objectives: To examine psychiatric medication and mental health service utilization, for children and young adults with ASD, in relation to suicidal thought and behaviors.

Methods: 992 parents of a verbal child or dependent young adult with ASD who were enrolled in the Interactive Autism Network (IAN), an online ASD research registry, completed the Mental Health and Suicidal Behaviors Questionnaire, a custom measure of suicidal thoughts and behaviors, current psychiatric medications, service use history, comorbid mental health conditions, and family history. Individuals with ASD had a mean age of 13.6 years (range 8-25 years; SD = 3.0), were predominantly male (81%), white (85%), and non-Hispanic (89%).

Results: 9.2% of parents reported that their child or young adult had a suicide plan or tried to end their life. An additional 11.6% reported that their child displayed active ideation (wanting to end their life without plan/attempt), and 21.1% said their child displayed passive ideation (wanting to die without active ideation or plan/attempt). 55.2% reported that the child/dependent was taking psychiatric medications (Mean = 1.98 medications, SD =1.09, range=1-7), with treatment significantly greater in those with ideation, plans, or attempts than those without. Most common were ADHD medications (34.8%), antidepressants/anti-anxiety medications (30.0%), and antipsychotics (17.6%) (Table 1). 72.0% sought treatment in response to their child's ideation or plan, and 88.6% in response to a suicide attempt (Figure 1), most commonly from a psychologist/counselor (64% with ideation/plan, 80% with attempt) or psychiatrist (50%, 54%). Other sources of treatment were from pediatricians, emergency departments, or other professionals. Hospitalization occurred in 45% of those with attempts, 15% of those with ideation or plan. Most were satisfied with actions taken or treatment (82% with ideation or plan; 78% with attempt). Similarly, most were satisfied with their access to treatment in response to their child's suicidality (78% with ideation or plan; 71% with attempt). However, this left approximately a quarter dissatisfied with actions taken, treatment received, or access to treatment.

Conclusions: Parents of children and young adults with ASD participating in an online research network report high rates of suicidal thought and behaviors, with high use of mental health therapies, medication, and other treatments. While a majority reported general satisfaction with the child's or dependent's care regarding suicidality, many reported insufficient treatment. Further understanding of the impact and availability of such treatments is required to decrease injury and death in this highly vulnerable population.

2:06 **125.004** Moderators of the Association between Symptoms of Anxiety and Autism

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Background: Anxiety is one of the most common co-occurring diagnoses for autism spectrum disorder (ASD; White et al., 2009). Up to 80% of youth with ASD experience impairing symptoms of anxiety, and 40% of youth meet diagnostic criteria for an anxiety disorder (Simonoff et al., 2008). The literature on the association between anxiety and autism is mixed (Kerns et al., 2012), with different studies revealing positive, negative, and no association. Examining factors that influence the association between symptoms of autism and anxiety may help clarify these conflicting results and better characterize the presentation of anxiety in ASD. Understanding under what contexts autism and anxiety symptoms correlate may help identify individuals at greatest risk for anxiety early in development. However, few studies have investigated factors that influence the association between anxiety and autism symptoms.
Objectives: Examine the association between symptoms of autism and anxiety in a large clinic-referred sample of individuals with ASD, as well as factors that moderate that association.

Methods: Participants included 291 individuals evaluated for ASD and received an ASD diagnosis in a university-based autism diagnostic clinic. Participants ranged in age from 2 to 21 (191 males). Autism symptoms in both the social-communication and restricted/repetitive behavior (RRB) domains were measured using Autism Diagnostic Observation Schedule, domain calibrated severity scores (ADOS-CSS; Gotham, Pickles, & Lord, 2009; Hus, Gotham, & Lord, 2012). Anxiety symptoms were indexed using the Behavior Assessment System for Children (Kamphaus & Reynolds, 2015). Demographic moderators of interest included age, gender and verbal and nonverbal IQ.

Results: Across the full sample, total autism symptoms were negatively correlated with level of anxiety, p=.001. This was driven by a negative correlation between RRBs and anxiety, p<.001, as no correlation emerged between social-communication symptoms and anxiety, p>.05. Furthermore, age, VIQ and NVIQ were all positively correlated with anxiety levels, p's<.001. Anxiety symptoms did not differ by gender, p>.05. The association between ADOS-CSS and anxiety symptoms was not moderated by age, VIQ, NVIQ, or gender for either domain of symptoms.

Conclusions: This was the first study to examine factors that moderate the association between anxiety and autism symptoms in a large clinic-referred sample of youth with ASD. Individuals who evidenced fewer RRBs during the ADOS were rated as more anxious. It may be that highly anxious individuals are aware of the social evaluation involved in a behavioral assessment such as the ADOS and regulate their behavior in that setting. Additionally, factors such as insistence on sameness may relate to both anxiety and RRBs, indicating a need for differentiating contributors to anxiety versus autism symptoms (Gotham et al., 2013). Our results also indicate that the association between autism and anxiety symptoms is preserved across a range of ages, cognitive levels and gender. Future research is needed to develop measures of anxiety validated for use with autism, and to determine whether moderations exist when using more sensitive measures of anxiety, as the presentation of anxiety may differ depending on a child's intellectual or language ability, age, gender, or a combination of each.

Oral Session - 3B
Medical and Psychiatric Comorbidity
126 - Comorbidity 2
2:30 PM - 3:25 PM - Room: 524

2:30 **126.001** Emotion Dysregulation As a Risk Factor for Suicidality: Comparison of Inpatient ASD, Community ASD, and US Census-Matched Youth Samples

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Background:
Individuals with ASD experience increased rates of emotion regulation (ER) impairments and suicidality, and ER deficits are predictive of suicidal ideation (SI) in neurotypical adolescents. However, neither ER nor SI have been compared across large representative ASD and general samples to elucidate the magnitude of these problems. Further, the association between impaired ER and suicidality in youth with ASD has yet to be investigated.

Objectives:

This study aimed to: 1) compare the prevalence of ER impairment and parent-reported SI across ASD and general US samples; 2) investigate the association between ER and SI across groups.

Methods:

Participants were 6-to 18-year-olds recruited from three sources: 1) 387 psychiatric inpatients with ASD from Autism Inpatient Collection (AIC); 2) 1,209 with ASD recruited via the Interactive Autism Network (IAN) across the US; and 3) 1,000 US-census matched youth recruited through YouGov, a polling company. All parents completed the Child Behavior Checklist (CBCL) item regarding SI ('talks about killing self'), Emotion Dysregulation Inventory (EDI), that produces theta scores (M= 0 and SD= 1) for Reactivity (EDI-R; poor ER and high emotional intensity) and Dysphoria (EDI-D), and Social Communication Questionnaire (SCQ). In addition to within-group analyses and descriptives, logistic regressions were run predicting SI based on age, gender, race, SCQ, group, EDI scales, and EDI-R/D by group interactions.

Results:

EDI-R scores in the non-ASD sample (YouGov; M= -1.20, SD= .78) were 1SD lower than the community ASD sample (IAN; M= -.30, SD= .85), and 2SD lower than the hospitalized ASD sample (AIC; M= .91, SD= .80; $F_{(2, 2752)}$ = 1029.95, p < .001). EDI-D scores in YouGov (M= -.68, SD= .78) were 0.5SD lower than IAN (M= -.18, SD= .87), and 1SD lower than AIC (M= .55, SD= .83; $F_{(2, 2752)}$= 344.13, p< .001). Parent report of youth SI significantly differed across groups, (AIC= 27.4%; IAN= 14.3%; YouGov= 4.8%; $F_{(2, 2593)}$= 44.74, p< .001). Participants with SI had significantly higher EDI-R scores in IAN (t = -.6.06, p<.001) and significantly higher EDI-D scores in IAN (t= -8.00, p < .001) and AIC (t=-2.02, p = .044) than participants from the same source without SI (See Figure 1).

In the model with EDI-R predicting SI, AIC and IAN (β= .24, p< .001; β= .09, p= .010), older age (β= .007, p= .009), and minority race (β= .01, p= .024) were related to a higher likelihood of SI, and there was a significant interaction suggesting a stronger association between EDI-R and SI in IAN (β= .12, p< .001). In the model with EDI-D predicting SI, there were main effects of AIC and IAN (ps< .001), as well as an interaction between both ASD groups and higher EDI-D (AIC: β= .13, p< .001; IAN: β= .12, p< .001).

Conclusions:

Results indicate markedly worse ER and higher SI in community and inpatient ASD samples compared to a non-ASD sample. Poor ER was significantly associated with higher reported SI across ASD groups, which supports poor ER as a risk factor and potential treatment target for suicidality in ASD.

2:42 **126.002** Looking Beyond Diagnostic Labels: How Depressed Mood Obscured Our Interpretation of Autism Neuroscience Data

K. Gotham[1], *G. T. Han*[2], *K. E. Carter*[1] *and F. Pezzimenti*[1], *(1)Psychiatry and Behavioral Sciences, Vanderbilt University Medical Center, Nashville, TN, (2)Vanderbilt University, Nashville, TN, TN*

Background: As summarized in reviews, autism psychophysiological and neuroscience literature often reports slower initial but overall heightened response to emotional material, which may represent more effortful neural processing of emotion in participants with autism spectrum disorder (ASD).
Objectives: To provide an example in which latent heterogeneity (here, on depressed mood) within ASD samples masks subgroup effects that are stronger than the reported summary group effect of "ASD" emotion processing.

Methods: Our current sample of n=130 will increase significantly by May 2019. This abstract reflects findings based on a preliminary subset of n=53 adults aged 18-35 with verbal IQ>80, including adults with ASD (n=21), typically developing adults with current depression (TD-depressed, n=13), and non-ASD, non-depressed controls (TD-controls, n=19). Participants completed diagnostic assessments (including the Autism Diagnostic Observation Scale, second edition, and the Structured Clinical Interview for DSM-5 Disorders), self-report questionnaires (e.g., Beck Depression Inventory), and a passive-viewing task employing emotionally-expressive faces, during which pupil motility was used to index cognitive-emotional load in response to single faces presented for 400 milliseconds, then masked for 8 seconds.

Results: In response to emotional faces, the pupil course of ASD participants, compared to TD-depressed and TD-controls, seemed to exhibit the general pattern noted in previous literature: slower initial but overall heightened response to emotional material (see red hatched line in Figure 1, compared to blue and green lines). However, participants with ASD who ranked in the highest third on depressive symptoms (blue solid line in Figure 2A) had faster, larger, and sustained pupil response to sad faces compared to their lesser-depressive peers with ASD (red and green lines on Figure 2A). This pattern of neural responsivity markedly resembled the TD-depressed pupil course to sad faces (Figure 2B), with no significant practical or statistical difference between the groups. Higher initial and sustained response to dysphoric stimuli apparently represents a similarity in emotion processing across ASD and TD populations that is specific to dysphoric mood.

Conclusions: In these data, the overall slow-but-sustained pattern generally associated with ASD masked depression subgroups that replicated

our comparison groups (TD with and without current depression). Specifically, a unique pattern of fast-and-sustained cognitive-affective response was associated with greater depressive symptoms across TD and ASD participants. More broadly, conclusions about emotion processing in the ASD population could be subject to latent effects that are similar to our observed effects here. These findings underscore the necessity of stratifying samples on cognitive and affective variables (e.g., depression, anxiety, rumination) regularly when interpreting neuroscientific data, given the potential for latent heterogeneity within autism. We will discuss analogous findings from independent sources.

2:54 **126.003** Group Cognitive Behavioral Treatment for Anxiety in Adolescents with ASD and Intellectual Disability

A. Blakeley-Smith[1], *A. T. Meyer*[2], *R. E. Boles*[3], *S. Hepburn*[4] *and J. Reaven*[5], *(1)Univ. of Colo. Denver-JFK Partners, Aurora, CO, (2)JFK Partners, University of Colorado School of Medicine, Aurora, CO, (3)University of Colorado School of Medicine, Aurora, CO, (4)Colorado State University, Fort Collins, CO, (5)JFK Partners, University of Colorado Anschutz Medical Campus, Aurora, CO*

Background: Adolescents with ASD and intellectual disability (ID) are an exceedingly underserved population. These teens evidence significant anxiety and behavioral challenges (Helverschous and Martinsen 2011), yet receive limited mental health support. While there is now an emerging body of literature supporting the effectiveness of adapted cognitive behavioral treatment (CBT) for youth with ASD, individuals with ID are typically excluded from these intervention studies. Given that behavioral approaches alone may not adequately address all anxiety symptoms (King, 2005), there has been a call for researchers to examine the use of CBT in an ASD/ID population (Rosen, Connell, & Kerns, 2016).
Objectives: The purpose of the study is to: 1) adapt a group CBT program designed for youth with ASD and anxiety (Facing Your Fears; Reaven et al., 2011) to meet the cognitive and linguistic needs of adolescents with ID, 2) assess initial feasibility and acceptability of the intervention, and 3) examine initial efficacy of the intervention.

Methods: This 14-week family focused intervention includes core CBT components for anxiety (i.e., psychoeducation, somatic management, cognitive strategies, and exposure) with adaptations made to treatment modality, session duration, and content. Content adaptations include: tailored visuals for adolescents with emerging language skills (e.g., single words/phrase speech) and those with verbal fluency, video modelling, adapted cognitive substitutes, and behavior plans. A well characterized sample of 23 adolescents (*M* = 15.9, range: 12-18) with ASD and ID were included. Participants had a mean Full Scale IQ of 58.3 (*SD* = 12.1, range: 40-79) and a mean Adaptive Behavior Composite of 57.45 (*SD*= 13.2, range: 40-79). Anxiety was assessed via parent report on the SCARED (Birmaher et al. 1999) and Anxiety Depression and Mood Scale (ADAMS; Esbensen et al. 2003) and was differentiated from problem behavior via functional assessment (O'Neill et al. 1990). Outcome measures also included parent acceptability (e.g., compilation of likert ratings of all CBT activities and adaptations of support). Dependent t-tests were conducted to examine pre-post differences in child outcomes.

Results: Of the 23 adolescent participants, 19 completed treatment and attended 94% of treatment sessions. Four adolescents withdrew and attended an average of 3 sessions. Parent acceptability ratings average was 4.56 (likert scale 0-5, with 5 indicating extremely satisfied). There was a significant reduction for the total SCARED score from baseline (M= 32.9, SD= 15.8) to post-intervention (M=26.2, SD=12.7) time points; $t(18)= 2.25$, $p = .04$. Similarly, there was a significant reduction in scores on the ADAMS from baseline (M= 40.7, SD= 10.7) to post intervention (M=29.9, SD=13.0) time points; $t(18)= 4.28$, $p = .001$.

Conclusions: This adapted program is the first group intervention to incorporate a CBT framework to treat anxiety in adolescents with ASD and ID. Results indicate that the group format and content is acceptable and feasible. Preliminary tests of outcomes suggest the intervention may improve teen anxiety and mood concerns, although this finding requires replication with a larger sample size and comparison to a control group. Future directions include further refinement and efficacy testing using a more rigorous methodological design.

3:06 **126.004** Comparing Online and in-Person Parent Trainings to Support Executive Function and Self-Regulation: Feasibility, Acceptability, and Outcomes

L. Anthony[1], *D. Childress*[2], *K. Kocher*[2], *A. C. Armour*[3], *A. Verbalis*[3], *M. Troxel*[1], *Y. Myrick*[3], *M. A. Werner*[4], *K. C. Alexander*[5], *L. Cannon*[6] *and L. Kenworthy*[3], *(1)University of Colorado, Denver, Aurora, CO, (2)3C Institute, Durham, NC, (3)Children's National Health System, Washington, DC, (4)Center for Autism Assessment and Treatment, Rockville, MD, (5)Occupational Therapy INstitute, La Mesa, CA, (6)Ivymount School, Rockville, MD*

Background: Unstuck and On Target (UOT; Cannon et al., 2011; 2018) is a school- and home-based cognitive behavioral intervention. It has been shown effective in two RCTs at improving executive functions (EF) and classroom behavior in children on the spectrum (Kenworthy, et al. 2014; Anthony, et al., in prep). In-person parent trainings were provided in the RCTs, but in-person trainings are not practical outside of research for the trainers and many families, who encounter disparities in access related to cost, geography, and free-time. To address these barriers, we developed an on-line parent training platform (*e*-Unstuck)that leverages the cognitive theory of multimedia learning (Mayer, 2009) for providing parents with interactive practice with EF concepts, opportunities to individualize materials/training for their child's specific needs, and videos demonstrating: the lived experience of autism through interviews with an autistic self-advocate; the use of the Unstuck strategies with children; and the experience of other parents with Unstuck.
Objectives: Determine whether *e*-Unstuck is an effective alternative to in-person parent trainings and viable as a standalone treatment.

Methods: 85 parents of ASD children (mean age=10.3 years; mean IQ=104) were randomized to receive *e*-Unstuck (n=41) or two in-person trainings (n=44). Study outcome assessments were completed online both pre- and post-treatment. Two types of outcome assessments were given: 1) parent strain, empowerment, and competence, and 2) child EF (BRIEF-II and top 3 EF problems). Training use was also evaluated via usage metrics (online group), attendance logs (in-person group), and parent diary (both groups). Acceptability was elicited through both survey feedback (both groups) and focus groups (e-Unstuck).

Results: Acceptability and feasibility were rated positively in both groups, with no significant differences between the groups. ANCOVAs assessing change while controlling for pre-training baseline scores, child IQ, and parent education, revealed no group differences in outcomes (all p's>0.27). Significant improvement in all parent self-ratings, as well as parent ratings of their child's EF, indicated that parents (and their children) in both groups benefitted from the training they received (all p's<0.01). Cohen's*d*was computed to further explore the impact of the training on parent self-ratings of strain, empowerment, and competence (Cohen's *d* range=0.28-0.53), as well as parent ratings of their child's EF problems (BRIEF ERI and BRIEF GEC, Cohen's *d*s=0.26 and 0.28, respectively), indicated small to medium effect sizes. For the three most frequently nominated EF difficulties (flexibility, inhibition, and emotion control), parents reported significant improvement, as measured by rank, for flexibility

(p=.027).Qualitative data is currently being analyzed and will be presented in an intramethod joint display (with the quantitative findings) to further explore parents' reports of the aspects of the trainings and outcomes that were most important to them.

Conclusions: The results of this study indicate that *e-Unstuck*is equivalent to in-person training as led by an UOT author. *e-Unstuck*will enable advanced training on this curriculum to be accessible to a significantly broader audience of parents than would be able to attend in-person trainings by the authors of UOT, which are only provided sporadically and in limited geographical settings.

Oral Session - 4A
Interventions - Pharmacologic
127 - Medication and Technologies
1:30 PM - 2:25 PM - Room: 518

1:30 **127.001** Effects of Balovaptan on Health-Related Quality of Life of Adult Males with Autism Spectrum Disorder: Results from a Phase 2 Randomized Double-Blind Placebo-Controlled Study (VANILLA)

T. Willgoss[1], *L. Squassante*[2], *F. Bolognani*[2], *J. W. Smith*[1], *L. Murtagh*[2], *P. Fontoura*[2], *O. Khwaja*[2], *D. Umbricht*[2], *K. Sanders*[3] *and M. del Valle Rubido*[2], *(1)F. Hoffmann-La Roche Ltd., Welwyn Garden City, United Kingdom, (2)F. Hoffmann-La Roche Ltd., Basel, Switzerland, (3)Product Development Neuroscience, F. Hoffmann-La Roche Ltd., Basel, Switzerland*

Background: Impaired social communication and social interaction are core symptoms of autism spectrum disorder (ASD), causing multiple challenges and affecting quality of life. Alleviating core symptoms may improve quality of life in individuals with ASD.
Objectives: The phase 2 VANILLA study investigated the efficacy and safety of balovaptan, a selective V1a receptor antagonist, in adult men with ASD and intelligence quotient ≥ 70 for the treatment of social and communication deficits. An exploratory objective was to evaluate the effect of 12-week treatment with balovaptan on health-related quality of life (HRQoL).

Methods: VANILLA (NCT01793441) was a 12-week, staggered parallel-group, randomized, double-blind, placebo-controlled study evaluating oral balovaptan 1.5, 4, or 10 mg per day. Participant HRQoL was assessed at baseline, week 6, and week 12 using the PedsQL™ Generic Core Scales v4.0, which has Young Adult (age, 18–25 years) and Adult (age, ≥ 26 years) versions. The scale assesses functioning in 4 domains: physical, emotional, social, and school/work, from which Total, Physical Health Summary (Physical Functioning), and Psychosocial Health Summary (Emotional, Social, and School Functioning) scores are derived. The PedsQL Family Impact Module and Cognitive Functioning Scale were used to assess impact of acute and chronic health conditions on parents and family, and cognitive functioning, respectively. Treatment comparisons of change from baseline at week 12 were estimated using a mixed model repeated measurements analysis of covariance. Since HRQoL was an exploratory endpoint, estimates for the differences between balovaptan doses and placebo with associated 90% confidence intervals (CIs) and *P* values are provided for descriptive purposes only.

Results: The study enrolled 223 participants, with 56 included in the analysis of balovaptan 10 mg (n = 30) compared with placebo (n = 26) at week 12. Clinically relevant differences were observed for 10 mg balovaptan compared with placebo on the PedsQL Generic Core Scale total score (estimate difference [ED], 7.15; 90% CI, 2.09–12.20; *P* = 0.021; effect size [ES], 0.63) and on the Psychosocial Health Summary score (ED, 8.53; 90% CI, 2.79–14.27; *P* = 0.016; ES, 0.67). No significant difference was observed on the Physical Health Summary score (ED, 4.14; 90% CI, −0.19–10.20; *P* = 0.257; ES, 0.31). Trends for improvement from baseline at week 12 were also observed in the balovaptan 10 mg group compared with placebo on the PedsQL Cognitive Functioning Scale (ED, 9.15; 90% CI, 1.81–16.49; *P* = 0.042; ES, 0.56). No differences were observed between any dose of balovaptan and placebo at week 12 on the PedsQL Family Impact Module.

Conclusions: The VANILLA trial showed positive trends of improvement in HRQoL with balovaptan 10 mg compared with placebo in adult men with ASD. Trends for improvement in the PedsQL Generic Core Scale and Cognitive Functioning Scale were observed with balovaptan 10 mg compared with placebo, suggesting meaningful improvements in HRQoL. To fully determine the effect of balovaptan on HRQoL, ongoing and future studies will be critical to replicate this signal and to extend these finding across the age and gender spectrum of individuals with ASD.

1:42 **127.002** Cannabidiol (CBD) Alters Low Frequency Activity and Functional Connectivity in the Brain in Autism Spectrum Disorder (ASD).

C. M. Pretzsch[1], *J. Freyberg*[2], *B. Voinescu*[2], *M. A. Mendez*[3], *R. H. Wichers*[4], *L. Ajram*[5], *G. Ivin*[6], *M. Heasman*[6], *S. C. Williams*[7], *D. G. Murphy*[8], *E. Daly*[4] *and G. M. McAlonan*[9], *(1)IoPPN King's College London, London, United Kingdom, (2)King's College London, London, United Kingdom, (3)Forensic and Neurodevelopmental Sciences, King's College London, London, United Kingdom, (4)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (5)Institute of Psychiatry, London, United Kingdom, (6)South London and Maudsley NHS Foundation Trust Pharmacy, UK, London, United Kingdom, (7)Centre for Neuroimaging Sciences, King's College London, London, United Kingdom, (8)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (9)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: The potential benefits of cannabis and its major non-intoxicating component cannabidiol (CBD) are attracting increasing attention for treating mental health conditions and neurodevelopmental disorders such as autism spectrum disorder (ASD). However, the mechanisms of action of CBD in the brain, and their relevance to ASD, remain unclear. We and others have previously shown that responsivity to pharmacological challenge, such as brain function, can be measured using functional magnetic resonance imaging (fMRI); but that there are differences in pharmacological responsivity in individuals with and without ASD.
Objectives: Therefore, we used fMRI to examine brain responsivity to CBD in adults with and without ASD.

Methods: Thirty-four healthy men (half with ASD) participated in a placebo-controlled, double blind cross-over study of responsivity to an acute oral administration of 600 mg CBD and placebo. We first conducted a hypothesis-free whole-brain analysis of the 'fractional Amplitude of Low Frequency Fluctuations' (fALFF) in brain activity. Significance was set at $p < 0.05$ (using Threshold Free Cluster Enhancement (TFCE)) with family-

wise error correction. Next, in regions where CBD significantly changed fALFF, we examined whether this was accompanied by any shift in the functional connectivity (FC) between those regions and the rest of the brain (using seed-based analysis). Data acquisition was timed to commence (at peak plasma levels) 2 hours after administration of CBD or placebo.

Results: CBD significantly increased fALFF in the cerebellar vermis and the right fusiform gyrus from a comparable baseline across both groups. However, post-hoc within-group analyses revealed that the effect of CBD was primarily driven by the ASD group, with no significant change in controls. Within the ASD group only, CBD also significantly altered FC between the vermis and several of its subcortical (striatal) and cortical targets. The FC of the fusiform was not significantly altered by CBD in either group.

Conclusions: In autistic adults, CBD boosts regional fALFF in the vermis and fusiform – brain areas that have consistently been linked to social and cognitive processing differences in ASD. In addition, CBD shifted cerebellar, but not fusiform, FC in ASD. This may be because the cerebellum has a rich network of connections, compared with the relatively more restricted connections of the fusiform. However, the autistic brain appears to be more pharmacologically responsive to an acute dose of CBD than the typical brain, especially in regions consistently implicated in the condition. Future studies are required to determine if the CBD-induced alterations of brain activity and connectivity in ASD also affect the complex behaviours these regions modulate.

1:54 **127.003** A Placebo-Controlled Trial of Cannabinoids in Children with ASD

A. Aran[1], *M. Harel*[1], *L. Polyansky*[1], *A. Schnapp*[2], *N. Barnoy*[1], *N. Wattad*[1], *D. Shmueli*[3], *Y. Pollak*[2] *and H. Cassuto*[4], *(1)Shaare Zedek Medical Center, Jerusalem, Israel, (2)The Hebrew University of Jerusalem, Jerusalem, Israel, (3)Child Development, Clalit HMO, Jerusalem, Israel, (4)Clallit and Leumit HMO, Jerusalem, Israel*

Background: Anecdotal evidence of successful cannabinoid treatment in children with autism spectrum disorder (ASD) are accumulating but randomized studies are lacking.
Objectives: To assess safety, tolerability and efficacy of cannabinoid treatment, in children with ASD, in a double-blind, randomized, placebo-controlled trial.

Methods: Children with ASD were randomly assigned to receive 1 out of 3 treatments for 12-weeks and cross-over to another treatment in a second 12-week period. Treatment options were: (1) oral placebo, (2) cannabis extract, contains cannabidiol and Δ9-tetrahydrocannabinol in a 20:1 ratio, at a cannabidiol dose of 10 mg per kilogram of body weight per day (maximum 420 mg) and (3) pure cannabidiol and Δ9-tetrahydrocannabinol in the same ratio and dose. The two treatment periods were separated by a 4-week washout period. The primary comparison was between the cannabis extract and the placebo. Secondary comparisons were between the pure cannabinoids and placebo and between the cannabis extract and pure cannabinoids treatments. The primary outcome measures were the clinical global impression of improvement (CGI-I) and the home situation questionnaire- ASD (HSQ-ASD) that taps disruptive behavior. The secondary outcome measures included the social responsiveness scale (SRS) that taps core ASD symptoms. A positive response to the treatment was defined as a rating of much improved or very much improved on the CGI-I scale, at least a 25 percent decrease in the HSQ total scores and at least a 15 percent decrease in the SRS score. We conducted a conservative parallel group analysis of cannabis extract versus placebo treatments for the first treatment period only.

Results: A total of 150 children (120 boys; mean [±SD] age, 11.82±4.1 years) were enrolled. ASD symptoms severity were in the high range in 78.7% of the children according to the Autism Diagnostic Observation Schedule (Comparison score = 8-10) and adaptive level in the Vineland behavior scales was "low" (standard score ≤70) in 88%. Fifty participants were randomly assigned to receive each of the 3 treatments, 45 in each group crossed-over to the second treatment and 44 in each group completed the study (12% attrition). In the first treatment period. The rates of a positive response to the placebo and cannabis extract respectively were: 21% and 49% on the CGI-scale (p=0.005); 44% and 53% on the HSQ-ASD and 22% and 50% on the SRS (p=0.015). The rates of positive response to each treatment in the first and second periods were not significantly different. The rates of positive response to pure cannabinoids and cannabis extract were not significantly different. Adverse events that were more prevalent in the active treatment groups included: somnolence, decreased appetite and disturbed sleep. There were no treatment related severe adverse events. The average number of adverse events during a 3-month period was 4.28, 5.02 and 4.87 for participants in the placebo, pure cannabinoids and cannabis extract groups, respectively.

Conclusions: Among children with ASD, the addition of cannabinoid treatment to conventional regimen resulted in greater reductions in the core- and co-morbid ASD symptoms than placebo, but was associated with higher rates of adverse events.

2:06 **127.004** Feasibility and Safety of Immersive Virtual Reality As a Tool to Improve Police Safety in Adolescents and Adults with Autism Spectrum Disorder

A. Zitter[1], *R. Solorzano*[2], *S. Turnacioglu*[2], *J. S. Miller*[3], *V. Ravindran*[4], *J. Parish-Morris*[1] *and J. McCleery*[5], *(1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Floreo Virtual Reality, Washington DC, DC, (3)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (4)Floreo, Inc., Washington DC, DC, (5)The Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Individuals with Autism Spectrum Disorder (ASD), are at an elevated risk of poor outcomes when interacting with police officers. Approximately 1 in 5 adolescents with ASD will be stopped and questioned by an officer before the age of 21 (Rava, Shattuck, Rast, & Roux, 2016), and individuals with disabilities, including ASD, are 5 times more likely to be incarcerated than individuals without disabilities (Bronson, Maruschak, & Berzofsky, 2015). Additionally, civilian injuries and fatalities during police interactions are disproportionately common among people with disabilities (Perry & Carter-Long, 2016). Therefore, it is critical to develop interventions that foster safe and effective communication between individuals with disabilities and police officers. Here we report the results of an NIMH-funded Phase I trial to test the safety and feasibility of using immersive virtual reality (VR) to teach police safety behaviors to adolescents and adults with ASD.
Objectives: Assess the safety and feasibility of an immersive VR-based Police Safety Module (PSM) developed by Floreo, Inc. for verbally fluent adolescents and adults with ASD.

Methods: Sixty individuals aged 12-60 years (Mean=16.9, 52 male) with ASD completed 1-3 visits during Phase I of the present study. IQ was estimated at the beginning of the study (Weschler Abbreviated Scale of Intelligence; WASI-II) to ensure that all participants met a minimum verbal

and overall IQ of ≥ 75 (Mean VCI=104, Mean FSIQ=104.5). During each visit, participants engaged in four 2-minute interactions with virtual police officers. Safety was assessed through direct experimenter observations, participant questionnaires, and a qualitative interview that inquired about potential adverse side effects. System usability was indexed via participant ratings on the System Usability Scale (Brook, 1996), adapted for adolescents and adults with ASD.

Results: Scores on the revised version of the System Usability Scale ranged from 52.5-100, with the average score exceeding a minimum acceptable score of 70 (Mean=85.3, SD=3.54). Ninety-eight percent of participants completed the entirety of the PSM. Five participants reported mild effects after usage (such as slight headache or disorientation) and no serious adverse events occurred. Eighty percent of participants reported that they would like to use this VR again, suggesting that this program is feasible in verbally fluent adolescents and adults with ASD.

Conclusions: This first-of-its-kind study demonstrated that using immersive VR to teach police safety skills in adolescents and adults with ASD is safe and feasible, with no serious adverse effects and acceptable usability scores. Phase II, beginning spring 2019, includes a randomized control trial to test the efficacy of Floreo PSM on behavior while interacting with live police officers.

Oral Session - 4B
Family Issues and Stakeholder Experiences
128 - Professional Education and Siblings
2:30 PM - 3:25 PM - Room: 518

2:30 **128.001** Teaching Pediatric Residents to Diagnose Autism in Primary Care: Enhancing Developmental-Behavioral Pediatric Rotations

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Background: The AAP has rightly adopted guidelines wherein pediatricians are encouraged to "screen-and-refer" children for ASD at 18- and 24-months of age. However, without also giving pediatricians explicit competence and ownership over being able to diagnose ASD within practice when clearly discernible symptoms are present, this wide-scale identification of general neurodevelopmental risk—and reliance upon specialty tertiary care diagnostic centers—creates a bottleneck for patients and providers alike. When asked about barriers to providing this type of care, pediatricians report factors such as lack of clear tools, discomfort, difficulty navigating follow-up services, and uncertainty around communicating with families and other providers. Pediatricians-to-be within our residency program reported an overall lack of hands-on, applied learning opportunities to strengthen their competence in recognizing ASD in young children and caring for these patients. Thus, if we do not provide wide-scale training in the basics of ASD recognition, diagnostic triage, and post-diagnostic care coordination to future pediatric medical providers, then "screen-and-refer" will continue to lead to lengthy waits for diagnostic confirmation and service initiation, maintaining the current mean age of diagnosis as after four years of age, and postponing access to the early intervention services.
Objectives: To assess a service system intervention for training residents in within-practice ASD diagnosis and care. To assess feasibility and acceptability of integrating enhanced curricular components within our existing developmental-behavioral pediatrics (DBP) rotation.

Methods: Our curriculum was designed to improve upon previously passive shadowing experiences within young child ASD clinics by integrating procedural, physician-tailored training in within-practice diagnostic identification and care coordination. In addition to multiple web-based procedural learning activities (including an interactive tutorial teaching administration/scoring of the Screening Tool for Autism in Toddlers and Young Children [STAT] and parent feedback), residents were required to actively participate in ASD evaluations under direct supervision of an attending provider. Using online completion metrics and pre/post-rotation REDCap surveys, we analyzed data on completion of curriculum components and changes in comfort level for a range of practice behaviors.

Results: Of the first 33 residents to complete the enhanced rotation activities, 94% completed new training requirements and 85% performed STAT activities during their DBP rotation. Participants reported increased comfort with identifying symptoms/risk for ASD, distinguishing between ASD and other concerns, and making a formal diagnosis. They also reported increased comfort providing feedback about diagnostic decision and effectively connecting families with services. After exposure to new curriculum, 94% of residents reported that they felt comfortable providing primary care for children with ASD, which was an increase from 59% pre-rotation. Updated results will be reviewed in depth.

Conclusions: In line with other residency training programs across the country, DBP rotations often present very few opportunities for active resident participation that would translate into skills relevant for future independent practice. This represents a tremendous training gap that, in turn, is also an opportunity for service system intervention. This project reflects the first step in advancing incorporation of ASD training into pediatric residency programs, thus increasing access to services and information for children with concerns for ASD and their families.

2:42 **128.002** Participation in an Online Autism Training Is Associated with Improved Attitudes Toward Inclusion and Self-Efficacy Among Educators in Training in Quebec and the US

S. Saade[1], *Y. Bean*[2], *K. Gillespie-Lynch*[3], *N. Poirier*[4] *and A. J. Harrison*[5], *(1)Psychology, Université du Québec à Montréal, Montreal, QC, Canada, (2)School Psychology, University of Georgia, Athens, GA, (3)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY, (4)Psychology, Université du Québec à Montréal, Montréal, QC, Canada, (5)Educational Psychology, University of Georgia, Athens, GA*

Background: Educators are often underprepared to successfully mainstream autistic students.Benefits of successful inclusion include improved academic and social skills among autistic students and increased acceptance of diversity among non-autistic peers (Ferraioli & Harris, 2011).Ineffective attempts at inclusion can lead to lack of progress, social isolation and bullying (Humphrey & Lewis, 2008). Prior autism trainings for educators focused on strategies to support autistic students specifically, including ABA (Alexander et al., 2015; Berthune, 2017), developmental (Probst, & Leppert, 2008), and cross-disciplinary approaches (Naturalistic Developmental Behavioral Interventions (NDBIs); Chang et al., 2016), without highlighting inclusion.The one published autism training study which aimed to promote positive attitudes toward inclusion among aspiring educators included only *one* item assessing attitudes toward inclusion (LeBlanc et al., 2009).Strategies to promote inclusion may be particularly useful in cultural contexts where children with disabilities are less frequently mainstreamed, such as Quebec, which has the lowest

proportion of mainstreamed students in Canada (Ducharme & Magloire, 2018).
Objectives: 1) Develop a training providing up-to-date information about autism including cross-disciplinary evidence-based practices which highlights Universal Design for Learning (UDL) as a tool to maximize inclusion. 2) Evaluate if training is associated with improved attitudes toward inclusion, autism knowledge, and self-efficacy among aspiring educators in Quebec and Georgia.

Methods: With input from teachers in NYC, we adapted an hour long online autism training which has been associated with improved knowledge among college students internationally (Obeid et al., 2015) to teach aspiring educators about autism, evidence-based practices and strategies to promote inclusion, including UDL. Education students in Georgia (n = 95; Mean age = 19.47; 84.2% Female) and Quebec (n = 179; Mean age = 24.81; 92.2.2% Female) completed the Teacher Attitudes toward Inclusion Scale (Cullen et al., 2010), Autism Self-Efficacy Scale for Teachers (Ruble et al., 2013), and Autism Stigma and Knowledge Questionnaire (Harrison et al., 2017) before and after an hour-long online training. Materials were in French in Quebec. Results: At pretest, participants in Quebec exhibited higher autism knowledge (M = 39.93, SD = 2.88) but lower attitudes toward inclusion (M = 62.23, SD = 8.69) than US students (M = 37.19, SD = 3.69; M = 67.68, SD = 8.70; ps ≤ .001). Self-efficacy did not differ (p = .86). Training was associated with improved attitudes toward inclusion and self-efficacy across sites (ps ≤ .001). Improvements in autism knowledge survived statistical corrections in Quebec (p < .001) but not the US (p = .02).

Conclusions: An online autism training emphasizing UDL as a strategy to promote inclusion shows promise as an efficient and cost-effective method for helping educators successfully integrate neurodiverse students. Given that attitudes toward inclusion were heightened in *Alberta*, Canada (which has a long history of inclusion; Ducharme & Magloire, 2018) relative to Australia, Hong Kong, and Singapore (Loreman et al., 2007) while aspiring educators in *Quebec* endorsed more *negative* attitudes toward inclusion (despite heightened autism knowledge) than students in the US, future research should examine the degree to which regional differences in legislation promoting inclusion predict educators' attitudes toward inclusion.

2:54 **128.003** Children with ASD and Their Siblings: A Global Analysis and a Micro-Analysis of Dyadic Interactions

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Background:
It is well accepted that siblings' interactions in childhood are important for typical social development (Dunn, 2007). Social interaction is a fundamental challenge in Autism Spectrum Disorder (ASD), and therefore studies on sibling interactions when one of them has ASD are highly important. Still, these studies are rare (Knott et al., 2007; Bontinck et al., 2018).

An exploratory sequential mixed methods design (Creswell & Plano-Clarck, 2018) was used in the present study to explore sibling interaction among children with ASD in great detail.

Objectives:

To characterize interactions between children with ASD and their older typically developing (TD) siblings.

Methods:

Twenty-eight sibling dyads in middle childhood, in which the younger sibling has ASD (see table 1), were video-recorded in their homes playing a game of their choice. The observations were analyzed in an exploratory approach, guided by open-ended questions. In a circular process, based on data and literature from relevant fields, a system was developed for coding and analyzing the interactions. The code was found to be reliable (Kappa=0.703-1.00), and was implemented in a software program for the analysis of behavioral observations (INTERACT). All observations were coded on a global and a micro-analytic level, and data were analyzed to address a set of research questions regarding the characteristics of the dyadic interaction, among them: what activities were chosen? What was the set-up for the interaction? What was the most prevalent engagement state of the child with ASD, and how collaborative was the playing? What predicts the behavior of each sibling (affect, frequency and quality of actions, and scaffolding by the TD sibling)?

Results:

The siblings demonstrated a wide range of game choices and play levels (from sensory-motor to symbolic-imaginary). They tended to play on the floor, facing each other or angled, thereby best supporting eye-contact. Children with ASD demonstrated a coordinated symbol-infused joint engagement state during 70% of interaction time. About half of the ASD siblings demonstrated notable episodes of symbol-infused joint engagement states even without eye contact.

Interactions were mostly positive. The most frequent actions demonstrated by both siblings were play-related, then pro-social for TD siblings, and low-level (incomplete/unclear) actions for ASD children.

Both siblings were involved in coordinated play 82.45% of the time. They were also coordinated in the expression of affect (rs=0.751, p<0.01).

The number of pro-social, play-related, discourse, imitation, and agonistic actions of the ASD sibling was predicted by the number of actions of the same kind by the TD sibling (see table 2).

The level of adaptive behavior function of the ASD sibling predicted the degree of scaffolding by the TD sibling ($\chi 2$=4.509, df=1, p<0.05; Nagelkerke-R2=0.32).

Conclusions:

The findings indicate sensitivity and coordination between the siblings, and explain recent findings on better outcomes among children with ASD who have TD siblings, in comparison to only children (Ben-Itzchak, Zukerman & Zachor, 2016). This study challenges the assumption of negative influence underlying much research on children with ASD and their siblings (Stoneman, 2005). The benefits of at-home play with a familiar, better-abled, non-didactic partner are emphasized.

3:06 **128.004** Young Adults' Sibling Relationships: The Role of Parental Differential Treatment and the Broader Autism Phenotype

A. Jensen[1], *M. Lieber*[1] *and G. I. Orsmond*[2], *(1)Brigham Young University, Provo, UT, (2)Department of Occupational Therapy, Boston University, Boston, MA*

Background:

Research highlights that parental differential treatment (PDT) has negative implications for sibling relationships (e.g., Jensen et al., 2013). This pattern extends into young adulthood, when positive relationships between siblings may be particularly important for those with autism spectrum disorders (ASD). Examining Broader Autism Phenotype (BAP) characteristics in the context of PDT is important because nonclinical traits of autism may moderate sibling processes.

Objectives:

The aim of this study was to examine how PDT is associated with young adults' sibling relationships. Because characteristics of developmental disabilities may change the nature of PDT within families (e.g., Tudor et al., 2017), we examined whether links between PDT and sibling relationships were moderated by BAP characteristics.

Methods:

Data came from a larger study about sibling influence in young adulthood, which included 866 young adults from the United States, recruited through Amazon Mechanical Turk. Young adult participants were in their mid 20s (*M age* = 25.43, *SD* = 2.54) and had about two siblings (*M* = 2.48, *SD* = 1.53; 58% female; 73% white). Participants reported on their relationship with their closest aged sibling and up to five additional siblings. In total, the 866 participants reported on PDT (6 items; Plomin & Daniels, 1985), sibling closeness (5 items; Bylth et al., 1982), and sibling conflict (3 items; Bylth et al., 1982), with 1,050 different siblings. Participants reported on their own BAP characteristics and those of each of their siblings via the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001).

Results:

Multi-level modeling was used to account for the nature of multiple sibling relationships nested within individuals. Separate hierarchical models were tested for each dependent variable: sibling closeness and sibling conflict. Each dependent variable referred to a relationship with a unique sibling. In the first step, we included family demographic controls, ratings of PDT of the mother and father, the participant's BAP characteristics, and each sibling's BAP characteristics. In the second step, four two-way interactions were included: maternal PDT X participant BAP, maternal PDT X sibling BAP, paternal PDT X participant BAP, paternal PDT X sibling BAP.

Young adults reported less sibling closeness when they were higher in BAP characteristics, their sibling was higher in BAP characteristics, their mother showed higher levels of PDT, or their father showed higher levels of PDT. Interactions of maternal and paternal PDT with the sibling's BAP also emerged. Testing of the simple slopes revealed that when the sibling was high in BAP characteristics, there was a negative association between maternal PDT and sibling closeness (see Figure 1). There was no association when the sibling was low in BAP characteristics. For paternal PDT (see Figure 2), when the sibling was low is BAP characteristics there was a negative association between PDT and sibling closeness. There was no association when the sibling was high in BAP characteristics.

Conclusions:

These findings suggest that PDT from mothers and fathers may have implications for sibling relationships in young adulthood and that BAP characteristics may moderate the ways PDT is linked to those relationships.

Oral Session - 5A
Molecular Genetics
129 - Genomics
1:30 PM - 2:25 PM - Room: 516ABC

1:30 **129.001** On the Nature of "Discordance" in Monozygotic Twin Pairs with and without Autism--a Quantitative Trait Analysis

*L. Castelbaum[1], Y. Zhang[2] and **J. N. Constantino**[3], (1)Kenyon College, Gambier, OH, (2)Washington University School of Medicine, Saint Louis, MO, (3)Washington University School of Medicine, St. Louis, MO*

Background: In any disease, the identical twin concordance rate serves as a key parameter for estimating heritability. In autism spectrum disorder, contemporary published reports of probandwise concordance for identical twins range from 65-90%. These statistics, however, have been based on thresholds for case designation that might classify twins with similar levels of symptom burden as "discordant" if they fall on opposite-sides of an arbitrary cutoff.

Objectives: Given that ASD traits and symptoms exhibit a continuous distribution in nature, we conducted a quantitative analysis of monozygotic twin-twin differences in autistic trait severity in a large sample of identical twins with and without ASD (n=347 pairs).

Methods: Twins were assessed using a standardized quantitative measure of autistic traits, the Social Responsiveness Scale-2 (SRS-2); the subjects represented the full range of autistic trait variation observed in nature. Seventy-nine of the identical pairs involved at least one twin clinically-diagnosed with ASD—these encompassed all monozygotic (MZ) twin pairs who were SRS-2-phenotyped within the Interactive Autism Network (IAN) registry and the Autism Genetic Resource Exchange (AGRE); the latter were additionally assessed using the Autism Diagnostic Observation Schedule (ADOS).

Results: Probandwise concordance for MZ pairs in which the proband was clinically-affected by ASD was 91% by research diagnosis, lower by community diagnosis; four out of five MZ pairs confirmed discordant by research diagnosis were female. The SRS-2 mean scores for clinically-affected twins were pathologically shifted approximately 3.5 standard deviations in comparison to the twins ascertained from the general population. MZ twin-twin difference scores exhibited a continuous distribution in each group (Figure 1), with pairs from the general population (Panel A1) spanning a much narrower range of differences than the clinical groups (Panels A2 and A3). MZ twin-twin intra class correlations were markedly higher in the general population (0.86) than among clinically-affected pairs (0.42), suggesting that much of the SRS-2 measured variation in symptom severity *above* the threshold for clinical diagnosis is unrelated to the heritability of the condition itself. Many MZ pairs lie on opposite sides of a diagnostic threshold (Panel B), yet generally differ by less than 1.5SD of the SRS-2 measurement. There were no age effects on MZ twin trait correlations, and for presumed discordant pairs, the magnitude of difference was comparably reflected by the SRS-2 and ADOS (Panel C).

Conclusions: These findings support very substantial heritability for ASD, with symptom burden distributed across a continuous severity gradient that extends to the general population. Extreme discordance for autistic trait burden in MZ twins is rare, and its frequency is inflated when

diagnosis relies exclusively upon community ascertainment. Although both autism and autistic trait variation in the general population are strongly genetically influenced, inter-individual variation in severity *above* the threshold for diagnosis may be significantly affected by non-shared environmental factors, possibly operating early in life, and incurring random deviations from an identical co-twin's social developmental trajectory. This has major implications for biomarker studies involving clinical subjects, and for the elucidation of non-inherited factors that may exert enduring influences on the severity of clinical autistic syndromes

1:42 **129.002** The Genetics of Childhood Disintegrative Disorder

A. R. Gupta[1], *C. Sullivan*[2], *A. Westphal*[3], *K. A. Pelphrey*[4], *F. Shic*[5,6] *and A. Jack*[7], *(1)Pediatrics and Child Study Center, Yale University, New Haven, CT, (2)Yale University, New Haven, CT, (3)Child Study Center and Department of Psychiatry, Yale University, New Haven, CT, (4)University of Virginia, Charlottesville, VA, (5)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (6)Pediatrics, University of Washington School of Medicine, Seattle, WA, (7)The George Washington University, Washington, DC*

Background: There is abundant evidence for the contribution of rare variants to autism spectrum disorder (ASD). However, little is known about the genetics of childhood disintegrative disorder (CDD) due to the rarity of this condition (1-2/100,000) and of autistic regression in general. Given the rarity, severity, and apparently sporadic transmission seen in most CDD cases, we hypothesized that rare variants also contribute to the etiology of CDD. Investigating the genetics of CDD will help elucidate the pathophysiology of a disorder which is not well understood.
Objectives: To identify rare variants that are associated with CDD, to determine if the candidate genes affected by these variants are coexpressed and/or belong to a common molecular pathway, and to compare these genes to those identified in an independent cohort of subjects affected by autistic regression.

Methods: We performed whole exome sequencing and copy number variant analyses of 18 families affected by CDD, which included 18 probands, 18 unaffected sibling controls, and their parents, to identify three types of rare (novel or found at most once across online and in-house databases) protein-changing variants: (1) *de novo*, (2) homozygous, and (3) hemizygous (mother-to-son transmission on chrX). We used the human BrainSpan exon-array transcriptome dataset to plot the brain expression profile of CDD candidate genes and conduct co-expression analysis.

Results: We identified one or more rare variants for all but one proband. CDD candidate genes did not overlap with high-confidence ASD genes. One gene, *SUPT20HL2*, which may play a role in transcription, was affected in two unrelated probands. Candidate genes that were found to be most conserved at variant position and most intolerant of variation (*TRRAP, ZNF236, KIAA2018*) also play a role or may be involved in transcription. A significant number of CDD candidate genes were co-expressed (P=0.0059). Overall, the candidate genes are more highly expressed in non-neocortical regions (amygdala, cerebellum, hippocampus, thalamus, striatum) versus neocortical regions. Moreover, there are increasing levels of expression in amygdala, striatum, and hippocampus during 1-6 years of age, the range that encompasses symptom onset. We compared the difference in median expression levels between non-neocortical and neocortical regions for genes affected by nonsynonymous and synonymous variants in CDD probands and their unaffected siblings, as well as ASD probands from the Simons Simplex Collection (SSC) both with (SSC+R) and without (SSC-R) regression. The expression profile of CDD candidate genes is qualitatively distinct from all comparison gene sets except for that of nonsynonymous variants in SSC+R.

Conclusions: There are important areas of overlap and difference between the genetics of CDD and ASD, perhaps reflecting the similarities and differences between the clinical features of these two disorders. Although there is no overlap between the list of candidate genes, both contain genes which play roles in transcription, offering clues to the pathophysiology of the disorders. The similarity of the expression profile of candidate genes for CDD and SSC+R suggest a pattern relevant to regression.

1:54 **129.003** Exome Sequencing in 8,737 Families Affected By Autism Spectrum Disorder

P. Feliciano[1], *X. Zhou*[2], *I. Astrovskaya*[1], *T. Turner*[3], *S. Xu*[1], *J. Hall*[1], *T. Wang*[4], *L. Brueggeman*[5], *L. Green Snyder*[1], *T. Yu*[6], *E. E. Eichler*[4], *B. J. O'Roak*[7], *J. J. Michaelson*[5], *L. Grosvenor*[1], *N. Volfovsky*[1], *Y. Shen*[8], *W. K. Chung*[9] *and S. Consortium*[1], *(1)Simons Foundation, New York, NY, (2)Department of Systems Biology, Columbia University, New York, NY, (3)University of Washington, Seattle, WA, (4)Department of Genome Science, University of Washington, Seattle, WA, (5)Psychiatry, University of Iowa, Iowa City, IA, (6)Harvard Medical School, Boston, MA, (7)Molecular and Medical Genetics, Oregon Health & Science University, Portland, OR, (8)Columbia University, New York, NY, (9)Pediatrics, Columbia University, New York, NY*

Background:
Autism spectrum disorder (ASD) is a genetically heterogeneous condition, caused by a combination of rare *de novo* and inherited variants as well as common variants in at least several hundred genes. Previous research has identified approximately 100 high-confidence autism risk genes. However, significantly larger sample sizes are needed to identify the complete set of genetic risk factors, which are estimated to include several hundred genes. We have recruited more than 50,000 individuals with ASD and their available first-degree family members into a recontactable research cohort called SPARK (SPARKForAutism.org).

Objectives:

To identify new high-confidence autism risk genes and identify mechanisms of biological convergence among these genes.

To return results to individual families with genetic variants in newly discovered and previously known high-confidence autism risk genes in order to accelerate clinical research targeted to specific genetic etiologies.

Methods:

Participants were recruited and consented online and provided saliva. Whole exome sequencing (WES) and genotyping data were generated for a pilot study of 457 families, including 465 individuals with autism. We subsequently expanded our analyses to 8,737 families, including 9,843 individuals with autism spectrum disorder and 17,772 of their first-degree family members. We identified several classes of genetic variants across multiple modes of inheritance (*de novo*, mosaic, and transmitted), including rare and deleterious single-nucleotide variants, small insertion/deletion variants and large copy number variants.

Results:

In our pilot study of 457 families, we identified nine newly emerging high-confidence autism risk genes. We also identified a returnable genetic cause in 10.8% of families. In our expanded cohort, initial analyses have identified *de novo* and inherited variants in genes and loci that are

clinically recognized causes or significant contributors to ASD in hundreds of families. The dataset has also identified numerous novel candidate loci, which are now being investigated. In order to accelerate knowledge in ASD, we have released all genomic and phenotypic data from these families to the research community.

Conclusions:

We have developed an interdisciplinary, collaborative high-throughput workflow for identifying, confirming and returning individual genetic results related to autism spectrum disorder to hundreds of research participants. Further analyses will greatly increase the number of high-confidence genetic risk factors associated with ASD and also contribute to a deeper mechanistic understanding of the genes and pathways that lead to ASD during development. Returning genetic results to SPARK participants will enable autism research that incorporates genetic etiology at scale.

2:06 **129.004** Characterizing the Neural Phenotype of CHD8 and CHD8-Regulated Targets

C. M. Hudac[1], *J. Gerdts*[1], *T. Turner*[2], *E. E. Eichler*[3], *S. J. Webb*[1] *and R. Bernier*[1], *(1)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (2)University of Washington, Seattle, WA, (3)Department of Genome Science, University of Washington, Seattle, WA*

Background:

CHD8 is one of the most commonly identified genes in ASD with the most prevalent recurrent de novo mutation rate in ASD cohorts and present a strong genetically-defined subtype of ASD (Bernier et al., 2014). Given the regulatory effects of *CHD8* on other neurodevelopmental genes (Cotney et al., 2015), recent evidence indicates that individuals with disruptive ASD-risk mutations to genes that are targeted by CHD8 exhibit a shared phenotype. Little is known about the human neural phenotype; however, *Chd8* haploinsufficient mice exhibit altered auditory functional connectivity (Suetterlin et al., 2018), which may suggest issues in processing auditory information.

Objectives:

We sought to characterize the neural phenotype associated with *CHD8* and genes regulated by CHD8, and predicted a shared neural phenotype.

Methods:

Participants (N=106, see Table 1) were grouped based upon genetic and diagnostic etiology: CHD8, Target, Non-Target, No Event ASD (i.e., no known disruptive genetic event), and Typically-Development (TYP). CHD8 target versus non-target functional gene groups were dichotomized based on prior research (Cotney et al., 2015). A passive auditory oddball EEG experiment (Hudac et al., 2018) measured attention and speed of habituation as reflected by the central N1 (60-140 ms). Multilevel analyses (SAS 9.4) tested group differences in condition (i.e., deviant tone vs. repeated tone) and habituation (i.e., the rate of decreasing P3a amplitude).

Results:

N1 amplitudes revealed the predicted pattern, $F(4, 2400) = 2.89$, $p = .021$, such that auditory deviance was larger in *CHD8* and Target groups, relative to Non-Target group, p's <.036, but not the No Event ASD group, $p = .78$. These effects were in part driven by the overall large N1 response of the Non-Target group (~8 µV) relative to the other groups (~6.5 µV). Notably, neither the *CHD8* or Target groups differed from the No Event (i.e., "idiopathic" ASD) group, p's > .15. There were no significant omnibus effects of habituation. However, pairwise comparisons indicated unique patterns of deviance (trial level p's < .05, LSD), such that the *CHD8* group exhibited early effects (before trial 40) and the Target group exhibited later effects (after trial 20).

Conclusions:

Children with disruptive *CHD8* mutations share a similar neural phenotype to children with a disruptive mutation to a gene targeted by *CHD8*. Critically, this shared phenotype is distinct from genes not targeted by *CHD8*, which suggests a potential converging genetic mechanism associated with *CHD8* that may have implications for an array of high-confidence ASD risk genes. We will discuss these implications and the potential for the distinct habituation patterns as they pertain evidence of overconnectivity in *Chd8* mice.

Oral Session - 5B
Biomarkers (molecular, phenotypic, neurophysiological, etc)
130 - Neuropathology / -omics
2:30 PM - 3:25 PM - Room: 516ABC

2:30 **130.001** The Cerebellar Dentate Nucleus in Autism: Are Neurons and Their Perineuronal Nets Preserved Despite Missing Purkinje Cells?

C. Brandenburg, *B. White, C. Ensor and G. J. Blatt, Hussman Institute for Autism, Baltimore, MD*

Background: Human postmortem studies from our laboratory and others have shown differences in Purkinje cell (PC) number, size and gene expression in the autism brain. In fact, PC dysfunction is the most consistent neuropathological finding in autism, with as many as 75% of cases showing reduced numbers. The lateral hemisphere displays the greatest PC decrease reported in autism. However, the dentate nucleus (DN), which normally receives projections from the lateral hemisphere, did not seem to be affected in preliminary studies of total neuron numbers in autism, although very few postmortem cases have been analyzed. The DN harbors the greatest percentage of neurons in the brain surrounded by a perineuronal net (PNN). Genes involved in PNN formation and function have been implicated in autism.

Objectives: Given the known PC reductions in autism, we aimed to determine whether there are further deficits in neuronal numbers within the cerebellar circuitry, as DN neurons are likely to be impacted by PC deficits. PNNs around the DN neurons were also quantified.

Methods: Immunohistochemistry was performed on human postmortem brain tissue from twenty control and twenty autism cases. From each case, five 40µm sections at every sixth interval through the DN were immunostained for anti-HPLN1, a link protein in the PNN, with neutral red as a counterstain for total neuron counts. Tissue was treated for antigen retrieval with tris-buffer (pH 9) for ten minutes in a scientific microwave at 98˚C, followed by twenty minutes of hydrogen peroxide, forty-eight hours of incubation with primary antibody (anti-HPLN1 1:125, R&D systems), two hours with anti-goat secondary antibody (1:600, Vector Laboratories), one and a half hours with avidin-biotin complex (Vector Laboratories)

with buffer rinses between each step. Nickel-DAB reaction was followed by 30 minutes of neutral red, dehydration through a series of ethanol solutions and five minutes of xylene before being coverslipped. A Zeiss Microbrightfield Stereoinvestigator system was used to quantify neuronal densities within the DN contour. The density of neurons surrounded by a PNN, neurons without a PNN and total neuron numbers were estimated with the optical fractionator method then divided by the total estimated area using the Cavalieri method within the software.

Results: The density of neurons with PNNs, based on HPLN1 expression, was not different between control (mean= 2,429.39±892.37 neurons/mm^3) and autism (mean= 2,141.63±569.80 neurons/mm^3). The density of neurons without a PNN also showed no differences in control (mean= 2,896.47±958.23 neurons/mm^3) or autism (mean= 2,901.33±995.33 neurons/mm^3) and therefore total neuron numbers were similar (control mean= 5,325.86±1,628.85 and autism mean= 5,042.96±1,202.45 neurons/mm^3).

Conclusions: Despite reports of significant reductions in the number of PCs in the lateral hemisphere of the cerebellum, similar reductions are not evident in the DN. Thus the targets of PC output within the DN appear to be preserved by the remaining PCs and inferior olive input. Furthermore, the proportion of neurons surrounded by PNNs compared to those without appear to be unaltered. Further work is underway to determine whether activity-dependent components of the PNN, such as aggrecan, are affected while total PNN numbers remain unchanged.

2:42 **130.002** Age-Related Changes in Axon Density and Myelin Thickness Are Altered in ASD

K. D. Murray[1,2], *A. Carr*[3], *T. A. Avino*[3], *S. Taylor*[4] *and C. M. Schumann*[2,3], *(1)Center for Neuroscience, UC Davis, Davis, CA, (2)Psychiatry and Behavioral Sciences, UC Davis School of Medicine, Sacramento, CA, (3)MIND Institute, UC Davis, Sacramento, CA, (4)Public Health Sciences, University of California, Davis, Sacramento, CA*

Background: Brain imaging studies have linked autism spectrum disorder (ASD) symptomatology to impairments in neuronal communication and cortical synchrony, with the prevailing hypothesis being over-connectivity of local brain regions and under-connectivity of distant regions. However, the cellular developmental trajectory that underlies alterations in neuronal connectivity remains understudied. Postmortem human brain tissue provides an invaluable opportunity to evaluate axonal ultrastructure in brain regions implicated in ASD. Electron microscopy of frontal lobe white matter reveals a disproportionate density of short- and long-range axons in ASD that varies with age (Zikopoulos et al 2018). Although there is extensive evidence of aberrant temporal cortical and subcortical development in ASD, the microscopic ultrastructure of axons in temporal white matter remains unknown.
Objectives: Our goal is to identify the neurodevelopmental changes in cortical axonal ultrastructure in white matter below the superior temporal gyrus (STG) and fusiform gyrus (FG) in neurotypical (NT) human brains, and determine if this trajectory is altered in ASD.

Methods: Postmortem human brain samples from 30 male cases (15 ASD, 15 age-matched NT controls) ranging from 2-44 years of age were micro-dissected from superficial and deep white matter of the inferior longitudinal fasciculus underlying STG in the dorsal region and FG in the ventral region. Tissue was prepared for ultrastructural analysis by electron microscopy (Liu and Schumann 2014). Ultrathin (70nm) sections were imaged at high resolution (8,400x magnification) to manually measure axon density, size, and myelination thickness. Small/medium axons (inner-diameter <0.7μM) in superficial white matter are presumed to be more short-ranging whereas larger axons (>0.7μM) in deeper white matter are presumed to be long-ranging.

Results: The density of smaller size axons decreases with age in NT superficial white matter underlying FG ($p<0.01$) and STG (trend $p<0.08$). This age-related NT decrease in axon density does not occur in ASD in either region, and in fact slightly increases, leading to an overall increase in the density of smaller axons in ASD relative to NT in STG superficial white matter ($p <0.01$). In contrast, there is a reduction in small axon density in FG deep white matter ($p<0.05$). The thickness of myelin in larger axons in superficial white matter underlying STG increases with age in NT ($p<0.01$), but not in ASD, leading to an overall decrease of myelin thickness in ASD in both STG and FG relative to NT ($p<0.01$).

Conclusions: The increase in density of smaller axons underlying STG is consistent with the hypothesis of over-connectivity of short-range local connections. The density of smaller axons decreases with age in neurotypical development, likely attributed to continual refinement of connections and synaptic pruning. However, this pattern of fine-tuning local temporal lobe connectivity is not as evident in ASD. Myelin thickness of larger, presumably longer-range, axons increases in neurotypical development with age, however this increase does not occur in ASD. In fact, myelin thickness of larger axons is reduced in ASD, which may have a dramatic impact on neuronal communication.

2:54 **130.003** Gut Feelings: Linking Gastrointestinal Multi-Omic Profiles with Complex Phenotypes in Pediatric ASD

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Background: Chronic gastrointestinal (GI) issues are a significant co-morbidity in autism spectrum disorder (ASD), and behavioral challenges, such as self-injurious and aggressive behaviors as well as sleep disruption, have been associated with the manifestation of GI symptoms. It is especially important to establish a way to identify when GI issues, such as abdominal pain, are present in autistic individuals who may be unable to directly communicate the location or source of their discomfort, where behavioral changes may be the only indication in these cases. While the role of the gut microbiome in human health is now well established, alterations in the composition of the gut microbiota in patients with neurodevelopmental disorders have been shown to correlate with clinical symptoms such as functional GI disorders (FGIDs).
Objectives: This study represents the largest, most well-controlled exploration of the gut microbiome and metabolome in pediatric ASD. Autistic children, unaffected siblings, and unrelated typically developing controls were compared. Comprehensive clinical data, including behavioral and GI phenotypes, have been analyzed in parallel with microbiome and metabolome results to create novel multi-omic profiles.

Methods: Extensive clinical history was obtained as well as data from several behavioral surveys (Sensory Profile-2, the Repetitive Behavior Scale-Revised, Aberrant Behavior Checklist, Social Responsiveness Scale, and the Child Behavior Checklist) and a two-week diary detailing diet, stooling pattern (Bristol stool ratings and stool frequency), and GI pain. Stool specimens were collected from pediatric subjects with ASD (n=145), unaffected siblings (n=48), and unrelated typically developing children (n=219). The QPGS-Rome III questionnaire was also utilized for the identification of FGIDs across all three groups. Microbiome and mycobiome characterization and global metabolomics were performed. Multiple bioinformatics and biostatistical approaches were utilized to identify individual organisms (both bacterial and fungal) and metabolites of interest.

Results: Differences in both microbial composition and diversity were observed across groups. The greatest shifts in the gut microbiome were associated with GI pain, with distinct differences noted in the ASD group that reported pain. Statistically significant differences ($p<0.05$) were observed in the relative abundances of several organisms that were previously reported as associated with pediatric ASD. These organisms were also associated with specific behavioral patterns and overall severity as well as with a variety of metabolites, including metabolic pathways associated with glutamate and tryptophan metabolism. Unique microbial profiles were also associated with additional behavioral (i.e. self-injurious behavior) and dietary variables (i.e. processed food consumption).

Conclusions: The microbiome-gut-brain axis is emerging as a key component of ASD phenotypes. Distinct differences exist in the gut microbiome and metabolome of children with ASD compared to their typically developing peers. Within ASD, subgroups can be identified based on complex phenotypes composed of behavioral characteristics, GI symptoms, and microbiome/metabolome profiles, and these multi-omic profiles will aid in identifying less communicative autistic individuals who may be experiencing GI pain as well as assist in the development of meaningful selection criteria for future microbially-mediated therapeutic interventions.

3:06 **130.004** Exposome-Wide Association Study in Autism Spectrum Disorder Using Targeted and Untargeted Metabolomics Platforms

C. Hernandez-Ferrer[1], *D. I. Walker*[2], *C. C. Johnson*[3], *M. K. Chung*[4], *I. H. Lee*[1], *W. J. Alvarez*[1], *C. J. Patel*[4], *K. D. Pennell*[3], *D. P. Jones*[5] *and S. W. Kong*[1,6], *(1)Computational Health Informatics Program, Boston Children's Hospital, Boston, MA, (2)Department of Environmental Medicine and Public Health, Icahn School of Medicine at Mount Sinai, New York, NY, (3)Civil and Environmental Engineering, Tufts University, Medford, MA, (4)Department of Biomedical Informatics, Harvard Medical School, Boston, MA, (5)Emory University, Atlanta, GA, (6)Department of Pediatrics, Harvard Medical School, Boston, MA*

Background: Both genetic and environmental risk factors contribute to the liability for autism spectrum disorder (ASD). Epidemiologic studies show that multiple environmental factors could be associated with increased risks of ASD; however, direct measurement of environmental exposures during critical periods of brain development is challenging due to a lack of technology to monitor the exposome during the critical periods of brain development as well as limited availability of relevant biospecimens.
Objectives: To characterize the exposome - the totality of environmental exposures throughout development and lifespan - in patients with ASD and their family members compared to children without ASD using both targeted and untargeted metabolomics platforms.

Methods: Plasma samples (N=1,803) from patients with ASD, their family members and children without ASD were collected from the biorepositories of the Autism Speaks, Boston Children's Hospital, and National Institute of Mental Health. Using gas chromatography - tandem mass spectrometry (GC-MS/MS), 80 chemicals including the neurotoxicants previously reported as environmental risk factors of ASD and the other toxicants were quantitively measured. For the same samples, we used liquid chromatography - high resolution mass spectrometry (LC-HRMS) to measure more than 22,000 features of both exogenous and endogenous origins. To prioritize exposure biomarkers of ASD, we fitted a generalized linear model to each of exogenous and endogenous chemicals after controlling for age, gender and shared environmental effect for each family. Furthermore, metabolic pathways perturbed in ASD were identified using annotated endogenous chemicals from LC-HRMS. Finally, the impact of exogenous chemicals on known biological pathways were analyzed by integrating GC-MS/MS measures with annotated chemicals in biological pathways from the Kyoto Encyclopedia of Genes and Genomes.

Results: GC-MS/MS analysis comparing cases with controls did not reveal any significant correlation between exogenous exposure biomarkers and ASD status after false discovery rate (FDR) correction. For 24 exogenous chemicals, the plasma concentrations were significantly correlated with blood gene expression levels of 822 transcripts at FDR < 0.05, which were enriched in focal adhesion, Fc epsilon RI signaling pathway, and proteoglycans in cancer. For LC-HRMS data, we found 191 features significantly associated with ASD compared to controls (FDR < 0.05). More than half of the significant features from LC-HRMS showed higher concentrations in ASD compared to controls including 35 annotated chemicals matching endogenous metabolites (N=13), dietary nutrients (N=8), pharmaceuticals (N=4), and environmental pollutants (N=2). Furthermore, concentrations of 10 exogenous exposures were significantly correlated with 736 features from LC-HRMS (FDR < 0.05) that were enriched in de novo fatty acid biosynthesis, C21-steroid hormone biosynthesis and metabolism, and vitamin D3 metabolism among others.

Conclusions: We performed the largest exposomic study in ASD and discovered endogenous and exogenous exposures significantly associated with ASD after controlling for shared environmental effect. By integrating GC-MS/MS data with gene expression and untargeted metabolomics profile, we highlighted physiological changes due to exogenous environmental exposures suggesting potential biological mechanism associated with environmental risk factors.

Oral Session - 6A
Cognition: Attention, Learning, Memory
131 - Cognition and Motor Control
1:30 PM - 2:25 PM - Room: 517C

1:30 **131.001** Information Processing in Autism Is Less Impacted By Increasing Decision Complexity

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Background: Recent studies have found that people with autism make more consistent and conventionally-rational decisions than do neurotypical (NT) adults (e.g., Farmer et al., 2017). However, little is known about the processes of information sampling and integration that underlie these patterns of behaviour. Studies of NT decision-makers have found that these processes can be illuminated by tracking eye-movements during the decision.
Objectives: To use eye-tracking to test for differences in the information processing that underpins autistic and NT decision-making.

Methods: 35 autistic adults were matched on age, gender, and IQ to 35 NT participants. The experimental task consisted of choosing an apartment to rent from a set presented in table format, where each apartment differed in several attributes (e.g., Rent, Cleanliness, Distance). We varied the

number of apartments (N_apartments = 2,3,5,7) and number of attributes (N_attributes = 2,3,5,7) giving 16 combinations in a 4x4 design. The tables were presented on a screen while the participant's gaze was tracked. We measured several variables including decision time, transition patterns (within apartment or within attribute), search depth (proportion of cells in the table inspected), and proportion of time spent inspecting the ultimately-chosen apartment.

Results: There was a main effect of the number of attributes such that more attributes resulted in slower decision times (F(1.77,120.37)=431.18, p<.01), reduced search depth (F(1.81,123.27)=253.23,p<.01), and an increased proportion of time spent fixating on the ultimately-chosen apartment (F(2.70,183.75)=51.18,p<.01). The same pattern was observed for the number of apartments on decision time (F(1.80,122.63)=453.96,p<.01), and search depth (F(1.78,120.96)=311.73,p<.01). Increasing the number of attributes led participants to transition more frequently from one cell to another within apartments (F(2.21,150.38)=99.27,p<.01), and increasing the number of apartments led participants to transition within attributes more often (F(2.03,137.87)=36.55,p<.01). There were no main effects of autism, and no interactions between autism and the number of apartments on any of the performance measures. However, there were significant interactions between autism and the number of attributes. The autism group's decision times did not slow as much with increasing numbers of attributes (F(1.77,120.37)=9.61,p<.01). The autism group's search depth fell more with increasing numbers of attributes (F(1.81,123.27)=5.91, p<.01), and, with increasing attributes, the autism group increased by more the proportion of time spent fixating the ultimately-chosen apartment (F(2.70,183.75)=4.83,p<.01).

Conclusions: This is the first study to use eye-tracking to examine the information processing underpinning multi-attribute decision-making in autism. There is an intriguing pattern suggestive of broadly the same strategy as NT decision-makers, but one that is less impacted by increasing the number of attributes that are available. One interpretation is that people with autism attach great weight to a small number of attributes, either as a simplifying heuristic or because those attributes are stronger, more valid cues to the utility of an option for this population.

1:42 **131.002** Identification of Autism Spectrum Disorder Subgroups Based on Facial Expression Recognition Performance Profiles: Links to Clinical Symptoms and Neurofunctional Responses

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Background:

Emotion recognition, a critical aspect of social communication, is underpinned by a well-known functional network, including the amygdala and fusiform gyrus, altered in autism spectrum disorder (ASD).

Impairments in emotion recognition in ASD groups relative to controls and differences in amygdala/FG activation have been found in some, but not all studies. This may be due to differences between the employed tests, which varied in terms of their stimulus features (e.g. basic vs. complex emotions, presentation times) and/or due to heterogeneity among autistic individuals.

Objectives:

Our first aim was to create a profile of behavioural emotion recognition capabilities across three facial expression recognition tasks to use as a basis for identifying subgroups. Our second was to ascertain whether these subgroups differed in terms of their clinical symptoms and neurofunctional activation.

Methods:

Study participants were 148-277 autistic individuals and 107-211 control participants (ages 6-30) with either typical development (TD) or mild intellectual disability from the EU-AIMS Longitudinal European Autism Project. Participants completed three emotion recognition tasks: the Karolinska Directed Emotional Faces (KDEF) (basic emotions, long presentation times), the Reading the Mind in the Eyes Test (RMET) (complex emotions/mental states identified from the eye-region only) and the Fleeting Films task (FF) (naturalistic stimuli, short presentation times).

First, we investigated case-control differences on each measure using accuracy and accuracy-adjusted response time as dependent variables.

Second, we used hierarchical clustering to identify subgroups based on combined performance on all three tasks.

Third, we related subgroups to measures of symptom severity (Social Responsiveness Scale-Revised) and adaptive behaviour (Vineland Adaptive Behavior Scale-2nd Edition), as well as functional activation in the amygdala and fusiform gyrus (defined using a regions of interest approach) during a fearful face-matching task.

Results:

Individuals with ASD differed significantly from TD participants across all tasks in terms of accuracy (KDEF: p = 9.8e-05, d = 0.36; RMET: p = 2.7e-06, d = 0.43; FF: p = 5.7e-03, d = 0.38). Accuracy-adjusted response times showed significant differences in tasks with shorter presentation times (RMET: p = 5.0e-05; FF: p = 0.015).

Hierarchical clustering generated one high- and one low-performing cluster for both the ASD and TD groups, validated by bootstrapping.

In functional validation, the ASD clusters differed significantly from one another in symptom severity (SRS: p = 0.011) and level of adaptive function (p = 0.045).

In functional brain imaging, the ASD cluster with impaired emotion recognition showed significantly lower amygdala activation than that with relatively intact emotion recognition bilaterally (left: p = 0.017, d = 0.69; right: p = 0.017, d = 0.845).

Conclusions:

We identified two ASD subgroups based on hierarchical clustering of facial recognition performance profiles. Preliminary external validation of these subgroups suggests that an impaired subgroup has more severe clinical symptoms as well as reduced recruitment of the amygdala, a critical node in the emotion recognition network. If these findings are replicated, facial expression recognition profiles may be useful as a potential stratification biomarker for autism.

1:54 **131.003** Age Moderates the Relationship between IQ and Facial Emotion Recognition at Low but Not High Levels of Autism Spectrum Disorder Symptom Severity

K. M. Hauschild[1], *A. N. Gioia*[2] *and M. D. Lerner*[1], *(1)Psychology, Stony Brook University, Stony Brook, NY, (2)Psychology, Stony Brook University, Albertson, NY*

Background: There is marked heterogeneity in the facial emotion recognition (FER) abilities of individuals with autism spectrum disorder (ASD; Harms, Martin, & Wallace, 2010). Due to a prevalent belief that individuals with ASD experience deficits in the implicit encoding and holistic processing of facial information (Behrmann et al., 2006), one interpretation of this variability has been that it represents individual differences in the capacity to develop and enact effective compensatory processing strategies (Rutherford & Troje, 2012). This has led to the examination of the role overall cognitive functioning (often operationalized by an intelligence quotient; IQ) may play as a proxy for these alternative, compensatory processing mechanisms in predicting FER abilities (Dyck, Pick, Hay, Smith, & Hallmayer, 2006). However, additional factors that may moderate this relationship such as participant age (Lozier, Vanmeter, & Marsh, 2014) and stimulus characteristics have rarely been explored. Given that FER abilities reach maturity during late-adolescence (Thomas et al., 2007) and that typically-developing individuals demonstrate a processing advantage for own- compared to other-age facial stimuli (Rhodes & Anastasi, 2012), we hypothesized that participant age would moderate the relationship between IQ and own-age FER abilities such that overall cognitive functioning would only be related to FER abilities until late-adolescence when FER expertise is typically achieved (Ewing, Karmiloff-Smith, Farran & Smith, 2017). Furthermore, we hypothesized that this moderation may be contingent upon ASD symptom severity (Webb, Neuhaus, & Faja, 2017).
Objectives: To delineate the relationship between IQ and own-age FER abilities for adolescents as a function of participant age and ASD symptom severity.

Methods: One hundred and forty-seven adolescents completed a standardized FER task (see Table 1). IQ was assessed by the Kaufman Brief Intelligence Test-2 (KBIT-2; Kaufman & Kaufman, 2004). ASD symptom severity was determined by the Autism Diagnostic Observation Schedule-2 Severity Score (ADOS-2; Lord et al., 2012). A three-way interaction model whereby participant age moderated the relationship between IQ and child FER errors, with this effect in turn moderated by ASD severity was tested.

Results: Results revealed a three-way interaction (B = -.005; p = .01) indicating that age moderated the relationship between IQ and errors in child FER (i.e., the relationship was strongest in the youngest adolescents, weaker in slightly older adolescents, and non-significant in the oldest adolescents), only when participants had low, but not moderate or high levels of ASD symptom severity. At moderate and high levels of ASD symptom severity, IQ significantly predicted own-age FER errors regardless of participant age (see Figure 1).

Conclusions: As predicted, results indicated that the relationship between IQ and child FER errors was moderated by participant age for adolescents. This suggests that overall cognitive ability may only relate to behavioral performance on tasks of FER until a level of developmental expertise is achieved (during late-adolescence). However, this moderation was also found to be contingent upon level of ASD symptom severity indicating that individuals with ASD may rely on compensatory FER strategies that are more closely and continuously tied to aspects of general cognitive functioning.

2:06 **131.004** Kinematics of Prospective Motor Control in Autism Spectrum Disorder: An Exploratory Multilevel Modelling Analysis of Goal-Directed Finger Movements during Smart-Tablet Gameplay

Y. W. Chua[1,2], *S. C. Lu*[2], *P. Rowe*[2,3], *C. Tachtatzis*[2,4], *I. Andonovic*[2,4], *A. Anzulewicz*[5], *K. Sobota*[5] *and J. Delafield-Butt*[2], *(1)Faculty of Humanities and Social Sciences, University of Strathclyde, Glasgow, United Kingdom, (2)Laboratory for Innovation in Autism, University of Strathclyde, Glasgow, United Kingdom, (3)Department of Biomedical Engineering, University of Strathclyde, Glasgow, United Kingdom, (4)Department of Electronic and Electrical Engineering, University of Strathclyde, Glasgow, United Kingdom, (5)Harimata Sp. z.o.o., Kraków, Poland*

Background:

Disturbance in movement is widely observed in autism and differences have been measured at the level of movement kinematics. Anzulewicz et al (2016) showed that gesture patterns from smart-tablet gameplay can distinguish between children with autism (ASD) and typically developing children (TD) with high accuracy using a machine learning algorithm, but a limitation of the data-driven approach used is that distinguishing features included in the algorithm may not be grounded in theory.

It has been suggested that prospective control of movement is disrupted in autism, and this may result from impairments in using sensory feedback as the movement unfolds, despite intact control of internally generated movements. Furthermore, movement kinematics variables which are influenced by task difficulty and change with motor development have been identified to indicate prospective motor control.

Objectives:

The objective of the analysis is to explore differences between ASD and TD children in the kinematics of prospective motor control during goal-directed finger movements to different target distances, using data collected by Anzulewicz et al (2016).

Methods:

Touch-screen position coordinates of 4775 goal-directed swipes made during a smart-tablet gameplay by 82 children, aged 3-5 years old, were analysed. Target distance was calculated as the length between start and end position of each swipe and five kinematic variables related to prospective motor control were calculated from time differentials of position, namely: (1) peak velocity of the full movement, (2) peak velocity of the first movement unit (1MU), (3) number of movement units (velocity peaks), (4) % time in deceleration and (5) % time to peak velocity. Multilevel modelling was conducted in Stata13.1 to analyse the fixed effects and interaction effect of target distance and ASD diagnosis on each kinematic outcome, including a random effect to control for correlation in the kinematic outcome for swipes by the same individual.

Results:

Increase in 1cm target distance led to an increase in peak velocity of the full movement, and ASD children showed a greater increase than TD (Interaction: 3%, CI: 1% to 4%, p<0.001). TD children showed a 3% reduction in peak velocity (1MU) (CI: -5% to 0%, p=0.05) and decelerate 0.41% longer (CI: 0.20% - 0.63%, p<0.001) for more distant targets, but children with ASD showed the opposite relationship (Peak velocity (1MU) - Interaction: 9%, CI: 3% to 14%, p<0.001; Deceleration - interaction: -0.54%, CI: -0.93% to -0.14%, p=0.008). ASD children reached a peak in velocity later for more distant targets (Interaction: 1.28%, CI: 0.39% to 2.16%, p=0.005), but no relationship is seen for TD children. On average, ASD children have 31% more movement units than TD (CI: 1% to 70%, p=0.04), but showed a 3% smaller increase in movement units for more distant targets (CI:

-5% to -1%, p=0.007).

Conclusions:

The kinematics of prospective control is different for children with ASD and TD, and may help to identify children with autism. These findings are consistent with the idea that individuals with ASD may differ in the use of feedback control, and internal feedforward control may be influenced differently by external constraints such as target distance.

Oral Session - 6B
Social Cognition and Social Behavior
132 - Socioemotional Functioning
2:30 PM - 3:25 PM - Room: 517C

2:30 **132.001** Tell Me More: Storytelling in Autism Reflects Motor, Executive, and Social Impairments

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Background: Narratives provide naturalistic insight into social-communicative and cognitive functioning. A recent meta-analysis shows that children with autism spectrum disorders (ASD) demonstrate impairments in narrative structuring (Baixauli et al., 2016). Reciprocity of movement (e.g., mimicry of interaction partners, imitation) is also crucial for social development. While mounting research indicates motor deficits and impaired social reciprocity in ASD, how these impairments are linked across domains is unclear. Associations among storytelling and measures of motor, executive, and social impairments can help construct the broader picture of behavior and cognition in ASD.
Objectives: This work examines: (a) diagnostic differences in storytelling, as measured by event inclusion and first-person speech, and (b) associations among storytelling and measures of motor, social, and executive function (EF). Event inclusion reflects memory and narrative structuring skill; first-person usage reflects flexibility of speech and perspective-taking. We hypothesized that: (a) compared with typically-developing (TD) children, children with ASD would include less events and use less first-person speech, and, (b) across ASD and TD groups, storytelling measures would be associated with measures of core social, cognitive, and motor impairments of ASD.

Methods: Twenty-eight children (16 ASD: 1f; 12 TD: 3f; M_{age}=10.04), matched on age and IQ, of a total target sample of forty, participated in a "memory game". Children watched a recording of a trained actor, who narrated a brief story while performing specific actions (yawning, arm scratching, face rubbing). Children then retold the story. Sessions were coded for spontaneous mimicry of the narrator's actions. Children's retell was evaluated for proportion of total story events included, and for first-person usage as a proportion of total utterances. Additional measures included: Social Responsiveness Scale (SRS-2), a praxis gesture imitation task, and mimicry of narrator (social functioning); Physical and Neurological Examination for Subtle Signs (PANESS, motor functioning); and Behavior Rating Inventory of Executive Function (BRIEF) and Wechsler Intelligence Scale for Children (WISC-V) Digit Span sub-scale (EF).

Results: The ASD group reproduced fewer events (p=.004) and used less first-person speech (p=.004) than did the TD group, suggesting poorer narrative structuring in ASD. Bivariate correlations (Figure 1) across groups revealed that event inclusion was correlated with motor (PANESS), $r(26)$=-0.57, p=.005, and social-communicative (SRS-2) function, $r(26)$=-0.58, p=.002, the latter being largely driven by the ASD group. Strong correlations of event inclusion with EF and praxis did not survive multiple-comparison corrections; event inclusion was not correlated with mimicry. Due to low dimensionality of first-person speech data, MANOVA was conducted with presence/absence of first-person speech as the predictor variable (Table 1). Children who produced first-person speech had higher motor control (PANESS: p=.03), social-communication (SRS-2: p=.02), and EF scores (BRIEF: p=.01). First-person speech was not associated with praxis or mimicry.

Conclusions: Using measures of event inclusion and first-person speech, this study demonstrated deficiencies in narrative structuring in children with ASD. The findings reveal that storytelling performance is strongly associated with measures of motor and social-communicative functioning. EF was associated specifically with first-person speech usage. Future analyses with the full dataset will examine how storytelling is associated with ASD symptom severity.

2:42 **132.002** Naive Thin-Slice Impressions Reveal Evidence of the Female Camouflage Effect in ASD

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Background: Individuals with autism spectrum disorder (ASD) are characterized by social communication challenges and repetitive behaviors that are quickly detected by experts (de Marchena & Miller, 2017). Recent research suggests that even naïve non-experts are capable of forming accurate impressions about a variety of human dimensions using only narrow windows of experience called "thin-slices" (Slepian, Bogart, & Ambady, 2014). Growing recognition of sex differences in a variety of observable behaviors in ASD (van Ommren et al., 2017), combined with research showing that some autistic girls may "camouflage" their symptoms (Lai et al., 2017), suggests it may be more difficult for naïve interlocutors to detect ASD symptoms in females. In this study, we explore "thin-slice" ratings of interaction quality in females and males with and without ASD.
Objectives: Compare "thin-slice" ratings of matched females and males with ASD, and typically developing (TD) participants. Based on prior research, we hypothesized that autistic girls would be judged as less different than TD girls, whereas ASD boys would be rated as more drastically different than TD boys.

Methods: Seventy-three participants with ASD (N=35, 14 females) or TD (N=38, 13 females) completed a 5-minute "get-to-know-you" conversation with a novel confederate (N=19, 16 females). Diagnostic groups were matched on IQ (ASD: 107; TD: 108; t=-.43, p=.67), but the TD group was younger (ASD: 11.63 years; TD: 9.99 years; t=2.60, p=.01). Autistic girls and boys did not differ significantly on overall ADOS calibrated severity scores (t=.91,

p=.37, Cohen's *d*=.31) or scores on the Social Communication Questionnaire (*t*=.17, *p*=.86, Cohen's *d*=.06). After each conversation, confederates completed a modified version of the Conversation Rating Scale (CRS-ext; Ratto et al., 2011). The CRS-ext includes 6 questions indexing conversational interest, warmth, flow, boredom, distance, and appropriate eye contact on a 1 to 7 Likert scale (range=6-42; higher scores indicate better conversation). A linear mixed effects model included age, IQ, sex, diagnostic group, the interaction between sex and diagnostic group, and a random effect to account for repeated confederates.

Results: There was a trend toward a significant interactive effect of sex and diagnosis on CRS-ext scores (estimate: -5.74, *t*=-1.85, *p*=.07; Figure). Comparing estimated marginal means (Tukey correction) revealed the interaction was driven by a significant sex difference in ASD participants, such that autistic girls had significantly higher CRS-ext scores than autistic boys (*t*=3.49, *p*=.005; Cohen's *d*=.87). TD girls and boys also had significantly higher scores than ASD boys, but there was no significant difference between ASD girls and TD girls (*t*=1.48, *p*=.46; Cohen's d=.36), TD girls and boys (*t*=.66, *p*=.91, Cohen's *d*=.16), or autistic girls and TD boys (*t*=.95, *p*=.77; Cohen's d=.23).

Conclusions: "Thin-slice" ratings of naturalistic conversations hold promise as a low-cost metric to gauge the impression that individuals with ASD make on naïve communication partners in everyday life. However, this method appears to be more effective for the male behavioral phenotype. These findings add to the literature showing that autistic girls are perceived as "less different" than autistic boys, which may reflect partially successful camouflaging.

2:54 **132.003** Associations Among Child Gestures and Measures of Social Communication and Autism Symptoms in Toddlers with and without ASD during a Home Observation

A. Delehanty *and A. Wetherby, Florida State University Autism Institute, Tallahassee, FL*

Background: Results of recent research suggest that there is a relationship between early gestures and developmental outcomes in children with and without autism spectrum disorder (ASD). Unique gesture inventories and the rate that young children use gestures can provide important indicators of ASD and developmental delay (DD).

Objectives: 1) To describe and compare mean rates of child gestures and communicative functions expressed during a home observation, and 2) to examine concurrent relationships among these variables and measures of social communication and autism symptoms.

Methods: Participants were 211 toddlers diagnosed with ASD (*n* = 121), DD (*n* = 46), and typical development (TD; *n* = 44) recruited through screening in primary care from the archival database of the FIRST WORDS Project. Children completed a video-recorded 1) home observation scored using the Systematic Observation of Red Flags for ASD (SORF; M_{length}=56:04, *SD*=6:19) at a M_{age} of 20.01 months (*SD*=1.70), and 2) Communication and Symbolic Behavior Scales Behavior Sample (CSBS), A detailed coding scheme was developed and the first author and one research assistant, blind to child diagnoses, coded child gestures using Noldus Pro© Observer XT.

Results: *CSBS:* Children with TD scored significantly higher than other groups on all composites (Social, Speech, and Symbolic). Children with ASD scored significantly lower than children with DD on the Social composite. *SORF:* Children with ASD scored significantly higher than other groups on social communication, red flags, and total sum scores. ASD differed from TD, but not DD, on the RRB sum score. *Gestures:* A total of 40,738 communicative acts was coded. Toddlers with ASD used a median of 9 unique gestures (DD=9; TD=11). Rate of gesture use significantly differed among all groups (M_{rate} ASD=2.7 per minute; DD=3.50; TD=5.21). The ASD group used a significantly lower rate of deictic gestures than DD and TD but did not differ from DD on rate of conventional and iconic gestures used. Rates of gestures used for behavior regulation differed among all groups; however, rate of acts for joint attention were not significantly different among DD and ASD groups, and for for social interaction, did not differ among groups.

Moderate correlations were observed between the CSBS Social and Symbolic composites and rate of deictic and conventional gestures (range *r*=.34-.46), as well as rate of gestures for behavior regulation and joint attention (*r*=.25-.57). Moderate to strong correlations were observed between the use of deictic gestures for joint attention and CSBS Social, Speech, and Symbolic composites (*r*=.53, .41, and .47, respectively). Moderate to large negative correlations among SORF total scores and rate of gestures for behavior regulation, social interaction, and joint attention were observed (*r* =.29-.55).

Conclusions: Previous investigations have studied child gestures in a structured clinical setting. Gathering information within the home environment is important since 88% of families receive early intervention services at home, and may help teams build consensus on early red flags of ASD. Results suggest that there may be great potential for incorporating gestures into early developmental screening for toddlers who are at risk for ASD.

3:06 **132.004** Age-Related Differences in Adaptive Functioning in Hospitalized Children with ASD: Identifying Subgroups at Risk for Functional Decline

B. J. Taylor[1]*, K. Pedersen*[2]*, C. A. Mazefsky*[3] *and M. Siegel*[4]*, (1)Psychiatry, Maine Medical Center Research Institute, Portland, ME, (2)Department of Psychiatry, Maine Medical Center, Portland, ME, (3)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA, (4)Maine Medical Center - Tufts School of Medicine, Westbrook, ME*

Background:

Approximately 30% of youth with autism spectrum disorder (ASD) experience a marked decline in adaptive functioning during adolescence. However, characteristics defining this vulnerable subgroup are not well understood, including whether age-related declines in adaptive functioning are apparent for males and females equally. Identifying risk factors for declines in adaptive functioning are necessary given that lower adaptive functioning is associated with increased risk for internalizing disorders, psychiatric hospitalization, higher healthcare costs, and decreased capacity for independent living in adulthood.

Objectives:

1) Examine cross-sectional associations between age and adaptive functioning in a large sample of psychiatrically hospitalized male and female youth with ASD; and 2) Evaluate moderators of the age-adaptive functioning association as a first step toward identifying subgroups for whom adolescence may be a particularly vulnerable period of development.

Methods:

Participants were 450 children (79.6% male) with ASD (confirmed by research-reliable ADOS-2) between the ages of 4 and 21 (mean=12.14±3.15). Participants were recruited from six inpatient units comprising the Autism Inpatient Collection (AIC). Hierarchical linear regression models tested associations between age and subscales of the Vineland Adaptive Behavior Scale III. Models were adjusted for verbal ability, nonverbal IQ, ASD severity, and maternal education (as an index of socioeconomic status). Finally, each covariate was further examined as a moderator of associations between age and adaptive functioning. To account for multiple comparisons, only p-values <0.01 were considered statistically significant.

Results:

In fully adjusted models, age was negatively associated with communication skills (β=-0.120, p=0.001), activities of daily living (ADLs) (β=-0.178, p<0.001), and socialization (β=-0.256, p<0.001; Figure 1). The main effect of age was driven by males as age was unrelated to adaptive functioning in females after adjusting for covariates. In males, the greatest difference in adaptive functioning was between those <12 and ≥12 in all domains: communication (partial η^2=0.098), ADLS (partial η^2=0.109), and socialization (partial η^2=0.146). In females, the greatest difference in adaptive functioning was between those <14 and ≥14 in communication (partial η^2=0.054) and ADLS (partial η^2=0.111), and between those <12 and ≥12 in socialization (partial η^2=0.070). No variables moderated associations between age and adaptive functioning in males. In females, associations with age were significantly stronger for those who were minimally verbal relative to fluently verbal in each domain of adaptive functioning: communication (β=0.798, p=0.007; ΔR^2=.046), ADLs (β=0.914, p=0.006; ΔR^2=.059), and socialization (β=1.431, p<0.001; ΔR^2=.148).

Conclusions:

These cross-sectional findings suggest that failure to meet age-expected gains in adaptive functioning increased with age in males only, with 12 years old as a potential age of onset. Because ASD samples are predominantly male (representative of the ASD population), previous reports of an adolescent-decline in adaptive functioning may have been driven by male participants. In females, failure to meet age-expected gains in adaptive functioning may be most evident for those with verbal communication deficits. Longitudinal studies are needed to evaluate predictors of change in adaptive functioning over the course of development and identify mechanisms by which the transition into adolescence may compromise adaptive functioning in youth with ASD.

Poster Session
136 - Cellular models/stem cells
5:30 PM - 7:00 PM - Room: 710

1 **136.001** 3D Forebrain-like Organoids Mimic Fetal Brain Development and Provide a Platform of Studying the Effect Autism-Associated Mutations on Corticogenesis and Chromatin Dynamics

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Background: Key regulatory networks control critical aspects of human cerebral cortex formation. Cellular differentiation, migration, and cortical lamination are controlled by precise dynamic shifts in epigenetic states. Genetic risk data from *de novo* mutations in simplex cases of autism spectrum disorder (ASD) converge during fetal brain development and risk genes form key regulatory networks. However, our understanding of the network characteristics and how specific mutations impact brain development remains limited. This is largely due to lack of available human biological samples of relevant genotypes, cell types, and developmental stages. Induced pluripotent stem cells (iPSCs) have emerged as a powerful tool for modeling human development. Moreover, the *in vitro* differentiation of 3D cortical organoids from iPSCs has been shown to recapitulate the same step-wise neurodevelopmental processes that occur during *in vivo* corticogenesis.
Objectives: To implement a scalable 3D forebrain-like organoid model system and characterize chromatin dynamics during corticogenesis at single-cell resolution.

Methods: We implemented a scalable 3D forebrain-like organoid model system, which has been reported to mimic the same critical fetal developmental time period implicated in ASD risk. Using a modified SpinΩ bioreactor protocol (Qian et al. 2016), we sampled dozens of individual human organoids derived from control iPSCs and matured for 30, 60 and 90 days *in vitro* (DIV). To assay dynamic changes in epigenetic states during organoid maturation, we measured chromatin accessibility using a single-cell combinatorial indexing ATAC-seq assay (Cusanovich et al. 2015) that allows for the generation for thousands of single cells in one experiment. Further, we multiplexed many organoids per experiment, allowing for valuable characterization of inter-sample heterogeneity.

Results: We generated over 10,000 single-cell ATAC-seq chromatin accessibility profiles from forebrain-like organoids. Clustering of these single-cell profiles revealed three clear cellular populations corresponding to neuroepithelial stem cells, neuroprogenitors, and post-mitotic neurons. To relate chromatin accessibility to putative transcription factor activity, we analyzed accessibility peaks for enrichment of specific transcription factor binding motifs. A pseudotemporal ordering analysis on the single-cell profiles revealed a succession of key brain transcription factor activities involved in cortical development. For example, cells putatively expressing transcription factor EMX1 increased between 30 and 60 DIV, reflecting a cell population transition from early neuroepithelial cells to neuroprogenitors, and then to early glutamatergic neurons. We see a strong correlation between the epigenomic shifts with previously cataloged transcriptional changes and transcription factor abundance validating the use of this model. Additionally, our genome-wide assessment of chromatin accessibility revealed previously uncharacterized putative enhancer regions. We are now extending these approaches to patient-specific iPSCs with *de novo* mutations in key transcriptional regulators, such as *TBR1*.

Conclusions: We present the first single-cell resolution characterization of chromatin dynamics during corticogenesis of forebrain-like organoids. These data support the use of organoids for modeling the effect of ASD-associated mutations on corticogenesis and discovering the critical changes in brain development that lead to ASD.

2 **136.002** Dr

ABSTRACT WITHDRAWN

Background:
Autism is a set of neurodevelopmental conditions with a complex genetic basis. Induced pluripotent stem cell (iPSC) studies with autistic individuals having macroencephaly have revealed atypical neuronal proliferation and GABA/glutamate imbalance, the latter also observed in magnetic resonance spectroscopy (MRS) studies. Functional genomics of autism post mortem brain tissue has identified convergent gene expression networks associated with autism. However, it is not clear whether the established autism phenotypes are relevant in the wider autism spectrum. It also not known whether autism-associated in vivo gene expression patterns are recapitulated during in vitro neural differentiation.

Objectives:

To establish differences during early neural differentiation from autism and controls iPSCs by studying the following markers/phenotypes: 1. Neuronal markers, 2. GABA/glutamate cell markers, 3. Neuronal gene expression networks.

Methods:

We generated induced pluripotent stem cells (iPSCs) from a cohort of autistic individuals with heterogeneous backgrounds, and differentiated them into early neural precursors, late neural precursors and early neural cells using an in vitro model of cortical neurogenesis. We undertook high throughput imaging to analyse cellular/molecular markers and RNA sequencing/gene expression analyses to analyse neuronal gene expression pathways.

Results:

We observed atypical neural differentiation of autism iPSCs compared with controls, and imbalance in GABA/glutamate cell populations over time. Gene expression analysis identified altered gene co-expression networks correlated with neural maturation and GABA/glutamate imbalance networks associated with autism post-mortem brains. Gene expression analyses also identified immune pathways enriched in autism neural cells, and found CD44, an autism-associated gene, to be significant.

Conclusions:

Our study demonstrates appreciable differences in neural differentiation between autism and control iPSCs including GABA/glutamate precursor imbalance, and preservation of atypical autism-associated gene networks observed in other model systems.

3 **136.003** Atypical Neurogenesis and Excitatory-Inhibitory Progenitor Generation in Induced Pluripotent Stem Cell (iPSC) from Autistic Individuals

D. Adhya[1], *V. Swarup*[2], *K. M. Jozwik*[1], *L. Dutan Polit*[3], *N. J. Gatford*[4], *D. G. Murphy*[5], *J. Carroll*[1], *J. Price*[6], *D. Geschwind*[2], *D. P. Srivastava*[4] *and S. Baron-Cohen*[7], *(1)University of Cambridge, Cambridge, United Kingdom, (2)University of California, Los Angeles, Los Angeles, CA, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Department of Basic and Clinical Neuroscience, Institute of Psychiatry, Psychology, and Neuroscience, King's College London, London, United Kingdom, (5)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (6)Institute of Psychiatry, KCL, London, United Kingdom, (7)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: Autism is a set of neurodevelopmental conditions with a complex genetic basis. Induced pluripotent stem cell (iPSC) studies with autistic individuals having macroencephaly have revealed atypical neuronal proliferation and GABA/glutamate imbalance, the latter also observed in magnetic resonance spectroscopy (MRS) studies. Functional genomics of autism post mortem brain tissue has identified convergent gene expression networks associated with autism. However, it is not clear whether the established autism phenotypes are relevant in the wider autism spectrum. It also not known whether autism-associated in vivo gene expression patterns are recapitulated during in vitro neural differentiation.
Objectives: To establish differences during early neural differentiation from autism and controls iPSCs by studying the following markers/phenotypes: 1. Neuronal markers, 2. GABA/glutamate cell markers, 3. Neuronal gene expression networks.

Methods: We generated induced pluripotent stem cells (iPSCs) from a cohort of 9 autistic individuals with heterogeneous backgrounds – including six non-syndromic autistic individuals, one individual with 3p deletion syndrome and two autistic individuals with a mutation in the NRXN1 gene, and 3 typically developing individuals, and differentiated them into early neural precursors, late neural precursors and early neural cells using an in vitro model of cortical neurogenesis. We undertook high throughput imaging to analyse cellular/molecular markers and RNA sequencing/gene expression analyses from a subset of autistic individuals and controls to analyse neuronal gene expression pathways.

Results: We observed atypical neural differentiation of autism iPSCs compared with controls, and imbalance in GABA/glutamate cell populations over time. Gene expression analysis identified altered gene co-expression networks correlated with neural maturation and GABA/glutamate imbalance networks associated with autism post-mortem brains. Gene expression analyses also identified immune pathways enriched in autism neural cells, and found CD44, an autism-associated gene, to be significant.

Conclusions: Our study demonstrates appreciable differences in neural differentiation between autism and control iPSCs including GABA/glutamate precursor imbalance, and preservation of atypical autism-associated gene networks observed in other model systems.

4 **136.004** Combining iPSC Derived Neural Cultures and Organoids with Deep Evolutionary Biochemical Mapping and Endogenous Tagging for ASD Associated Genes

K. L. Uhl[1], *S. M. Bilinovich*[1], *T. A. Watkins*[2], *E. M. Mendenhall*[3], *D. Vogt*[1], *D. B. Campbell*[4] *and J. W. Prokop*[1], *(1)Pediatrics and Human Development, College of Human Medicine, Michigan State University, Grand Rapids, MI, (2)Biological Sciences, University of Alabama Huntsville, Huntsville, AL, (3)University of Alabama Huntsville, Huntsville, AL, (4)Department of Pediatrics and Human Development, Michigan State University, Grand Rapids, MI*

Background: Autism Spectrum Disorder (ASD) affects 1 out of 68 children in the United States. Studies suggest that neurobiology underlies characteristic symptoms of ASD as a result of altered early stages of development and genetic mutations to ~1,000 genes. Yet several areas of biology have hindered understanding of ASD, including a lack of biochemical knowledge of genes and a lack of culture techniques with cellular variety and structural complexity. Cerebral organoids are generated from human induced pluripotent stem cells (iPSCs) and provide an advancement in representation of the developing human brain for understanding the ASD associated gene biochemistry.
Objectives: To establish tools for the study of ASD associated genes using neural cultures and organoids from iPSCs. These include deep

evolutionary mapping of functional motifs, endogenous epitope-tags for molecular and cellular characterization, and single cell data processing of genes from public databases.

Methods: Neural organoids were grown to day 40, RNA extracted, ribosomal reduction RNAseq performed on three separate organoids, reads mapped/quantified with Kallisto, and genes compared to the SFARI lists. Mapped genes were then taken through our deep sequence-to-structure-to-function (SSF) analysis tools for motif and domain mapping. CHD8 was chosen as the initial characterization gene. CRISPR/Cas9 was used to generate cells with an endogenously FLAG tagged CHD8 C-terminus to screen further genome modifications affecting CHD8 activity.

Results: Of the 855 ASD genes, 73% (624/855) of them are expressed in the iPSC generated neural organoid at a value above 1 TPM (transcripts per million sequenced reads). A total of 43% of transcripts (1317/3042) are mapped for these 855 ASD genes. Of 25 category 1 SFARI genes, 23 are expressed in neural organoids, with 68% (53/78) of transcripts detected. In comparison to human Allen Institute single cell database, 24/25 genes are expressed. All Cat 1 genes have been taken through our robust SSF tools to map functional regions of the gene. *CHD8*, a Cat 1 gene, is expressed at 15.5±1.7 TPM in our neural organoids and found expressed in 47% of cells in the human Allen Institute single cell database. Functional motif calling for CHD8 in 124 species identified 30 functional motifs, most poorly characterized. To combat this issue, we have generated both iPSCs and NPCs (neural progenitor stem cells) endogenously FLAG tagging the C-terminus of CHD8 followed by a self-cleavage site and neomycin resistance. This construct allows us to capture endogenous CHD8, while providing a tool for rapid screening of CRISPR modifications (knockouts, point mutations, in frame indels) that will be useful in the characterization of the 30 motifs of CHD8.

Conclusions: Like many other labs, we support the use of iPSC neural organoids in ASD gene characterization when combined with multiple human datasets and novel molecular characterization techniques. This work supports the use of high throughput motif mapping strategies for the biochemical/molecular understanding of ASD genes, an area vastly understudied in our current genomic era.

5 **136.005** Development of Human Stem Cell Pre-Clinical Models to Understand Novel ASD Genes Identified in Multigenerational Families

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Background:
In the last five years there have been exciting developments regarding the genetic causes of ASD, however mechanistic analysis of ASD pathophysiology has been impaired by the inaccessibility of disease-relevant brain tissue. Patient-derived induced pluripotent stem cells (iPSC) enable modelling of genetic diseases *ex vivo*, providing an outstanding opportunity to investigate disease mechanisms and ultimately develop and test novel therapies for ASD. Here, we have applied a novel approach to gene discovery in ASD by studying large families and then used iPSC models to determine how the mutation may be linked to ASD.

Objectives:

To develop pre-clinical models to test the role of the genetic variants and more broadly demonstrate the utility of iPSCs in ASD research.

Methods:

iPSC lines from 9 individuals were generated from the family that the variant linked to ASD was identified. Isogenic controls were generated using to CRISPR-Cas9 technology to use alongside the iPSC that carry the variant. A glial/neuron co-culture differentiation protocol was used to generate neuronal networks and visualised using confocal microscopy. Real time PCR, confocal microscopy, calcium signalling assays, multi-electrode arrays (MEAs) and synaptogenesis assays were used for characterisation studies.

Results:

We have successfully generated a neuron/glia co-culture system which have active and functional neuronal networks. We have recently generated CRISPR-Cas9-corrected isogenic control iPSC lines in two members from one of our ASD families where we identified the novel variant linked to ASD. Our preliminary data in our neuron/glial cultures, demonstrates a reduction in neuronal network activity in our mutant iPSCs compared to our isogenic control cells. More specifically we have shown a decreased firing rate, bursting rate and synchrony metrics of the neuronal networks in the cells containing the mutation compared to the isogenic control cells. We are currently establishing a calcium signalling assays to determine functionality of these networks as well as synaptogenesis assays to determine whether there are any defects in synapse function in mutant vs isogenic control cells.

Conclusions:

We have generated a pre-clinical pipeline using human iPSCs to determine how novel genes identified in multi-generational pedigrees may be contributing to ASD. This approach will make an important contribution to our understanding of the aetiology and pathogenesis of ASD and will establish the pipelines to use more broadly with other ASD genes.

6 **136.006** A Novel Cost-Effective Approach to Derivation of Induced Pluripotent Stem Cells from Epstein-Barr Virus Immortalized β-Lymphoblastoid Cell Lines

S. J. Walker[1,2], *D. Leavitt*[3], *A. Wagoner*[1] *and D. Mack*[4], *(1)Wake Forest University Health Sciences, Winston Salem, NC, (2)Wake Forest Institute for Regenerative Medicine, Winston Salem, NC, (3)Wake Forest University, Winston Salem, NC, (4)University of Washington, Seattle, WA*

Background: Autism spectrum disorders (ASD) may be viewed as a collection of heterogeneous disorders that are currently diagnosed based upon DSMV criteria. The vast phenotypic differences that can exist from individual to individual suggest that the underlying etiologies are complex and

likely involve multiple genetic and environmental inputs. Given that the availability of tissue, especially brain tissue, from ASD patients is extremely limited, the development of alternative tools to investigate molecular and neurobiological mechanisms is critically important. One key resource for ASD research is immortalized lymphoblastoid cell line (LCLs) banks generated from proband and family member blood samples. Induced pluripotent stem cells (iPSC), derived from these LCLs, can be to generate patient-specific neurons for use in downstream mechanistic studies.

Objectives: The objective of this study was to use LCLs to generate iPSCs for the downstream study of neurobiological aspects of ASD. The availability of a streamlined, standardized, reproducible, cost-effective, and efficient approach will render the use of well-characterized LCLs for ASD research a gold standard.

Methods: We obtained LCLs from two males (proband and sibling) from the Autism Genetics Resource Exchange (AGRE) and two males (proband and parent) from the NIMH Repository and Genomics Resource (Phelan-McDermid Syndrome [PMDS] patients). IPSCs were generated from all 4 EBV-LCLs by transfection with Epi5 Episomal iPSC reprogramming plasmids. For the first 7 days after transfection, cells were cultured on Matrigel-coated plates in N2B27 based medium. After 7 days, the reprogramming cells were cultured in Essential-8 medium until ready for passaging. PCR, RT-PCR, immunocytochemistry, and a novel assay, the Taqman® human pluripotent stem cell Scorecard™ Panel were used to fully validate endogenous pluripotency of all iPSC clones generated.

Results: IPSCs, generated via transfection with Epi5 Episomal iPSC reprogramming plasmids, were apparent as early as Day 8 post-transfection and ready for propagation as early as Day 18. IPSCs derived from LCLs obtained from the AGRE were propagated to passage 23 first, followed by the PMDS lines, which are currently at passage 10. Two clonal iSPC lines per original LCL were evaluated for normal karyotype, expression of pluripotency markers, and loss of OriP/EBNA-1 expression vectors. We have confirmed these iPSC clones are plasmid-free and EBV-free. Three of four clones had the expected expression of cell-autonomous pluripotency genes and normal karyotype. All clonal lines were allowed to spontaneously differentiate into embryoid bodies and were assayed for pluripotency markers and germline-specific transcripts using the Taqman® human pluripotent stem cell Scorecard™ Panel. Results indicated that all four iPSC lines are suitable for neuronal differentiation protocols.

Conclusions: This protocol describes a reproducible method to efficiently generate iPSCs with standardized and cost-effective reagents. IPSCs produced following this improved protocol can be used to generate and evaluate novel *in vitro* models to study a plethora of previously inaccessible neuronal cell types that underlie pathological mechanisms in ASD.

7 **136.007** Geneotype-to-Phenotype Landscape of the Methyl CpG Binding Domain Highlights a Critical and Novel Role in Neuron Enhancer Regulation and ASD

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Background: The methyl CpG binding proteins including MBD2, MBD3, and MeCP2 have long been thought of as genome regulators for methylation. Throughout their evolution, particularly into invertebrates, the factors have lost their ability to bind methylated DNA, yet maintain their GATAD2A interactions for the Nucleosome Remodeling Deacetylase (NuRD) complex. Recent ENCODE work in HepG2 cells has suggested an MBD3 based GATAD2A role in enhancer biology not driven by DNA methylation, which has not been explored to date in most cell types.
Objectives: In this work we track the inter and intra species evolution, biochemistry, and expression of MBD containing proteins and GATAD2A based NuRD components to determine if they play a role in enhancer biology of neurons.

Methods: Each of 11 MBD containing genes were taken through sequence (1,229 open reading frames), structure, dynamic (120 simulations), human variant (>120,000 human exome/genomes), expression (FANTOM, HPA, GTEx, Allen Brain Atlas) and function analysis tools. Both iPSC and NPC cell lines had GATAD2A endogenously FLAG tagged using CRISPR/Cas9 followed by differentiation and ChIP-Seq in hepatocytes (translate HepG2 ENCODE transcription factor maps) and neurons.

Results: We mapped three critical amino acids (2 Arginine and 1 Tyrosine) to methylation coordination within MBD as confirmed by evolutionary selection, biophysics and molecular dynamic simulations (mds). The movement of these amino acids in mds revealed MBD2, MBD3 and MECP2 to coordinate methyl and hydroxymethyl DNA. Analysis of invertebrates resolved novel functional MBDs in a wide array of species including lancelet, tick, scorpion, spider, cockroach, octopus, and sea cucumber. Moreover, analysis of expression of species that do not possess methyl or DNA binding MBDs, but still coordinate GATAD2A and the NuRD complex, suggest brain and peripheral nerve function. Translation of GATAD2A data from ENCODE HepG2 using ChIP-Seq from iPSC derived hepatocytes and neurons, elucidated a critical role of GATAD2A regulating enhancers of multiple autism associated genes in non-proliferating cells (*AUTS2, PCDH7, TBL1XR1, TENM2, ADGRL2, PTPRD, SPRY2, CSMD3, FSTL5, TENM4, CNTN5,* and *UNC5D*). Further dissection of human expression databases revealed a shared MBD expression profile between brain and liver relative to hundreds of tissue types, where MBD2 expression is low and MBD3 and MECP2 highly expressed, suggesting a shift in methyl binding to MECP2 and GATAD2A localization to enhancers of ASD associated genes. Single cell analysis of the Middle Temporal Gyrus revealed only 41% of cells expressing a functional MBD protein (16% MECP2, 11% MBD2, 7% MBD3, 3% MECP2/MBD2, 2% MECP2/MBD3, 2% MBD2/MBD3, 0.4% MECP2/MBD2/MBD3) and 29% expressing GATAD2A/B, with only 13% of cells overlapping (7% MECP2, 5% MBD2, 4% MBD3).

Conclusions: The regulation of methylation binding in neurons and hepatocytes by MBD proteins seems to suggest a more diverse role than previous thought, with GATAD2A driven NuRD complex serving a primary role in enhancer regulation of ASD genes and MECP2 present in the most cells for methylation binding, suggesting a model for Rett syndrome genotype-to-phenotype MECP2 mutations.

8 **136.008** High Throughput Screening of Human Induced Pluripotent Stem Cell (hiPSC)-Derived Organoids Reveals Cellular and Electrophysiological Phenotypes in Idiopathic Autism

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Background:
Human induced pluripotent stem cells (hiPSCs) are an important tool for understanding the interaction between genetics and cellular function in autism. hiPSC-derived three dimensional (3D) organoid cultures, such as serum free embryoid bodies (SFEB), can mimic aspects of early corticogenesis, and therefore provide insights regarding potential neurodevelopmental perturbations with respect to autism. However, the utility of 3D organoids is restricted by variability and reproducibility, and require large sample sizes for sufficient statistical power. This can be addressed by application of high-throughput methods in screening for autism-relevant phenotypes.

Objectives:

We aimed to apply assays such as high-content imaging and multielectrode array (MEA) to screen for autism-relevant phenotypes in hiPSC-derived organoids. Our goal is to develop a platform to establish neuronal phenotypes in 3D cultures, and use these methodologies for phenotypic drug screening and translational medicine.

Methods:

We used the SFEB model optimized by Nestor et.al. (2013). SFEBs were differentiated from autism and control iPSCs by plating in a 96-well V-bottom plate for 14 days, after which the SFEBs were transferred to cell culture inserts and grown until 60 days in vitro (DIV). All imaging for immunocytochemistry was done using the ThermoFisher ArrayScan XTI. For electrophysiology, SFEBs were transferred to 48-well MEA plates coated with polyethylenimine and laminin. Baseline spontaneous activity as well as response to pharmacological agents was measured for 20 minutes. Calcium imaging was performed by transducing SFEBs with AAV9-GCamp6 and imaging for 2 minutes per well 7 days post transduction.

Results:

First, we determined if there were differences in cellular composition and morphology between autism and control SFEBs. Because excitatory/inhibitory balance has emerged as a possible hypothesis underlying autism neurobiology, we examined ratio of γ-aminobutyric acid (GABA)ergic and glutamategic populations within SFEBs. Using high content imaging, we found a decrease in GABAergic neurons in the autism cohort (n=270 SFEBs/line). Consistent with this finding some of our autism lines showed increased baseline spontaneous network-level synaptic activity (n = 72 SFEBs/line).dditionally, we found a potential deficit in synaptic plasticity based on the lack of response to induction of long-term potentiation with glycine. We have also demonstrated that calcium transients from individual neurons can be detected in control and autism-derived SFEBs using high content live-cell imaging. Activity from individual neurons will be correlated with field recordings from the MEA, as well as analysis of microcircuitry around active electrodes, to determine the contribution of individual neurons to network activity.

Conclusions:

In this study, we addressed the issue of experimental variability in 3D-organoids by adapting high-throughput approaches. Future studies would benefit from additional refinement of high-throughput methods, as well as an increased number of cell lines. Our approach increases the efficiency of screening for autism-relevant phenotypes, and provides a promising starting point for building phenotypic drug screening platforms.

9 **136.009** Idiopathic ASD Patient Derived Neural Precursor Cells (NPCs) Exhibit Dysregulated Proliferation and Altered Response to bFGF Stimulation

M. Williams[1], *S. Prem*[1], *R. J. Connacher*[2], *X. Zhou*[3], *A. Markov*[3], *M. Mehta*[4], *P. G. Matteson*[4], *J. H. Millonig*[4] *and E. DiCicco-Bloom*[1], *(1)Rutgers Robert Wood Johnson Medical School, Piscataway, NJ, (2)Rutgers University- New Jersey Medical School, Piscataway, NJ, (3)Rutgers University, Piscataway, NJ, (4)Center for Advanced Biotechnology and Medicine, Rutgers Robert Wood Johnson Medical School, Piscataway, NJ*

Background: Autism spectrum disorder (ASD) is a complex, heterogeneous disorder exhibiting abnormalities in social communication and repetitive behaviors. Despite being highly heritable, the majority (~80%) of cases are genetically undefined. Postmortem and genetic studies suggest convergence on early neurodevelopmental processes in ASD pathologenesis. Further, ~20% of ASD individuals exhibit macrocephaly while ~10% exhibit microcephaly. One mechanism implicated in altered brain size is neural precursor cell (NPC) proliferation.
Objectives: Utilizing a cohort of three families, each containing a male with idiopathic autism and his unaffected brother, we investigated proliferation phenotypes in NPCs derived from induced pluripotent stem cells (iPSC). We hypothesized autism NPCs would exhibit proliferation defects compared to controls.

Methods: NPCs expressed markers Sox2, Pax6, and Nestin, and differentiated into neurons and glia. Assays examined 2 to 5 iPSC clones/individual and for each, ≥2 NPC lines were derived. A minimum of three experiments/NPC line was conducted per assay. Cells were cultured in control media +/- Fibroblast Growth Factor (bFGF) and labeled with tritiated-thymidine to assess DNA synthesis. Cultures were dissociated at 2, 4 and 6 days and quantified via hemocytometer. To measure apoptosis, NPCs plated for 24h were fixed, stained for cleaved caspase-3, and quantified. Protein levels were visualized via western blot.

Results: All ASD individuals exhibited altered NPC proliferation with either hypoproliferation or hyperproliferation. The hypoproliferative group, comprised 2 I-ASD individuals, exhibited a reduction in DNA synthesis (ASD-1072-65%, p <0.0001; ASD-1012-20%, p =0.0055) and cell numbers after 6 days (ASD-1072-60%, p <0.0001; ASD-1012-40%, p =0.0144). The hyperproliferative group (1 ASD) displayed increased DNA synthesis (ASD-1077-60%, p <0.0001) and proliferation (ASD-1077-60%, p <0.0001). Though all NPCs displayed changes in proliferation, each displayed person-specific defects in S-phase entry and apoptosis. To determine whether signaling pathways that regulate proliferation were affected, NPCs were stimulated with developmentally relevant mitogen, bFGF. ASD NPC proliferation was inversely correlated with mitogenic response. Hypoproliferative NPCs exhibited ~20% increased sensitivity (ASD-1072 p= 0.0059; ASD-1012 p= <0.0001) to bFGF, while hyperproliferative NPCs displayed diminished response, (~30%) (ASD-1077, p<0.0001). To begin defining mechanisms, we assessed a key mitogenic pathway, ERK signaling. In hypoproliferative NPCs, p-ERK1 levels were increased; whereas hyperproliferative NPCs showed no difference. Lastly, we wondered, do ASD proliferation differences emerge only in the neural lineage? Interestingly, there were no differences in iPSC proliferation in ASD subjects regardless of NPC proliferation phenotypes.

Conclusions: Using iPSC technologies, we observe dysregulation of ASD NPC proliferation and altered responsiveness to bFGF compared to sex-matched, sibling controls. In individuals exhibiting hypoproliferation, increased sensitivity to bFGF correlated with increased levels of p-ERK1, suggesting dysregulation of a key developmental signaling pathway in some ASD individuals. More broadly the expression of dysregulated proliferation in NPCs specifically, and not iPSCs from which they were derived, may suggest why the CNS is a major disease target. In aggregate, our findings suggest that alterations in neurogenesis may be a common feature of autism, while more nuanced differences underscore the need

for personalized medicine in this heterogeneous disorder.

10 **136.010** Induced Pluripotent Stem Cell Modelling for the Role of NRXN1 Deletion in Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) has a high co-morbidity with epilepsy clinically. Genetically it is associated with hundreds of rare risk factors, and *NRXN1* gene is among the most common ones in ASD, schizophrenia, intellectual disability, epilepsy and developmental delay. The pre-synaptic protein Neurexin1 (*NRXN1*) signals bi-directionally through both excitation and inhibition. Previous studies suggest that the short presynaptic *NRXN1β* is primarily involved in excitation, whereas the long *NRXN1α* regulates both excitation and inhibition, via differential splicing and interactions with postsynaptic Neuroligins, GABAergic or Glutamatergic receptors and SHANKs. Deletions and/or mutations of the *NRXN1* gene have been implicated in a number of neurodevelopmental diseases including ASD. However, the functional consequences of *NRXN1* lesions are unknown, due to the lack of patient-derived disease models. Induced pluripotent stem cells (iPSCs) have the potential to revolutionize human disease modelling *in vitro* and to target unmet clinical needs.

Objectives: NRXN1 protein is expressed in both excitatory and inhibitory synapses, and deletion of either heterozygous and homozygous *NRXN1* has been implicated in altering the excitatory and inhibitory postsynaptic transmission. Furthermore, Neurexins are essential for coupling voltage-gated calcium channels to the release machinery. We hypothesize that *NRXN1α*$^{+/-}$ gene deletion may dysregulate the balance of synaptic excitation and inhibition and disturb the electrical electrical firing and calcium signalling of neurons. The aim of this study was to investigate the impact of *NRXN1α*$^{+/-}$ deletion on iPSC-derived neurons and uncover the functional phenotypes and molecular pathways.

Methods: Using skin biopsies from 3 ASD patients with *NRXN1α*$^{+/-}$ deletion and 5 healthy donors, we derived induced pluripotent stem cells (iPSCs). The iPSCs were differentiated into 100-day cortical excitatory neurons using dual SMAD inhibition. Neuronal function were investigated using single cell patch clamping and calcium imaging. Furthermore, RNA sequencing was performed to investigate the underlying molecular mechanism.

Results: 100-day neurons with *NRXN1α*$^{+/-}$ deletion displayed higher potassium and sodium currents, with selectively impaired depolarization and repolarization characteristics. The action potential amplitude was significantly increased, whereas the action potential threshold was decreased in *NRXN1α*$^{+/-}$ deletion neurons. The repolarization slope was significantly increased and consequently, the repolarization duration was decreased. live cell calcium imaging on the 100-day neurons with Fluo4-AM showed neuronal networks displayed inherent spontaneous firing activity with a significant increase in the frequency and duration of calcium transients in *NRXN1α*$^{+/-}$ deletion neurons. The transcriptome analyses have demonstrated substantial up-regulation in ion channels and transporter activity, with voltage-gated calcium channels (VGCCs), voltage-gated potassium channels (VGKCs) and voltage-gated sodium channels (VGSCs) being mostly enriched among the differentially expressed genes. In addition, the KEGG pathway analyses have revealed further impairments in calcium signaling, vesicle exocytosis and synaptic transmission.

Conclusions: Our results show for the first time that deletions of *NRXN1α*$^{+/-}$ gene impair the electrical firing of human neurons, in addition of their calcium transients, illustrating the value of this patient-derived iPSC model with *NRXN1α*$^{+/-}$ deletion for studying ASD disease phenotypes. The *NRXN1α*$^{+/-}$ iPSCs may be offered as a human model with translatable phenotype for drug screening and testing of ASD.

11 **136.011** Investigating the Neurodevelopment of FOXG1 Haploinsufficiency Syndrome in Urine-Derived iPSCs

ABSTRACT WITHDRAWN

Background: FOXG1 syndrome is a rare neurodevelopmental disorder characterized by a rare ASD characterized by seizures, an unusually small head size (microcephaly), intellectual disability, stereotyped movements, and limited social interaction. It is caused by a mutation or deletion of a single copy of the *FOXG1* gene on chromosome 14.

Objectives: In this study, we aim to elucidate the role of *FOXG1* in neurodevelopment and characterize cellular phenotypes of the disorder by modeling *FOXG1* syndrome using induced pluripotent stem cells (iPSCs).

Methods: We generated urine-derived iPSC lines from a female patient with a ~ 3 MB deletion containing the *FOXG1* gene, a sex-matched family member control, and an artificially induced *FOXG1* knockout (KO) cell line using CRISPR/Cas9, and an isogenic control.

Results: Our *FOXG1* $^{+/-}$ models recapitulate expected reductions in *FOXG1* compared to controls in neural progenitor cells (NPCs) and act as viable models for *FOXG1* syndrome *in vitro*.

Conclusions: Our goal is that by modelling *FOXG1* haploinsufficiency syndrome in human iPSCs, we may better understand how a loss of *FOXG1* leads to such profound neurodevelopmental deficits

12 **136.012** Molecular Consequences of Rare Cask Mutations Found in Autism and Neurological Disorders

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Background: Differences in synaptic development, pruning, plasticity, and signaling have been implicated in autism spectrum disorder (ASD) both from genetic and functional studies. One of the critical proteins active at the pre- and post-synapse is calcium/calmodulin-dependent serine protein kinase (CASK). The gene is located on the X chromosome, and when mutated causes a range of neurodevelopmental disorders including ASD. In the general population, depletion of loss-of-function and missense mutations affecting *CASK* have been reported. Although the role of CASK during neuronal development have been studied in model organisms, and it has been shown to interact with many genes involved in ASD etiology in cellular models, studies investigating the direct molecular consequences of *CASK* mutations in human neurons and how it is involved in ASD etiology are lacking.

Objectives: Our project aims to elucidate the downstream effects of different *CASK* mutations using patient-derived induced pluripotent stem cell (iPSC) derived neuronal populations.

Methods: We identified two *CASK* mutation carriers through research and clinical genetic screenings; a male with ASD without cognitive impairments carrying a maternally inherited splice-site mutation and a female with severe intellectual disability and microcephaly with pontine and cerebellar hypoplasia (MICPCH) carrying a *de novo* tandem duplication of two exons. We derived iPSCs from fibroblast of the mutation carriers and two sex-matched controls and analyzed the molecular, morphological and functional consequences of the mutations in iPSC-derived neuronal epithelial stem cells (NES) and differentiated neurons. We performed RNA-sequencing and single cell RNAseq of neuronal populations after 4 week of differentiation to identify dysregulated genes, molecular pathways, and affected neuronal subtypes. Additionally, we analyzed the synaptic and neurite morphology of the neurons and measured individual neuron and neuronal network activity using calcium signaling.

Results: We confirmed in neuronal cells that both mutation carriers have ~50% reduction of CASK protein. This reduction of CASK leads to dysregulation of 560 genes with a false discovery rate <1.0e-5. Among these, downregulated genes converge specifically in the synaptic vesicle cycle pathway and upregulated genes in signaling pathways, such as the Wnt pathway. Our single-cell RNA-seq data suggests that the NES cells in our undirected differentiation protocol develop in to five distinct neuronal cell populations of which the excitatory neuronal population is affected explicitly in neurons derived from the ASD patient. Our preliminary calcium imaging results also suggest that reduced and/or delayed spontaneous network activity occurs in the cells with reduced levels of CASK.

Conclusions: Our results indicate that rare variants in *CASK* impair the synaptic vesicle pathway with consequences to neuronal activity. Moreover, our results highlight potential drug targets such as the Wnt signaling pathway which could potentially act as a route for drug development for CASK deficiency. The use of iPSC-derived neurons from mutation carriers with variable phenotypes opens a window to understanding direct consequences of *CASK* mutations at the molecular and single cell level.

13 **136.013** Understanding the Role of Autism Related Presynaptic NRXN1 and Postsynaptic SHANK3 in Regulation of Activity Dependent Plasticity Using hiPSC Derived Cortical Neurons

A. Paul[1], *A. T. Massrali*[2], *L. Dutan Polit*[3], *N. J. Gatford*[4], *D. Adhya*[5], *D. P. Srivastava*[4], *M. R. Kotter*[6] *and S. Baron-Cohen*[7], *(1)Department of Psychiatry, Autism Research Centre, Cambridge, United Kingdom, (2)Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Department of Basic and Clinical Neuroscience, Institute of Psychiatry, Psychology, and Neuroscience, King's College London, London, United Kingdom, (5)University of Cambridge, Cambridge, United Kingdom, (6)Department of Clinical Neurosciences, Wellcome Trust-MRC Stem Cell Institute, University of Cambridge, Cambridge, United Kingdom, (7)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: Autism Spectrum Conditions (ASC) are a set of complex heterogeneous neurodevelopmental conditions characterised by impairments in social cognition, communication development alongside unusually narrow interests and sensory hypersensitivity. Genetic studies suggest that mutations, deletions and copy number variations in synaptic genes affect neural communication and synapse formation/pruning thereby altering brain development and connectivity. The homeostatic equilibrium of synaptic connections and the dynamic changes in neurites and dendritic spines in response to environmental changes in the early brain is a longstanding scientific question in autism research. NRXN1 and SHANK3 are presynaptic and postsynaptic genes respectively and are known to be highly penetrant for syndromic autism. However, the contribution of NRXN1 and SHANK3 towards autism pathophysiology through the regulation of activity dependent plasticity is not well characterised in human neurons.

Objectives: The aim is to study NRXN1 and SHANK3 deletion-mediated differences in the structure and function of synapses and to investigate how the dynamics of actin cytoskeleton might be in response to environmental changes. The emerging cellular phenotypes will be amenable to hypothesis-driven high content screen-based experiments aiming to rescue the synaptic deficits.

Methods: In this study we are using iPSCs from individuals with deletions in SHANK3 (n=2, 1 male, 1 female), NRXN1 (n=2, 1 male, 1 female) and healthy controls (n=2). GFP tagged NGN2 transcription factor was introduced in the iPSCs using lentiviral vectors to generate induced cortical neurons. The glutamatergic excitatory neurons thus produced were grown for three weeks (Day 21) in culture for the downstream assays. The healthy controls were also tested for siRNA mediated knockdown. The neurons were then treated with KCl, NBQX, TTX and tested for expression of MAP2 and synaptic markers such as Synaptophysin and Homer. The expression of immediate early genes such as Arc and BDNF were measured with immunoblots and RT PCR. Neurite formation was assayed using live imaging of GFP-tagged NGN2 neurons. The spontaneous and activity dependent firing was measured with calcium imaging under non-stimulating and stimulating conditions. The activity of neurons was further measured using extracellular (multielectrode arrays) and intracellular (patch clamp) recordings.

Results: The knockdown experiment demonstrate downregulation of early immediate genes such as Arc and BDNF in response channel blockers NBQX and TTX. The colocalization of presynaptic and postsynaptic markers also show marked decrease on such treatment conditions. The calcium imaging revealed impairment in synaptic connectivity induced by channel blockers and was more severe in knockdown conditions. Moreover, the neurite outgrowth assay on patient lines demonstrate impaired neuronal migration due to changes in the ratio of filamentous to globular actin. Currently we are generating isogenic hiPSC lines by introduction of deletions of NRXN1 and/or SHANK3 gene in wildtype hiPSC lines with CRISPR-Cas9 gene editing technique to validate the results.

Conclusions: Transient knockdown of autism related synaptic genes such as SHANK3 and NRXN1 affects activity dependent transcription of early immediate genes and synaptic connectivity under different stimulating conditions. Patient lines with deletions in these genes are affected severely due to deficits in neuronal migration and inability to form optimal synaptic connections.

14 **136.014** Understanding the Role of Neurexin1 in Early Human Neurodevelopment: Implications for Autism Spectrum Disorder

N. J. Gatford[1], *V. Higgs*[1], *L. Dutan Polit*[1], *D. Adhya*[1,2], *R. Nagy*[1], *A. T. Massrali*[3], *A. Paul*[4], *M. R. Kotter*[5], *J. Price*[1], *S. Baron-Cohen*[6] *and D. P. Srivastava*[1,7], *(1)Department of Basic and Clinical Neuroscience, Institute of Psychiatry, Psychology, and Neuroscience, King's College London, London, United Kingdom, (2)University of Cambridge, Cambridge, United Kingdom, (3)Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (4)Department of Psychiatry, Autism Research Centre, Cambridge, United Kingdom, (5)Department of Clinical Neurosciences, Wellcome Trust-MRC Stem Cell Institute, University of Cambridge, Cambridge, United Kingdom, (6)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (7)Department of Developmental Neurobiology, MRC Centre for Neurodevelopmental Disorders, Institute of Psychiatry, Psychology, and Neuroscience, King's College London, London, United Kingdom*

Background: Autism spectrum disorders (ASD) are a heterogenous group of neurodevelopmental disorders exhibiting complex genetic and neurobiological aetiology. Despite this complexity, genetic risk-factors often converge to influence neurodevelopmental processes e.g. the development of neuronal cellular morphology. In vitro, key stages of this morphogenesis are recapitulated via neuroepithelium formation and neurite outgrowth. Cell adhesion proteins are critical regulators of neurite outgrowth, particularly at the growth cone leading edge. Gene mutations in the neurexin-neuroligin adhesion complex are frequently associated with ASD pathogenesis, particularly, neurexins (NRXN). However, the role this protein super-family and their ASD-associated counterparts play during early neurodevelopment remains unclear.
Objectives: To characterize the expression profile of NRXN1 isoforms, cellular and subcellular distribution in neurodevelopment, and to investigate the role of this protein at key stages of neurodevelopment.

Methods: Six patient-derived induced pluripotent stem cell (hiPSC) lines were generated; three containing no known genetic mutations with no psychiatric diagnoses (typically developing individuals), one hiPSC line generated from an individual with a large 200 kB deletion spanning chr2:50,579,853-50,786,547 and with a diagnosis of ASD; two hiPSC lines generated from a mother and son pair, both harboring identical deletions in NRXN1 spanning chr2:50,661,714-50,720,591. The mother has no diagnosis, and thus is considered to be typically developing, whereas the son has a diagnosis of ASD and microcephaly. All NRXN1 lines have deletions within the NRXN1 gene at an overlapping site. HiPSC lines were neuralized via dual-SMAD inhibition to generate neural progenitor cells (NPC). Terminally differentiated neurons were obtained by the addition of 10μM DAPT to NPC cultures, resulting in the generation of immature cortical neurons. Cells were assessed at two time points during neurodevelopment coinciding with the generation of the neuroepithelium and immature neurons. Cells were assessed for NRXN1 isoform expression using RT-qPCR and immunocytochemistry at both time points. Neural stem cell markers were assessed via immunocytochemistry at neuroepithelial stage staining for Nestin, Zeb2, Pax6, Tuj1, and FoxG1. Immature neuron morphology was assessed by high-content screening and automated quantification staining for mature cortical neuronal markers MAP2 and Tuj1.

Results: Characterization of all six lines via immunocytochemistry revealed all lines were pluripotent and can generate NPCs as determined by expression of pluripotency markers in iPSCs (Oct4, Nanog, SSEA4, TRA-1-81) and NPC markers in neuroepithelial cells (Nestin, Zeb2, Pax6, Tuj1, FoxG1). Significant differences in TRA-1-81 and FoxG1 expression was observed between control and patient iPSCs. Significant differences in Oct4, Nestin, and Zeb2 expression were observed between control and patient neuroepithelial cells. RT-qPCR revealed the patient lines have altered isoform specific expression of NRXN1 alpha at neuroepithelial stage. Further analysis of immature cortical neurons revealed altered neurite outgrowth phenotypes in patient lines compared to control cells.

Conclusions: These data indicate NRXN1 may play a role in early human neurodevelopment, particularly in neuroepithelium formation and the establishment of early neuronal morphology. Further research will focus on comparing these results to isogenic controls and understanding the mechanisms underlying these phenotypes.

15 **136.015** Valproic Acid Induced Expression Changes in Developing Cortical Neurons Provide Genetic Link to Autism Risk

T. Fryland[1], *P. Qvist*[1], *J. Pallesen*[1], *H. S. Ooi*[1], *S. Glerup*[2], *T. J. Corydon*[1], *K. Lage*[3,4,5,6], *J. H. Christensen*[1] *and A. Bøglum*[1], *(1)Biomedicine, iPSYCH, Aarhus University, Aarhus, Denmark, (2)Biomedicine, Aarhus University, Aarhus, Denmark, (3)Department of Surgery, Massachusetts General Hospital, Boston, MA, (4)Broad Institute of MIT and Harvard, Cambridge, MA, (5)Department of Surgery, Harvard Medical School, Boston, MA, (6)Institute for Biological Psychiatry, Mental Health Center Sct. Hans, Roskilde, Denmark*

Background:
Both genetic and environmental factors have been associated with increased risk for autism spectrum disorder (ASD). Large-scale genomic projects have, in recent years, progressively increased our knowledge of the genetic architecture of ASD as well as provided biological and mechanistic insights. However, we are still far from understanding the interplay between genetic and environmental risk factors and how this affect brain development.

Valproic acid (VPA) is a commonly used anti-convulsive drug used in the treatment of epileptic seizures. Prenatal exposure to VPA is associated with increased risk of congenital malformations, intellectual disability (ID), ASD and attention deficiency and hypersensitivity disorder (ADHD). Mice and rats prenatally exposed to VPA show behavioral changes with translational relevance to ASD and evidence points towards VPA causing an imbalance of excitatory and inhibitory neurons.

VPA is a broad histone deacetylase (HDAC) inhibitor with high affinity for HDAC1 and 2 and its actions cause epigenetic- and gene expression changes in cells. The HDACi 4b is a selective class I HDAC inhibitor with high affinity to HDAC 3 compared to HDAC1 and 2.

Objectives:

We hypothesized that prenatal exposure to VPA will dysregulate the expression of ASD risk genes in the brain. Considering, that known rare and de novo ASD risk variants are typically disruptive of protein function, we hypothesized that VPA would decrease the expression of these genes.

Methods:

To investigate these hypotheses, we exposed developing, primary cortical neuron cultures from newborn mice to vehicle, VPA and HDACi 4b, and examined temporal neurite formation, neuronal markers and comparative transcriptomic expression profiles. We integrated our transcriptomic data with data from large psychiatric genomic studies and functional gene sets with relevance to mental illness and performed enrichment analyses.

Results:

Our analyses revealed a comprehensive downregulation of rare and de novo variant ASD risk genes as well as enrichment of common variant ASD risk genes following VPA exposure. VPA also dysregulated genes associated with ID, FMRP targets and other gene sets implicated with mental

illnesses.

Conclusions:

Valproic acid decrease the expression of rare and *de novo* variants ASD risk genes in primary cortical neurons providing a direct link between environmental and genetic risk for ASD. In support, we observed a significant dysregulation of common variant ASD risk genes in cultures exposed to VPA. HDACi 4b did not show the same effects on ASD risk genes, suggesting that inhibition of HDAC1 and 2, but not HDAC3, affects the expression of ASD risk genes.

Poster Session
137 - Cognition: Attention, Learning, Memory
5:30 PM - 7:00 PM - Room: 710

How Does Visual Attention to Social and Non-Social Information Influence Learning and Memory for Autistic Children?

ABSTRACT WITHDRAWN

Background:

Autism Spectrum Disorder has been characterized as associated with atypical attention and memory (Ames and Fletcher-Watson, 2010; Boucher et al., 2012), in particular in social contexts (Chita-Tegmark, 2016; Guillon et al., 2014). Previous studies that have explored these cognitive signatures have focused on either attention or memory, with the majority of studies focusing on attention alone. As a result, little is known about how attention and memory interact in ASD. For example, how does attention influence learning and memory? Furthermore, how does social (or conversely, non-social) information in one's environment shape this relationship?

Objectives:

The objectives of the study were to:

(1) examine how autistic children attend to, learn, and remember information in social and non-social contexts, using behavioural and eye-tracking measures, and (2) explore how individual differences (e.g. social functioning and anxiety) influence attention and memory.

Methods:

Thirty-one children with and without autism (Ages = 5-17; M_{age} = 11.67 years; N = 62) completed a visual search and memory task, including scenes containing social or non-social information. First, in the learning phase, participants searched for target objects embedded in social or non-social scenes. Second, in the memory phase, they recalled the locations of the targets by placing them in the remembered locations within the same scenes. Both behavioural and eye gaze measures were recorded throughout the task. Parents completed the Social Responsiveness Scale – 2, and Spence Child Anxiety Scale, as respective measures of social functioning and anxiety.

Results:

Search time and memory precision measures showed that both children with and without autism learned and remembered information equally well in social and non-social contexts. In both learning and memory phases, eye-tracking revealed that *all* children gave significantly more attentional priority to and engaged more with the social than non-social information. Further, improvements in search time speed were significantly related to better memory precision in social scenes only ($r(59) = -.43$, $p = .001$). Individual differences in social functioning and anxiety moderated these effects in autistic children. Specifically, levels of social functioning ($r(24) = .42$, $p = .043$) and anxiety ($r(24) = .45$, $p = .027$) were positively related to the duration of looking to the social information in the memory phase.

Conclusions:

Contrary to expectations, results indicate that children with and without autism show similar attentional and memory profiles in social and non-social contexts. Combining eye-gaze and behavioural data, we suggest that social information may be used by children, both with and without autism, to aid learning and memory. Critically, individual differences measures suggest that autistic children experiencing more anxiety and social difficulties may be more hypervigilant to social information. We suggest that this hypervigilance may be useful in guiding memory (Doherty et al., 2017). These results shed novel insights into the interaction of attention, learning, and memory in children with and without autism, and provide a framework for understanding how social information may be used to facilitate these processes.

16 **137.016** Cognitive Skills in Bilingual and Monolingual Children with Low and High Levels of Autistic-like Traits

ABSTRACT WITHDRAWN

Background: Research on bilingualism has shown cognitive advantages, such as in executive functions (e.g., attentional control; Adesope et al., 2010) and Theory of Mind (i.e., belief attribution to oneself and others; Nguyen & Astington, 2014). Alternatively, the same areas are often impaired in autism (Baron-Cohen, 1991; Schuh & Eigisti, 2012). Therefore, studying bilingualism and autism offers an avenue for investigating interactions between contrasting cognitive profiles. However, diagnosing autism may be more complex and qualitatively different in bilinguals than in monolinguals. Specifically, the same levels of autistic traits tend to be acknowledged to a significantly different degree across various cultures (Burke et al., 2015). As bilinguals are often bicultural, investigating potential interactions of bilingualism and autism only in diagnosed samples suffers a risk of leaving out a large part of the spectrum caused by a possible cultural bias in the diagnosis.
Objectives: The study investigates the interaction of bilingualism and autistic-like traits (ALTs) in a general sample of children in relation to their cognitive skills. By looking at children with low or high levels of ALTs from a general population sample, without requiring a clinical diagnosis of autism, we eschew any disparities that might arise between monolinguals and bilinguals caused by the diagnostic bias. The following questions are addressed: (1) do bilinguals and monolinguals differ in their executive function and Theory of Mind skills? (2) does the level of ALTs affect children's executive function and Theory of Mind skills? (3) does bilingualism have any ameliorating effects on cognitive skills in children with high ALTs?
Methods: The sample included 19 bilinguals with high ALTs, 25 bilinguals with low ALTs, 21 monolinguals with high ALTs, and 28 monolinguals with

low ALTs, matched on age (M = 9;1, SD = 1;7) and the socioeconomic status. Monolinguals spoke English, and bilinguals spoke English and another language. Low ALTs indicated virtually no impairment in social communication/interaction and in restricted interests/repetitive behaviour (≥ -1SD from the population mean on the ALTs measure). High ALTs indicated difficulties in the same areas (≥ +1SD from the population mean on the ALTs measure). ALTs were measured with the Social Skills Improvement System-Rating Scales (Gresham & Elliott, 2008) and the Social Communication Questionnaire (Rutter et al., 2003). Demographics were collected through a caregivers' questionnaire. The dependent variables were measured with three executive function tasks and a Theory of Mind task.

Results: On the executive function tasks, bilinguals and monolinguals performed equally well. However, children with low ALTs performed significantly better than children with high ALTs. On the Theory of Mind task, bilinguals showed more accurate responses than monolinguals. Similarly, children with low ALTs were more accurate than children with high ALTs. Finally, the initial analyses showed some ameliorating effects of bilingualism in children with high ALTs based on their Theory of Mind accuracy scores.

Conclusions: The study identifies traces of positive effects of bilingualism on some aspects of cognition in children with high ALTs. Further investigations are required in larger samples including children with even higher levels of ALTs.

17 **137.017** Does Multilingual Exposure Have an Effect on the Severity of Autistic Traits?

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Background: Current research suggests multilingualism may have a significant impact on various aspects of autism. Recent evidence shows that multilingual autistic individuals demonstrate improved executive function and communicative competence (Gonzalez-Barrero & Nadig, 2016; 2017; Reetzke et al, 2015; Uljarevic et al, 2017). These are skills that can be a challenge for individuals with autism (Baron-Cohen et al, 1997; Happé, 1993; Hill, 2004). If multilingualism affects these areas of challenge, it is possible that it could interact with the way in which autistic traits are expressed.
Objectives: This study investigates the relationship between multilingualism and the prevalence of autistic symptomatology, as measured by the social-responsiveness scale (SRS II).

Methods: Data from the children in this sample were taken from three separate research projects. These children were separated into two cohorts, based on language background information. Parents were asked to complete the SRS-2, which is a questionnaire aimed at identifying autistic traits and quantifying its severity. *Cohort 1:* 45 multilingual autistic children and 314 monolingual autistic children (mean age = 5.4 years, sd ± 0.99) were tested across 12 different countries. Multilingualism was identified by the researcher working with each child and based on whether the child was exposed to more than one language in their home environment. *Cohort 2:* 22 monolingual and 30 multilingual autistic children (mean age = 12.9 years, sd ± 11.05) were tested in the UK. Parents of these children completed an extensive language background questionnaire, where they reported on the number of languages spoken, proficiency and frequency of use in each language.

Results: We ran independent t-tests to assess whether the average SRS scores differed between the monolingual and bilingual groups, where the bilingual group was defined as any child exposed to more than one language. For the first cohort, the mean SRS scores were 152.31 (32.21) for the bilingual children and 160.53 (28.21) for the monolingual children, this difference was not significant (t=1.794, p=0.074). For the second cohort, an independent t-test also showed no significant difference between the average SRS scores for bilinguals (mean score = 78.772) and monolinguals (mean score = 81.125) (t(38.334) = -0.793, p-value = 0.4328). Finally, we looked at whether proficiency and frequency of use in multiple languages among the bilingual group predicted differences in SRS scores in the second cohort. The regression models revealed that level of multilingualism significantly predicted differences in SRS scores, with higher levels of bilingual proficiency and frequency of use predicting lower SRS scores ($F(1, 30) = 2.415$, $p = 0.004$, > 0.01; $r^2 = 0.22$).

Conclusions: SRS scores were not significantly different between monolingual and bilingually exposed groups. However, bilingual proficiency and frequency predicted lower presentations of autistic traits on SRS. The findings from this project will help inform our knowledge of autism and how environmental factors, such as multilingualism, may influence its presentation.

18 **137.018** : Self-Reported Autism Characteristics Differentially Relate to Target-Decision Time for Object Targets and Non-Object Targets

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Background: Individuals with autism spectrum disorder (ASD) often demonstrate superior detail-oriented perceptual skills and diminished feature-binding into a holistic percept (Behrmann et al., 2006). This may relate to etiology of core ASD symptoms (Happé and Frith, 2006), and the presence of ASD traits in neurotypical (NT) populations (Chouinard et al., 2013). Detail-oriented processing in ASD is associated with elevated performance on visual search tasks (VS; Gilga et al., 2015; O'Riordan et al., 2001). However, paradigms that most reliably elicit superior VS in ASD are low-demand, feature-conjunction search paradigms that do not rely on holistic processing (HP); in studies employing naturalistic object-search, which utilize HP, no such effect has been shown (Kaldy et al., 2016). Thus, it is unclear if superior VS in those with ASD (and greater ASD traits) is truly associated with greater detail-oriented processing, or if it is an artifact of reduced HP requirements of extant tasks. Computational models of VS predict that HP increases efficiency of search processes by imposing top-down control on neurocognitive pathways involved in deciding if a stimulus is the target (Rao et al., 2002). Given that HP is required when engaging in real-world activities like searching for objects in one's environment, a task that directly investigates the degree to which HP for objects aids in naturalistic VS (i.e., object-facilitation) would be valuable for determining when and if detail-oriented visual processing translates into functional benefits for individuals with ASD.
Objectives: To determine whether VS advantage associated with ASD symptomology extends into more ecologically valid tasks of scene perception by operationalizing object-facilitation in a naturalistic search paradigm.

Methods: Forty-six NT adults (M_{age}=21.04, SD_{age}=2.26; 12 male) completed a naturalistic VS task for object and non-object targets (Figure 1) while eye-tracking data were recorded. During the task participants rated each target according to objectness on a 1-5 scale (1 = "target was not a single, complete object; 5 = "target was a single, complete object"). Target decision time (TDT) was calculated by subtracting the time of initial target-

fixation from that of behavioral response of correctly identifying the target when looking at it. Variations in ASD characteristics were measured using the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001).

Results: TDT was significantly shorter for object versus non-object trials (t=-7.45, p<0.001). Higher AQ total score related to longer TDT for objectness-5 trials (r=0.29, p=0.05), but not for objectness-1 trials (r=-.06, p=0.68), and there was a significant difference between these two correlations (Z=-1.68, p=0.05; Figure 2). TDT for objectness-5 trials significantly correlated with social subscales on the AQ including social skills (r=0.33, p=0.03), communication (r=0.46, p=0.001), and imagination (r=0.32, p=0.03).

Conclusions: These data indicate that while individuals with high ASD symptomology demonstrate improved performance on traditional VS tasks (O'Riordan et al., 2001), when complexity of the task is increased to better approximate real-world visual scenes, this advantage is attenuated, even in sub-clinical populations. ASD characteristics might instead relate to deficits in real-world VS, which often involves searching for whole-objects, due to possible deficits in HP associated with the disorder.

19 **137.019** A Double-Edged Sword? Factors Associated with Increased Perceptual Capacity in Autistic and Non-Autistic Individuals.

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Background: Recent studies show that, for autistic people, perceptual capacity (the amount of sensory information processed at any one time) is increased in the auditory (Remington et al., 2016) and visual domains (e.g. Remington et al., 2012). This increase in perceptual capacity may be responsible for both positive (superior auditory perception skills) and negative (increased distractibility) aspects of the condition. It remains unknown, however, what is driving this difference and whether it is specific to autism. Answering this question is vital in order to establish how to capitalize on the additional perceptual capacity and support the challenges associated with it.

Objectives: The current study examined whether altered perceptual capacity is associated with sensory sensitivities or anxiety levels, rather than general autistic traits. Both sensory experiences (e.g. Baron-Cohen et al., 2009; Dunn, 1997) and anxiety levels (Croen et al., 2015; Simonoff et al., 2008; van Steensel, Bogels & Perrin, 2011; van Steensel & Heeman, 2017; White et al., 2009) have been shown to be altered for those on the autistic spectrum compared to their neurotypical peers. Further, increased perceptual capacity has also been found in other groups with higher anxiety (e.g. Sadeh & Bredemeier, 2011). It is possible, therefore, that increased perceptual capacity is not a characteristic of autism specifically, but rather is associated with sensory sensitivities or anxiety.

Methods: 73 adults (24 autistic and 49 neurotypical) 18-54 years, matched in age and cognitive ability took part in an auditory test of perceptual capacity (developed by Fairnie et al., 2016). The task, a dual-task paradigm, involved performing an auditory search task in the presence of varying numbers of distractors, while also performing a secondary detection task. Participants also completed three self-report questionnaires: 1) The Sensory Perception Quotient (Tavassoli et al., 2014) to quantify overall sensory symptoms in daily life (e.g. "I would be able to hear the sound of a vacuum cleaner from any room in a two-storey building") 2) The Spielberger State-Trait Anxiety Inventory- T (STAI-T, Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) and 3) The Social Responsiveness Scale (a measure of autistic traits, Constantino, 2002).

Results: Data collection and analyses are ongoing, however preliminary results suggest that there is a strong correlation between sensory sensitivity and perceptual capacity (r_s= .44, p=.002) and between level of autistic traits and perceptual capacity (r_s= .35, p=.015), but no such association with anxiety levels. Pre-registered planned regression analyses will explore the relative contributions of each of these factors.

Conclusions: The findings indicate that an increased perceptual capacity is associated with higher levels of autistic traits and sensory responsiveness in everyday life. This offers a target for autism-specific interventions, education and therapy and could assist in the development of improved sensory environments which are adapted to autistic people's increased perceptual capacity.

20 **137.020** ASD-Related Memory Dysfunction in Middle Childhood

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Background: Although individuals with autism spectrum disorder (ASD) display similar memory performance on semantic memory tasks compared to typically developing controls (TDC), they perform significantly more poorly when recalling episodic events, which might derive from altered hippocampal function. If this is the case, we should observe memory deficits when children are asked to retrieve information about the association between an event and its context, even with tasks that reduce the strategic memory process demands.

Objectives: To compare memory for event-context association in children with ASD and TDC. Item-color context versus an item-space context associations were examined.

Methods: Participants included 62 children with ASD and 68 TDC (Table 1). The ability to recall events in association with specific contextual details was assessed across two tasks. In the event-color task, 80 black-ink drawings were presented with a border in one of 4 colors (20 of each color in a random order). Participants were instructed to try to remember both the item and the color of the border. The spatial position task was identical, except that the drawings did not vary in colored border but in the spatial position in which they appeared (1 of the 4 quadrants of the computer screen in random order). Rate of accurate recollection of item-context association, and discrimination between old and new items irrespective of context (i.e., d' prime) were calculated.

Results: We conducted a 2 (Diagnosis: ASD versus TDC) X 2 (Detail type: color versus spatial) mixed ANOVA with rate of correct event-context associations as the dependent measure. We found a significant main effect of diagnosis $F(1, 115) = 16.81$, $p < .001$, $n^2 = .06$, indicating a significant difference between ASD (M = 0.52, SD =0.22) and TDC (M = 0.65, SD =0.23) across both conditions. There was also a significant main effect of detail type, $F(1, 115) = 8.29$, $p < .01$, $n^2 = .03$, such that children recollected fewer item-color (M = 0.55, SD =0.23) compared to item-space associations (M = 0.63, SD =0.23). Critically, there was also a significant diagnosis by detail interaction, $F(1, 119) = 9.22$, $p < .01$, $n^2 = .03$, (Figure 1), suggesting that the ASD group exhibited worse performance for the event-space condition. This interaction persisted when we included d' and IQ as covariates, $F(1, 116) = 12.00$, $p < .001$, $n^2 = .03$.

Conclusions: Event-context deficits were restricted to the spatial aspect of episodic memory even after controlling for IQ and the capacity to discriminate new images from older images. Discussion will center on possible explanations for this specific deficit, which might include reduced reliance on conceptual representations of space.

21 **137.021** Abnormal Face Scanning in Children with Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by social interaction and communication deficits, as well as the presence of restricted interests and repetitive behaviors (American Psychiatric Association, 2013). Associated with the social deficits, children with ASD have been found to show abnormal face scanning patterns, especially reduced eye-looking time compared to the typically developing (TD) people (Jones & Klin, 2013; Pelphrey et al., 2002; Yi et al., 2013). The social motivation theory (Chevallier et al., 2012) is a popular theory to explain this abnormal face scanning in ASDs. However, this theory was challenged by Jaswal & Akhtar (2018) recently, who argued that the "abnormal" face scanning of ASDs do not necessarily reflect lack of social motivation, and other alternative explanations should be considered.

Objectives: The current study aimed to test an alternative explanation for this reduced eye contact in ASDs: different from the social motivation account, it hypothesizes that children with ASD may use a compromise strategy to avoid direct eye contact by fixating at other regions to process the eyes through peripheral vision. If this is the case, it is wrong to explain the abnormal face scanning found in children with ASD under the framework of social motivation theory.

Methods: Participants include 25 high-functioning children with ASD and 20 TD children. Six children with ASD were excluded from analysis due to their poor eye movement data quality, resulting in 19 children with ASD in the final sample. This study used a traditional eye movement paradigm that let participants scan clear (full view) faces (clear condition), and a novel gaze-contingent paradigm, in which the whole face was blurred except for a small region being fixated at (blur condition) (Figure 1). In this blur condition, viewers, who could not rely on the peripheral information, need to seek out and process face information by their focal attention.

Results: Children with ASD fixated less on the eyes than TD children for both conditions (Figure 2A). Within 1000 ms after the face appeared, both groups showed longer eye-looking time in the clear condition than in the blur condition, possible due to the physical saliency of the eyes in the clear condition that captured attention automatically (Figure 2B). After 1000 ms, TD children gradually looked more at the eyes of the blurred faces relative to the clear faces, possible due to their motivation-based guidance of attention to process the eyes. Children with ASD didn't show this motivation modulation—their eye-looking time at the blurred faces after 1000 ms was very similar to the clear faces. In addition, we found that children with ASD scanned faces more randomly than TD children, implying that they lack strategy to efficiently scan the faces (Figure 2, C and D).

Conclusions: Our findings suggest that the abnormal face scanning pattern in ASDs could not be explained by their compromise strategy to process eyes through peripheral vision, which advance our understanding of the mechanisms underlying abnormal face scanning and have implications for the treatment of ASDs.

22 **137.022** Assessment of Executive Functions and Their Effects on Adaptive Behavior in Children with Autism Spectrum Disorders

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Background: Executive functioning is an umbrella term for higher order cognitive functions that include various skills such as inhibition, flexibility, emotional control, initiation, working memory, organization of material, planning, and monitoring. Executive functions (EFs) are involved in the control of action and thought and are crucial in social adaptation process, cognitive development, interpersonal and communication skills. Recently, researchers have stated that the theory of executive dysfunction is the primary cognitive process that best explains Autism core symptoms and behavioral manifestations. Studies from developing countries have shown that individuals with Autism spectrum disorder (ASD) encounter difficulties in wide range of EFs when compared to typically developed children. In Lebanon, as in most countries of the Middle East, studies evaluating EFs in ASD cases are scarce. Their assessment is an important element in identifying profiles of ASD children and to successfully carry out an appropriate course of action.

Objectives: The aim of the current study is the evaluation of Global Executive Functions (GEF) and their components in children with ASD and to identify an EF profile for ASD cases in Lebanon. We also sought to examine their effects on adaptive behavior.

Methods: A total of 30 children aged 5 to 14 years old with ASD were matched by age and gender to 30 normal typically developing (TD) individuals. Teachers were asked to complete the Behavior Rating Inventory of Executive (BRIEF-T) scale assessing children's Global Executive functions (GEF) and its different domains within everyday contexts. Adaptive behaviors were assessed by Vineland Adaptive Behavior Scales-Second Edition (Vineland-II). Statistical analysis was performed using SPSS version 22.0

Results: Statistically significant differences were found in GEF as well as all EF subdomains assessed in ASD group compared to their TD counterparts with lower performance by the ASD group. The mean VABS score was lower among ASD group compared to the TD group (Mean VABS among ASD 37.3 with a SD of 9 compared to 114.5 and a SD of 13.2 with a P-value <0.001) suggesting deficits in adaptive behaviors in ASD cases than their TD counterparts. Inhibition and emotional controls subdomains of the BRIEF-T were positively correlated with VABS suggesting their impact on the adaptive behavior of children with ASD.

Conclusions: ASD cases exhibited impairment in inhibition, flexibility, emotional control, initiation, working memory, organization of material, planning, and monitoring domains of EFs relative to their TD peers. Deficits in adaptive behaviors were also found in ASD individuals than TD children. Finally, deficits in inhibition and emotional controls were associated with decreased adaptive behavior of children with ASD. Considering the low EF profile found in ASD children in Lebanon, educational strategies should be suggested in order to improve their EFs and thus to improve their adaptive behaviors.

23 **137.023** Attention and Autonomic Arousal Toward Emotional Faces in Children with Autism Spectrum Disorder Who Are Minimally

Verbal

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Background: To our knowledge, no studies have examined attention and autonomic arousal toward emotional faces in children with autism spectrum disorder who are minimally verbal (ASD-MV). Children with autism spectrum disorder (ASD) and typically-developing children(TD) demonstrate a differential looking pattern toward faces based on emotion, including a preference for looking at the mouth region of happy compared to neutral or fearful faces (Eisenbarth & Alpers, 2011; Wagner et al., 2013). Children with ASD, compared to TD children, have a decreased pupillary response to unfamiliar fearful faces (Nuske et al., 2014) which may influence social communication. Utilizing eye tracking to measure allocation of attention and pupillary response to emotional faces in children with ASD-MV may provide insight into the social-communication challenges of this phenotype.

Objectives: This study investigated whether children with ASD-MV differentiate emotions based on allocation of attention and pupillary response to faces (happy, fear, neutral).

Methods: Participants (n=41) completed this eye tracking study at the baseline visit of a clinical trial targeting language through behavioral intervention combined with medication or placebo. Enrolled children were 6-11 years old, had a diagnosis of ASD, confirmed using the Autism Diagnostic Observation Schedule-2 (Lord et al., 2012), and fewer than 30 functional words used on a language sample. Eye tracking data was collected using the Tobii Eye Tracker. Following calibration, images of 10 individuals (5 female) were presented showing fear, neutral or happy facial expressions in a randomized order. Duration of fixations on eyes, mouth and face regions was calculated. An eyes-mouth index (EMI: ratio of looking time in the eye region to looking time in eye and mouth regions combined) was used to measure differences in gaze in these regions independent of total gaze (Key & Stone, 2011). Autonomic arousal was measured as a weighted average of pupil diameter when looking at the face region across same-emotion trials (Wagner et al., 2016).

Results: A repeated-measures ANOVA revealed significant differences in EMI by condition ($F(2,80)=11.94$, $p=<.001$). Post-hoc analyses identified a lower EMI in the fear condition ($M=.746$, $SD=.203$), ($t(40)=-3.42$, $p=.001$) and happy conditions ($M=.725$, $SD=.237$), compared to the neutral condition ($M=.838$, $SD=.194$), ($t(40)=-4.619$, $<.001$). No differences in autonomic arousal were found between conditions ($F(2,80)=.459$, $p=.633$).

Conclusions: Children with ASD-MV spent more time looking at the mouth of happy and fearful compared to neutral faces. Further investigation is needed to determine if the lack of behavioral differentiation between positive and negative emotional faces contributes to the increased social-communication challenges in children with ASD-MV relative to children with ASD and expressive language. There was no difference in autonomic arousal, measured by pupillary response, between emotions. As this is consistent with findings of atypical pupillary response in children with ASD (Nuske et al., 2014), this deficit may be related to general ASD characteristics, and not the specific social communication deficits of children with ASD-MV. Examination of the relation between looking patterns, autonomic arousal and behavioral and developmental measurements of functioning in children with ASD-MV is needed to provide insight into the clinical significance of these findings.

24 **137.024** Attention and Intermodal Processing in Autism Spectrum Disorder

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Background: Children with ASD often have challenges with different aspects of attention. This includes disengaging from one stimulus to another, as well as with intermodal processing (integrating visual and auditory information). Even young infants orient their heads and search visually for sounds that are presented near their ears (Arterberry & Kellman, 2016). Because these processes are so vital and apparent in early development, Posner (1988) hypothesized that they would be involved in selective attention. In this study we examine the concurrent development of these skills in children with and without ASD.

Objectives: In this study we examined whether difficulties in shifting and disengaging attention are associated with weak intermodal processing abilities in children with ASD. If these abilities are related, this likely suggests that they develop intertwined together. The findings provide insight into whether strengths and limitations in these abilities are related in typical development and, more particularly, in ASD, where attention skills are more varied. In addition, parent reports often differ from behavioural measures of attention. The observed attention responses as well as intermodal processing are compared with parent reports of attention.

Methods: 14 children with ASD were compared to 19 typically developing children. Children ranged from 6 to 16 years of age. They completed an intermodal processing task using the preferential looking paradigm. Specifically, participants were presented with 4 screens, where only 1 screen had a video track synchronous with the audio track, while the other screens had asynchronous video and audio. They were also presented with an attention task where 4 screens appeared sequentially, either immediately following one another (shifting) or with a slight period of overlap (disengaging). During these tasks, participant eye gazes were recorded using eye-tracking technology. Parents were also given a common report of attention (Conners-3).

Results: Overall, for typically developing children, shifting attention, but not disengaging, and intermodal processing were related ($|r| = 0.56 - 0.65$, all $p < 0.05$). However, in children with ASD, these abilities were not significantly related ($|r| = 0.19 - 0.35$, all $p > 0.10$). Parent reports of attention correlated with shifting and disengaging abilities ($r = 0.57 - 0.69$, $p < 0.05$) in the ASD group only.

Conclusions: These results indicate that in typical development shifting attention is related to the ability to efficiently integrate information from different senses. However, for children with ASD these abilities were not related to each other. This suggests that if impairment occurs in one of these areas, the other may be preserved or may be differentially affected. In the present study, while some children with ASD had impairments in both attention skills and intermodal processing, these degree of the deficits were not consistent on the two tasks. This may mean that different aspects of selective attention develop independently in those children with specific deficits. In addition, parent reports of attention were consistent with observed behaviors in the ASD group only. The lack of association in the non-clinical group may be due to reduced variability in a typical sample.

25 **137.025** Attentional Disengagement and the Locus Coeruleus – Norepinephrine System in Children with Autism Spectrum Disorder

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Background: Differences in non-social attentional functions have been identified as among the earliest features that distinguish infants who develop autism spectrum disorder (ASD), and may play a critical role in the emergence of core ASD symptoms. Specifically, slowed attentional disengagement and difficulty reorienting attention have also been found across the lifespan in those at risk for, or diagnosed with, ASD. In addition, the locus coeruleus-norepinephrine (LC-NE) system, which is known to play an important role in arousal regulation and selective attention, has been shown to function atypically in ASD. For example, indices of LC-NE activity, such as pupil diameter and P3 amplitude, differ in individuals with ASD. However, exactly how atypical LC-NE activity relates to impairments in attentional disengagement in ASD has not been determined.

Objectives: To assess the role that the LC-NE system plays in manifestation of atypical attentional processes in children with ASD.

Methods: Participants were 23 children with ASD and 15 age- and IQ-matched typically developing (TD) children. The study consisted of separate gap-overlap and baseline eye-tracking paradigms. In the gap-overlap task, participants were instructed to fixate on a central crosshair and then move their eyes to a peripheral target once it appeared. Each trial began with a crosshair presented alone in the center of the display. Following fixation on the crosshair, a peripheral target could appear with either the crosshair remaining on the screen (overlap condition) or 200ms after the crosshair disappeared (gap condition). There were 16 possible target locations arranged on two invisible concentric circles (8 per circle); circles surrounded the fixation cross at eccentricities of 4.9° (near) and 9.8° (far). For the baseline eye-tracking paradigm, a black central crosshair was presented on a grey background, and participants were instructed to relax, remain still, and to look at the crosshair. Latency of participants' saccades and pupil diameter were monitored using an EyeLink 1000 Plus remote eye-tracking system.

Results: Groups did not differ on overall saccadic response time (RT). Children were faster to shift attention to targets in the gap compared to the overlap condition ($p < .05$). There was also a marginally significant interaction between group and condition ($p < .1$). Saccadic RT difference scores (overlap – gap, i.e., gap effect) for ASD and TD children revealed that children with ASD showed larger difference scores for near (ASD = 100ms; TD = 44ms; $p < .05$) but not far (ASD = 106ms; TD = 69ms; $p = .33$) targets. Baseline pupil measures revealed that individuals with ASD had increased pupil dilation compared to their TD peers ($p < .1$). Correlational analyses showed that decreased disengagement efficiency (i.e., larger gap effect) was associated with increased pupil diameter ($r = .31$, $p < .1$).

Conclusions: Consistent with prior reports, our preliminary results show that children with ASD exhibit slowed attentional disengagement and increased arousal. Associations between measures of disengagement efficiency and pupil dilation suggest that atypically increased tonic activation of the LC-NE system may be associated with poorer attentional disengagement in children with ASD.

26 **137.026** Attentional Networks in Young Children with Autism Spectrum Disorder

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Background:

The Attentional Network Test (ANT) has been used to examine visual attention abnormalities in individuals with autism spectrum disorder (ASD; Fan et al., 2002; Rueda et al., 2004). The ANT assesses three interconnecting attentional networks related to alerting, orienting, and executive control (Posner et al., 2011). The orienting attention network, which indexes the ability to disengage, shift, and reengage attention, may be especially important for children with ASD. Orienting has been linked to the development of self-regulation, emotional control and social communication (Rothbart et al., 2011, Keehn et al, 2010). While past research suggests that children with ASD have deficits in the orienting network compared to their typically developing (TD) peers (Keehn et al, 2010), these results have not been replicated within younger populations. It is important to examine the orienting network in younger children to better understand when these challenges develop so that interventions can be implemented early in children's development

Objectives:

Our objective was to investigate whether challenges in orienting attention are present in an early childhood sample of children with both typical development and ASD. We hypothesized that we would replicate previous findings such that there would be significant differences across groups in orienting network. Given our extension of this task to a younger sample, we also hypothesized that age that would be a unique predictor of attention networks.

Methods:

Participants were 142 children (ages 3:0 to 6:11), including 88 children with typical development (42% female) and 54 children with ASD (20% female). Children completed the ANT via laptops in a laboratory or home setting.

Results:

A multi-level factorial ANOVA was conducted to evaluate the effects of age and diagnostic status on orienting scores, calculated by subtracting median response times for the spatial cue condition from the center cue condition (Posner et al., 2007). The main effects of age, $F(3, 134) = 0.40$, $p = .752$, $\eta p^2 = .009$, and status were not significant, $F(1, 134) = 1.05$, $p = .307$, $\eta p^2 = .008$. However, the interaction effect between age and diagnostic status consumption was significant, $F(3, 134) = 3.96$, $p = .010$, $\eta p^2 = .08$.

Conclusions:

The current study replicated previous findings regarding performance on the orienting attention network in children with and without ASD. However, significant differences in orienting attention scores between groups were only seen within the interaction between age and diagnostic status. These results suggest the important role of age in the assessment of attention network scores and indicate the need for future research to isolate the possible role that different developmental patterns in attention may play in the development of co-emerging skills such as self-regulation, emotional control, and sociocommunicative functioning (Rothbart et al., 2011, Keehn et al, 2010). By further isolating differences in attentional development in young children with ASD, it may be possible to create early intervention focused on increasing attentional abilities that may have effects on skills needed for later childhood demands.

27 **137.027** Attentional Processing of Emotion FACES in THOSE High and Low in Autistic Behaviors and Social Anxiety

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Background: Attention to or away from emotional faces may explain later deficits in emotion identification in individuals with autistic traits and social anxiety. Because these traits are significantly correlated yet separate constructs, it is important to examine the independent role they each play in the attentional processing of emotions.

Objectives: This study examined preferential attention to faces in a sub-clinical sample with different levels of autistic traits and social anxiety using a dot-probe paradigm.

Methods: The participants included undergraduate students (122 males, 133 females, 11 unspecified; M_{age} = 19.30 [*SD* = 1.89] years) from a medium-sized university in the southeastern United States. The pictures used in the dot probe paradigm included the same models displaying either a basic emotion (happy, fear, surprise, disgust) or a neutral expression (Tottenham et al., 2009). On each trial, two face stimuli were displayed simultaneously on the left and the right side of the screen; one face was an emotional face while the other was a neutral face depicting the same person. The presentation time of the faces was 100 ms, 200 ms, or 500 ms. The faces were followed by the presentation of a dot on one side of the screen. Reaction time to a button press indicating which side of the screen the dot was displayed was recorded as a measure of relative attention to the emotional face versus the neutral face. Participants also completed a self-report measure of autistic behaviors, the Broad Autism Phenotype Questionnaire (BAPQ; Hurley, Losh, Parlier, Reznick, & Piven, 2007), and the Social Phobia and Anxiety Inventory (SPAI-23), a self-report measure of social phobia (Roberson-Nay, Strong, Nay, & Beidel, 2007).

Results: Consistent with previous studies, BAPQ scores were correlated with SPAI scores, r = .51, p < .001. SPAI was included as a covariate in analyses involving BAPQ and BAPQ was used as a covariate in analyses including SPAI as a factor. A 3 (Block; 100, 200, 500ms) X 4 (Emotion: disgust, fear, happy, surprise) X 3 (BAPQ group: high, middle, low) ANOVA was conducted. Of most theoretical interest, this analysis revealed a main effect of BAPQ, $F(2, 247) = 3.77$, p = .024. Those who scored highest on the BAPQ were significantly slower than those who scored the lowest on the BAPQ. To assess the effects of social anxiety on dot probe reaction time, a 3 (Block; 100, 200, 500ms) X 4 (Emotion: disgust, fear, happy, surprise) X 3 (SPAI group: high, middle, low) was also conducted. Unlike what was observed for BAPQ scores, there was not a main effect for SPAI.

Conclusions: The present findings add to growing evidence that, despite being relatively strongly correlated, those who report high levels of autistic behaviors and those who report high levels of social anxiety demonstrate distinctive task performance, suggesting dissociable underlying processing mechanisms. Future research should assess the performance of the four potential subcategories (high or low in autistic behaviors and social anxiety or those who are only high in autistic behaviors or social anxiety).

28 **137.028** Average Look Duration and Its Correlation with Neurophysiological Activity in Young Children with and without Autism Spectrum Disorder

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Background:
Autism spectrum disorder (ASD) is characterized by early attentional differences that emerge during the infant/toddler period. Development of novel tools that measure attentional behaviors may lead to earlier identification of children at risk for ASD. In this work we introduce a new measure related to social attention, the *average look duration (ALD)* to a stimulus, a measure of attention behavior while viewing dynamic stimuli. We also introduce the *Relative ALD (RALD),*a normalized measure indicating preference when comparing stimuli responses, e.g., to compare ALD in social vs nonsocial stimuli.

Objectives:

Our objectives are to evaluate whether preschool-age children with ASD versus typical development (TD) differ in terms of their ALD and RALD while watching social and nonsocial video stimuli; and to examine associations between these measures and signal features of simultaneously recorded electroencephalographic (EEG) activity.

Methods:

Two groups of 31 age-matched ASD and TD children, 28-81 months old, participated. Participants were presented 3 types of stimuli (social– nursery rhymes; nonsocial - toys; neutral - bubbles) lasting 1 minute each and repeated twice, with simultaneous video recording of children faces and EEG. Periods of visual attention to the stimulus were marked by raters on recorded videos. ALD(Stimulus) was computed as total time spent looking/attending at the stimulus divided by total number of looking periods. RALD(Stimulus1,Stimulus2) was computed as (ALD(Stimulus1) – ALD(Stimulus2))/(ALD(Stimulus1) + ALD(Stimulus2)). First, ANCOVA models were utilized to compare groups on the attention variables. Second, EEG data were pre-processed, resulting in 40 seconds of artifact-free data for each stimuli type. Average relative power of the EEG signal (RP), log-ratio of RP (LRP) in four frequency bands, and log-ratio of theta-beta ratio (LR_TBR) between social and toys stimuli, retrieved from frontal, central, and posterior scalp regions, were computed. Associations between RP/LRP/LR_TBR and ALD(social)/RALD(social,toys) were tested using linear models, FDR-corrected at 0.05 level. Covariates are Full Scale IQ, age, and sex.

Results:

While the ALD pattern while viewing toys and bubbles was similar in both groups, ASD children demonstrated shorter average look duration when viewing the social stimulus (Fig. 1). Strong effects of group ($p<0.001$), stimulus type ($p<0.001$), and group by stimulus interaction ($p<0.05$) were observed for ALD. RALD (social,toys) and RALD (social,bubbles) were significantly lower in the ASD group ($p < 0.002$ and $p < 0.04$, respectively), while RALD (toys,bubbles) was not. Simultaneous increase of EEG theta RP and decrease in beta RP during social stimulus was positively associated with increase in RALD (social, toys) in the TD group, while no significant associations were found for the ASD group. Log-ratio of posterior TBR was positively associated with RALD (social,toys) in the TD and negatively in the ASD group (Fig.2).

Conclusions:

Average look duration was significantly lower in the ASD group across all conditions. Also, ASD was associated with relatively shorter look duration while viewing social as compared to nonsocial stimuli. Relative look duration to social vs. nonsocial stimuli was differentially associated with specific patterns of relative theta and beta EEG power for ASD and TD children.

29 **137.029** Characterizing Individual Differences in Attention across Autism Spectrum Disorder: A Multiple Object-Tracking Study.

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Background: Multiple-object tracking (MOT) tasks have been used to characterize differences in attention between typically and atypically developing populations (i.e. Autism Spectrum Disorder (ASD); Koldewyn et al., 2013). Furthermore, we have recently demonstrated that MOT tasks can characterize individual differences in attention resource capacity across neurotypical adults (Tullo et al., 2018). Attention resource capacity is an ideal descriptor of attention as it identifies cognitive load; the amount of task demands an individual can process. By manipulating the task's cognitive load, via speed and number of target items, the aforementioned study concluded that analytical reasoning (i.e., fluid intelligence) is predictive of performance at the limits of attentional capacity. Given the attention-related challenges in autism and how they affect various cognitive spheres (Anthsel et al., 2013), the characterization of attention resource capacity for individuals with autism is a priority. Previous attempts at isolating attention in autism using visually-based tasks have been limited by their accuracy in targeting attention, and their accessibility to lower-functioning participants.
Objectives: The aims of the current study are twofold: (i) To examine whether attention resource capacity can characterize individual differences in ASD (ii) whether fluid intelligence contributes to the characterization of individual attentional differences in ASD.

Methods: We recruited 108 participants: 59 neurotypical (NT) children, adolescents, and adults ($M_{MentalAge}$=16.61), and 59 children, adolescents, and adults with an ASD diagnosis ($M_{MentalAge}$=16.25). All participants completed a MOT task, which required participants to visually track either 1, 2, 3, or 4 target items (separate cognitive load conditions) from among 8 items moving arbitrarily for 8 seconds. MOT performance was defined as the average speed (cm/s) at which a participant tracked *all* target items across load conditions. Participants were then administered the Wechsler Abbreviated Scale of Intelligence-2nd edition (WASI-II) to obtain a measure of fluid intelligence.

Results: As expected, the MOT average speed score decreased logarithmically as cognitive load increased, replicating the unique trend found in the neurotypical group ($y = -118.2\ln(x) + 215.09$, $R^2 = 0.989$). However, the average speed score of the ASD group was lower than that of the neurotypical group across both low (1-2 targets) and high cognitive load (3-4 targets) conditions ($t(58)=-2.432$, $p=.018$, $t(58)=-2.411$, $p=.019$). Furthermore, fluid intelligence was predicative of MOT performance for only high load condition in the ASD group ($b=.562$, $t(58)=3.508$, $p=.001$, $R^2=.405$, $F(2,55)=18.753$, $p=.000$).

Conclusions: Results corroborate the association between fluid intelligence and attention for individuals with ASD. Our findings suggest that MOT capability can be used as an assessment of attention and is generalizable to a sample with ASD. Findings are also clinically relevant since MOT can used as a tool to assess attention resource capacity for atypically developing populations. In the classroom, attention resource capacity is a potential descriptor for how much material a student with ASD can process.

30 **137.030** Characterizing Learning As a Function of Attention Using a Multiple-Object Tracking Task: Defining Learning Trajectories in

ASD and Other Neurodevelopmental Conditions

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Background: Attention plays a significant role in learning by directing cognitive resources to satisfy task demands. As learning occurs, the need for attentional resources from the individual's limited resource capacity decreases. Therefore, learning trajectories differ across the population as a function of differences in attentional capacities. These differences are exacerbated among individuals diagnosed with a neurodevelopmental condition (Melby-Lervåg & Hulme, 2015), whom present attention-specific difficulties (e.g., ADHD), or exhibit clinically significant difficulties in attention among other challenges (e.g., Autism Spectrum Disorder; ASD; Antshel, et al., 2013). Multiple Object-Tracking (MOT) paradigms are ideal for assessing the reciprocity between learning and attentional resource capacity because (i) MOT paradigms are robust measures of selective, sustained, distributed, and dynamic attention, and (ii) MOT can characterize individual differences in attention resource capacity (Tullo et al., 2018).

Objectives: We investigated whether a reciprocal nature of attention resource capacity and learning in ASD exists and if this relationship differs across other neurodevelopmental conditions that either do (i.e., ADHD) or do not have attentional difficulties (i.e., Intellectual or Learning Disability; ID; LD) as a primary concern. Specifically, we assessed the effect of repeated practice on an adaptive MOT paradigm, across 15 sessions. Additionally, we explored whether intelligence, our proxy for cognitive capability, influenced learning trajectories.

Methods: Children and adolescents (Ages 7-17; M_{age}=13.51; N=106) with confirmed diagnoses of either ASD (n=32), ADHD (n=35), or ID/LD (n=39) completed 15 daily MOT sessions. An MOT session involved visually tracking 3 of 8 spheres moving randomly for 8 seconds. Daily performance was defined as the average speed (cm/s) participants correctly tracked *all* target items. Cognitive status (or IQ) and attentional ability were assessed for all participants, using the Wechsler Abbreviated Scale of Intelligence – 2nd Edition (WASI-II) and the Conners Continuous Performance Test 3rd Edition (CPT-3), respectively.

Results: Collectively, the sample's (i) IQ fell between 1 and 2 standard deviations below the population average (M_{FSIQ}=77.27, SD_{FSIQ}=13.16), and (ii) baseline attention met problematic levels of attention on the CPT-3 ($M_{d't\text{-}score}$=60.00). A latent growth model revealed that MOT performance mapped onto a logarithmic function, which resembled a typical learning curve, at R^2=0.87. Performance improved by 105% from the first to last day of testing. Moreover, the model revealed that day-one performance was predicted by intelligence: R^2=0.28, and the rate of change, or learning trajectory differed across diagnostic groups. Here, the ASD group ($M_{sD1\text{-}15}$=1.11) demonstrated a greater standardized change compared to the ADHD ($M_{sD1\text{-}15}$=0.54) and ID/LD ($M_{sD1\text{-}15}$=0.52) groups.

Conclusions: These results characterize individual differences of learning capability and attention resource capacity, specific to children and adolescents diagnosed with a neurodevelopmental condition, where individuals with ASD demonstrated a unique learning trajectory. This unique trajectory may be indicative of distinct learning preferences specific to ASD cognitive profiles. Further, these findings demonstrate the value in using MOT to identify individual differences in learning trajectories as a function of attention. Therefore, we recommend (i) considering attention when characterizing learning capability on a case-by-case basis and (ii) adopting these descriptors of attention and learning towards tailoring learning material to capability.

31 **137.031** Children with Autism Spectrum Disorder (ASD) Demonstrate Cognitive Flexibility in Categorizing Foods

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Background: Cross-classification, i.e., categorizing the same object in multiple ways (Nguyen & Girgis, 2014), is a basic aspect of cognitive flexibility that has not been studied in children with Autism Spectrum Disorder (ASD). Deficits in cognitive flexibility have been found in ASD, but the nature and magnitude of these deficits is unclear, due to the varied ability levels of participants, complexity of tasks, and stimulus domains used (Landry & Al-Taie, 2016; Memari et al., 2013). Given the impairments in executive functioning, rigidity, and perseverative thought and behavior observed in individuals with ASD (Hill, 2004), impairments in cross-classification may be expected.

Objectives:

To investigate basic categorization and cognitive flexibility among children with ASD employing a highly familiar stimulus domain – food.

- To investigate the accuracy of children with ASD when categorizing food items into taxonomic, script, and evaluative categories.
- To investigate the flexibility of children with ASD when cross-classifying the same food item into more than one of the above categories.

To improve on previous methodologies by using restricted age and IQ ranges.

Methods:

Participants

19 boys, 2 girls diagnosed with ASD

Age: *M*=9.62 years; *SD*=1.66

FSIQ *M*-composite-score=99.29; *SD*=13.42

Categorization Experiment (Following Nguyen & Murphy (N&M), 2003)

Children viewed 28 triads of color photographs of foods comprising 12 taxonomic (e.g., fruit, meats), 12 script (based on setting/time of eating), and 4 evaluative (healthy/unhealthy) groupings. Each triad consisted of a unique target food and two choices: a choice sharing a taxonomic, script, or evaluative relationship with the target; and an unrelated choice. Children were asked to identify the choice that was the same food type as the target.

Cross-Classification Experiment (Following N&M)

Children performed a categorization task like above, but this time each target food was presented first in either a taxonomic or script triad and later presented again in the opposite triad. Identifying the correct choice in both types of triads for the same target was deemed correct cross-classification.

Results:

Categorization Experiment

Mean Percentages of Correct Categorization:

	All(*N*=21)	*t(20)*	Grp 1 7-9yo(*n*=11)	Grp 2 10-12yo(*n*=10)	Grp1Vs2
	M(SD)	compared to 50%	*M(SD)*	*M(SD)*	*t(19)*
Taxonomic:	93(08)	24.46*	92(07)	93(09)	-00.25
Script:	87(16)	10.61*	89(11)	85(20)	00.51
Evaluative:	83(24)	06.33*	89(17)	78(30)	01.06
Overall:	89(12)	14.81*	90(07)	88(16)	00.51

*p<.000

Comparing our 7-9yo sample (M=90) with the N&M (M=85) neurotypical sample of 7yo's yielded a significant difference (t(10)=2.64, p=.025).

A 2(age group)X3(category type)ANOVA produced no main effect for age (F(1)=.54, p=.473) or interaction. Category type (F(2)=3.61, p=.037) was significant.

Cross-Classification Experiment

Mean Percentages of Correct Cross-Classification:

	t(20)	
	M(SD)	compared to 25%
All(*N*=21):	70(20)	10.38*
7-9yo(*n*=11):	73(14)	11.32*
10-12yo(*n*=10):	67(25)	05.24**

*p<.000 **p<.001

There was no difference in overall performance on cross-classification between 7-9yo's and 10-12yo's (t(19)=0.69, p=.498).

Conclusions: Our children, with ASD and average IQs, scored above chance (50%) when categorizing by each category type and our 7-9yo's outperformed an age-matched neurotypical sample. Our children performed above chance (25%) when cross-classifying the same food into more than one category, thus demonstrating categorization ability as well as cognitive flexibility when tested using highly familiar stimuli.

32 **137.032** Cognitive Profiles of Children and Adolescents with ASD

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Background: Individuals with Autism Spectrum Disorder (ASD) have been characterized as having a heterogeneous cognitive and executive functioning profile. Compared to typically developing peers, individuals with ASD have been found to have deficits in executive functioning, verbal working memory (Ozonoff, Pennington, & Rogers, 1991), cognitive control (Solomon et al., 2009; Solomon, Ozonoff, Cummings, & Carter, 2008), and cognitive flexibility (Ozonoff, et al., 2004) 2008). Although cognitive impairments have been characterized in ASD, more investigation is required to understand these impairments in an epidemiological sample of cognitively matched controls using the NIH Toolbox Cognition Battery (NTCB). Objectives:

1. Investigate group differences in the NTCB in participants with ASD and an IQ-matched sample Typically Developing controls (TD).
2. Explore the utility of NCTB measures in predicting group membership using stepwise discriminant function analysis.

Methods: Participants: The current study examines an IQ case-matched sample of boys and girls with ASD (n=29, 82.7% male, mean age 13.66 [2.74] years, IQ=101.97), and TD (n=29, 75.86% male, mean age 13.27 [2.60] years, IQ 103.17) originally seen in the CHARGE (Childhood Autism Risks from Genetics and the Environment) study, which now is being followed-up as part of the Environmental influences on Child Health Outcomes (ECHO) cohort. The Stanford-Binet Intelligence Scales, Fifth Edition was used to obtain an Abbreviated Battery IQ. Participants were screened for ASD symptoms using the Social Communication Questionnaire (SCQ). For participants meeting threshold criteria on the SCQ, ASD was determined by care-giver reported history of DSM-V ASD symptom criteria and a clinician administered Autism Diagnostic Observation Schedule, Second Edition (ADOS-2). The NTCB was administered, and includes measures of Fluid Intelligence, Crystalized Intelligence, and Early Childhood Cognition, as well as the Dimensional Change Card Sort (DCCS), the Flanker Inhibitory Control and Attention, the Picture Sequence Memory, List Sorting Working Memory, Pattern Comparison Processing Speed, Picture Vocabulary, and Reading Recognition Tests. Stepwise discriminant function analysis was used to examine the NTCB variables that best predicted diagnosis in ASD versus TD group.

Results:

Stepwise discriminant analysis results determined that NTCB variables that best predicted diagnosis (ASD vs. TD) was for the DCCS task at a classification accuracy of 100% (Wilks λ =0.881, Chi-square=6.797, p <0.01). No other task on the NCTB met criteria to discriminate between diagnostic groups.

Conclusions:

On a task of cognitive flexibility (DCCS) participants with ASD were more impaired on performance compared to IQ matched TD controls. This was the only cognitive measure that discriminated the diagnostic groups. Cognitive inflexibility is considered a characteristic of ASD; however, the

result is novel in indicating this deficit was present even when ASD was compared to an IQ matched control group suing the new well validated NCTB. This is a preliminary exploration of a sample that will increase the number of participants; therefore, future analysis of the sample is required. One novel area of future investigation is comparison with a developmentally delayed sample and a sample with ASD and low IQ. Additionally, the NCTB is a valid tool for cognitive assessment of children with ASD.

33 **137.033** Cortical Processing of Mental Addition in Visual and Auditory Modalities in Adults with High-Functioning Autism

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Background: Individuals with high-functioning autism (HFA) or Asperger's syndrome have been shown to have average mathematical skills in general, and some may exhibit exceptional mathematical giftedness with a unique pattern of brain activation. As individuals with HFA show limitations in verbal social communication, it is unclear whether presenting mental addition problems in visual vs. auditory modalities would make a difference in the speed and accuracy outcomes. At the cortical level, very little is known about the temporal aspects of mathematical processing in HFA in comparison with normal age-matched controls.
Objectives: The present event-related potential (ERP) study aimed to explore possible differences in cortical mechanisms of mental calculation in visual and auditory modalities by testing HFA adults and control subjects with a mental addition task.

Methods: Ten adults with HFA and ten age-matched controls (age range: 19-38) participated in the study. All subjects were native speakers of English with normal hearing and right-handed. The mental addition task used two-digit numbers. There were two presentation conditions. Each trial in the visual condition started with a tone beep prompt. Then the two Arabic numerals with the "+" sign in between were presented together on screen, followed by an answer in Arabic numerals on the computer screen. Subjects were required to do mental addition and press button to indicate whether the given answer on screen was "correct" or "incorrect." The auditory condition replaced the question part (not the answer part) with auditory verbal stimuli. There were 120 trials for each condition. The auditory stimuli were presented at 60 dB sensation level. The EEG data were recorded with a 64-channel EEG system in an acoustically-treated booth. The sampling frequency was 512 Hz, and the passband was 0.016 - 200 Hz. Trials with peak amplitudes exceeding the range of +/- 50μV were rejected. The data were bandpass filtered offline at 0.5~40 Hz and the epoch window was -100 ~ 1000 ms for ERP averaging.

Results: Behavioral data showed no significant difference in response accuracy between visual and auditory modalities for mathematical calculation in either subject group. While the control group also showed no significant difference in reaction time between the two modalities, the HFA individuals took longer time in the auditory modality than the visual modality. Both behavioral and ERP data consistently showed strong effects of congruency in the two subject groups. It took longer reaction time for the subjects to respond to the incongruent answers than the congruent answers. The incongruency effect appeared similar between the two subject groups with a negative ERP component between 300 and 400 ms followed by a positive component between 400 and 600 ms in the visual modality. In the auditory modality, however, HFA adults showed delayed neural responses in both early and late components.

Conclusions: Both behavioral and ERP results indicate that stimulus presentation modality affects the speed and cortical responses for mathematical processing. Future work will examine this phenomenon from a developmental perspective to further investigate the relationship between language development and mathematical processing.

34 **137.034** Developing a Novel Visual Search Task Using Personalized Interests

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Background: Circumscribed interests are a common feature of Autism Spectrum Disorder (ASD), and can significantly interfere with daily functioning. Previous work in our lab has demonstrated that children with ASD have decreased cognitive flexibility to cues that represent their interests compared to Typically Developing (TD) children (Bos et al., under review), suggesting cognitive interference. One hypothesis as to why interests have greater affective salience in ASD is that individuals with ASD may show increased visual processing abilities for interests, similar to how TD individuals show enhanced processing skills for faces.
Objectives: Building upon prior work demonstrating that experts on a specific topic perform better on visual search tasks related to that topic, we created a novel visual attention task personalized to each individual's circumscribed interest. The goal was to determine whether low-level visual features were processed differently for interests in ASD vs. TD. We hypothesized that participants with ASD would perform better than TD participants due to the increased visual processing abilities that ASD individuals have for interests.

Methods: 29 individuals (5-30 years of age, mean = 15.38; 14 ASD) completed a novel visual search task personalized for his or her circumscribed interest. In the lab, participants were required to locate an unscrambled image in a group of scrambled distractor images as quickly as possible, presented on an iPad. Each trial had either 3, 15, or 35 distractor images, with a total of 108 trials. There were 3 conditions: pictures of faces, pictures of houses, and pictures of the participant's interest. Accuracy and reaction times were calculated for the three array sizes and by each condition. Caregivers completed the RBS-R as well as a novel questionnaire asking about the intensity and prior history of circumscribed interests. Analyses were conducted using Matlab.

Results: The effect of the array size on performance, calculated as the slope of reaction time over number of array elements, was significantly lower for the face condition as compared to the house condition and the interest condition for both ASD ($p = .001$, $p < .001$) and TD ($p < .001$, $p = .030$). The effect of the array size on performance was significantly correlated with age for the house condition ($R^2 = .600$, $p = .018$) and the interest condition ($R^2 = .639$, $p = .010$) in the TD group, and for the interest condition ($R^2 = .812$, $p < .001$) in the ASD group. There was no effect of array size for the face condition in either group. In addition, there were no significant differences in any condition between the ASD and TD groups.

Conclusions: Our current task did not demonstrate significant difference in performance between ASD and TD individuals, suggesting that the difference in affective salience occurs at a different, higher level of visual processing than our current low-level visual processing task required. In the future, we will further probe at what level of the visual stream differences emerge between ASD and TD individuals for processing cues that represent one's interests.

35 **137.035** Domain-Specific Training Improves Math Proficiency for Children with Autism and Other Neurodevelopmental Conditions

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Background: Math ability is integral to academic success and predicts overall achievement at later grades, therefore methods for improving math ability are crucial (Claessens & Engel, 2013). Domain-general attentional skills have demonstrated importance for math proficiency for typically developing (TD) children and children with neurodevelopmental conditions (NDCs; Cragg & Gilmore, 2014). Given the role of attention in math proficiency, it follows that attention-based interventions have the potential to demonstrate *far-transfer* effects; that is, improved attention resulting in improved math proficiency. While domain-specific interventions targeting math skills have been effective at improving proficiency for children with autism (Cihak & Foust, 2008), research has yet to compare the effectiveness of domain-general (attention) vs. domain-specific (math) interventions for math proficiency in NDC populations.

Objectives: The purpose of this study is to assess whether interventions targeting domain-specific math skills or domain-general attention skills can improve mathematics proficiency in young students with a NDC.

Methods: We recruited 36 students with a NDC diagnosis (n_{ASD}=21, $n_{Non\text{-}ASD[ADHD,ID]}$ =15). Pre-test measures of attentional abilities and mathematical proficiency were obtained using The Conners' Continuous Performance Test 3rd Edition (CPT-III) and the Easy Curriculum-Based Measure Numerical Operations subtest (EasyCBM), respectively. Students were equally and randomly divided into 3 groups (math and attention treatment groups, and a passive control group). Participants in the attention treatment group were trained on an attention-based multiple-object tracking (MOT) task. MOT involves visually tracking a set of target objects while ignoring distractor items for eight seconds. The math treatment group trained with a computerized math-based strategy task, *2048*. In the math-based task, students are faced with numbers in a grid and must combine identical numbers to create multiples, ultimately working to get the sum 2048. All groups completed post-testing (CPT-III, EasyCBM) after training.

Results: Students who completed the MOT task demonstrated improvements in attention that transferred to performance on the CPT-III (Tullo, Faubert & Bertone, 2018). Training on 2048 did not have an effect on attention. A mixed-model ANOVA was conducted to assess group by time interaction for the effects of training on math proficiency. There was no significant main effect of time, but there was a significant effect of group, $p=.028$, partial h^2 = .207. Furthermore, there was a significant interaction of group and time p = 0.033, partial h^2 = .198. Post-hoc analyses revealed that the group that completed 2048 demonstrated significant improvements in performance on the EasyCBM at post-test compared to both the MOT and passive control group. The MOT group and control group were not significantly different.

Conclusions: Results indicated that training on MOT improved attention, but this did not have a far-transfer effect to improving math performance. This suggests far-transfer effects of attention training to math proficiency are not immediately evident in young students with NDCs. Alternatively, engaging with 2048, a number-based strategy task, resulted in improved math performance in the area of numerical operations. Thus, interventions targeting domain-specific math skills, as opposed to domain-general attentional skills, result in improved performance on tasks of math proficiency for young students with NDCs.

36 **137.036** Effectiveness and Retention of Memory Strategy Training of Children with Autism Spectrum Disorder

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Background: Although memory strategies are essential to executive functioning, attention, and learning, children with autism spectrum disorder (ASD) often have difficulty spontaneously using strategies like categorization (grouping items) and cumulative rehearsal (effortful repetition of items in a cumulative nature) when in new learning situations. When spontaneous strategies are observed, the same strategy is frequently used repeatedly or ineffectively (Andersen et al., 2013; Bebko & Ricciuti, 2000). Resulting memory limitations lead to challenges in learning critical new information, which can negatively impact the proper execution of daily functions (e.g., remembering appointments) and reduce academic and social functioning. Few studies have explored interventions for enhancing memory strategy use in children with ASD and the generalization of learned memory strategies to new situations.

Objectives: We examined the effectiveness of an intervention for enhancing categorization and rehearsal strategies strategy use by children with ASD. Of particular interest was the lasting effects of the teaching, specifically the maintenance of the learning after the intervention was finished, and the generalization of the strategies to new contexts.

Methods: Methods: A single-case research design with multiple participants was used where each child was his/her own control. Participants were nine children with ASD, ages 7-13 years (M = 10.25; SD = 1.75) with Full Scale IQs (WASI) > 60 and receptive vocabulary level ≥ 4 years. Participants were given a memory probe task using cards from eight distinct categories (e.g., food, furniture). During baseline, spontaneous categorization and rehearsal strategy use was assessed by inviting participants to do whatever they wished to help themselves remember the cards, following which they were turned down. Recall was assessed after a 30-second unfilled delay. Following baseline, there were 45-minute memory strategy training sessions given twice per week for three consecutive weeks. Important added components were metamemory awareness (the "why" and "how"" of strategy use) and attribution training (e.g., my gains in recall are due to my efforts vs external factors). Maintenance of training gains and generalization was observed two weeks following training. Categorization and rehearsal strategy use was measured during study time, along with two output variables, clustering (items grouped upon recall) and free recall.

Results: During Baseline, only two participants showed signs of memory strategy use, but these strategies were used inefficiently. The other seven participants showed no evidence of spontaneous categorization or rehearsal use. After receiving only two sets of training trials participants began using categorization and rehearsal successfully. By the final session, all nine participants showed evidence of using the categorization and rehearsal strategies and demonstrated improved clustering and free recall. Newly-learned skills were maintained at follow-up. "Far" generalization of the categorization strategy to a "Guess Who?™" game was limited.

Conclusions: Results have significant implications for educators and therapists. With a controlled procedure including metamemory awareness and attribution training, effective learning strategies can be readily taught in a limited number of sessions. This can lead to positive outcomes for children with ASD through improved performance in learning situations, with gains that are maintained well after training ends.

37 **137.037** Executive Function and the Severity of Autism Symptoms and Associated Behaviors in Young Children with Autism Spectrum Disorder

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Background: Although research has shown that individuals with autism spectrum disorder (ASD) evidence impairments in executive functioning (EF) (Demetriou et al., 2018), less is known about the association with other aspects of functioning in children, including language, adaptive behavior, and challenging behaviors. Furthermore, little is known about the relationship between EF and attentional skills in ASD. However, previous eye tracking (ET) studies have demonstrated that, when shown a dynamic video containing social and nonsocial stimuli, children with ASD spend less time attending to stimuli compared to typically developing children (Chawarska, Macari, & Shic, 2012).
Objectives: We examined the relationship between EF and core autism symptoms, language, adaptive behavior, challenging behaviors, and attention assessed via ET in young children with ASD.

Methods: 176 children with ASD (140 males; ages 2-8) participated in a clinical trial; ADOS-2 and ADI-R confirmed diagnosis. At baseline, participants completed the Expressive One-Word Picture Vocabulary Test, Fourth Edition (EOWPVT-4) and watched a 3-minute video including social and toy stimuli; gaze was monitored via ET. Sixteen participants were excluded for non-compliance and calibration failures, n = 160. Caregivers completed the Behavior Rating Inventory of Executive Function (BRIEF) or BRIEF-Preschool (BRIEF-P; participants under age 5), PDD Behavior Inventory (PDDBI), and Aberrant Behavior Checklist – Community (ABC-C) questionnaires, and Vineland Adaptive Behavior Scales, Third Edition (VABS-3) interview. BRIEF/BRIEF-P analyses included comparison of overlapping scales: Inhibit, Shift, Emotional Control, Working Memory, and Plan/Organize.

Results: Greater EF impairment, across all BRIEF scales, was associated with more severe autism symptoms, as reflected in the PDDBI Autism Composite score. Furthermore, greater EF impairments on all five BRIEF scales were associated with more severe symptoms on PDDBI Approach-Withdrawal subscales (Sensory/Perceptual Approach Behaviors, Ritualisms/Resistance to Change, Social Pragmatic Problems, Semantic/Pragmatic Problems, Arousal Regulation Problems, Specific Fears, and Aggressiveness; correlations ranging from r=.21 to r=.64, all p<.01). Greater EF impairments were also associated with increased challenging behaviors (ABC-C composite and all subscales: Irritability, Lethargy, Stereotypy, Hyperactivity, and Inappropriate Speech; correlations ranging from r=.42 to r=.54, all p<.03). Examining language, only the BRIEF scales measuring Inhibition and Working Memory were associated with less expressive vocabulary (EOWPVT-4 raw score). Greater EF impairments were associated with less developed adaptive skills on the VABS-3 Adaptive Behavior Composite, Communication Domain, and Daily Living Skills Domain. Finally, ET data revealed that greater proportion of time looking at media was positively associated with better EF in the areas of Emotional Control, Working Memory, and Plan/Organize.

Conclusions: Results suggest executive dysfunction, including challenges with inhibiting, shifting, emotional control, working memory, and planning/organizing, is associated with increased autism severity and challenging behaviors, and decreased expressive language and adaptive skills. Further, results indicate better EF in emotional control, working memory, and planning/organization is associated with more time visually attending to a dynamic video containing both social and non-social stimuli. Taken together, these results suggest that EF skills are closely linked to a wide range of behaviors in young children with ASD. As such, interventions that address EF skills may lead to improvements in other behavioral domains.

38 **137.038** Functional Adaptive Behaviors Are Associated with Gaze Fixation Duration When Viewing Social Video in Young Adults with ASD

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Background: Eye gaze tracking (EGT) studies in adults with autism spectrum disorder (ASD) have shown associations between visual attention and social cognition, however, less is known about the relationship between visual attention measured in laboratory experiment and adaptive behaviors in everyday life.
Objectives: To investigate the associations between functional adaptive behaviors of ASD young adults with their gaze fixation duration on human faces when viewing social scenarios.

Methods: Nineteen young adults with ASD and 21 matched controls participated in an EGT study. They viewed 6 video vignettes portraying social conflict between 2 characters and were asked to describe the scene. Their narrations were analyzed to compute the ratio of mental verbs to action verbs. Thereafter the participants completed the Adaptive Behavior Assessment System (ABAS) questionnaire.

Results: Adaptive performance in the ten behavior composites of the ABAS (e.g. Communication, Leisure and Social skills, Community Use, and Self-Care) was significantly lower in the ASD group compared to controls. Additionally, less adaptive behavioral composites were associated with reduced fixation duration on speaking characters when viewing social scenarios and reduced use of mental verbs when describing the social scenarios.

Conclusions: EGT holds promise as a non-invasive and quantitative evaluation instrument that is associated with social cognition and adaptive behavior in young adults with ASD. EGT might help to determine behavioral adaptive outcomes in clinical trials investigating functional interventions for young adults with ASD.

39 **137.039** Impacts of Sensory Challenges on Attentional Control in Young Children with Autism

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Background: Individuals with autism (ASD) often present with challenges with attentional control (Karhson & Golob, 2016). Concurrently with tasks of attention, individuals with ASD often struggle to effectively filter multisensory input (Boland et al., 2018). Thus, as additional sensory stimuli are introduced, attentional control skills like focused attention are negatively impacted (Brandwein et al., 2015). Because sensory challenges co-occur in up to 90-95% of individuals with autism (Baker et al., 2008), it is important to examine the role of sensory stimuli in the attentional control skills of young children with ASD.
Objectives: Our objective was to investigate the potential mediational role of sensory on attention focusing in ASD and typically developing (TD) populations. We hypothesized that sensory would mediate the relation between status (ASD vs. TD) and attention. Specifically, we predicted that increases in sensory would help explain the attention focusing skills for status groups. Additionally, given that children with ASD have increased

sensory symptoms, we hypothesized that the relation between sensory and attention focusing would be stronger for our ASD sample.

Methods: Participants included 170 children between ages 3:0 and 6:11. Our sample comprised of 96 TD children (43% female) and 74 children with ASD (24% female). A subscale of the Autism Behavior Checklist (ABC; Krug et al. 1980) was used to determine sensory symptoms. Parents' ratings from the Child Behavior Questionnaire (Rothbart et al., 2001) were used to evaluate children's attentional control.

Results: A mediated multiple regression analysis was conducted to investigate the degree to which sensory mediated the relation between status and attentional focusing. Findings indicated significant indirect effects for both status groups through sensory (B = 7.389, CI_{95} = 5.73 to 9.05) and sensory through attention (B = -.182, CI_{95} = -.367 to -.003). Correspondingly, the total indirect effect was statistically significant (B = -1.344, CI_{95} = -2.755 to -.184), supporting our prediction that sensory would mediate the association between status and attention. The negative valence of this effect means that children with ASD demonstrated, on average, a 1.344 point decrease in focused attention compared to the TD group as a result of the effect of status on attention through sensory.

Conclusions: Results supported our hypotheses that the ASD group would exhibit a higher frequency of sensory symptoms and that sensory symptom severity increases would impact focused attention. Sensory severity also mediated the relation between status and attention, suggesting that increased sensory behaviors relate to lower sustained attention and that this relation is stronger for children with ASD. Attentional skills have been linked with higher cognitive functioning (Lawson & Ruff, 2004) and increased sensory challenges in children with ASD are related to deficits in across multiple domains (i.e., social outcomes [Stevenson et al., 2014], daily living [Baker et al., 2008], and emotion regulation [Woo et al., 2015]). In sum, interventions that target sensory challenges may help to minimize barriers to attentional capacity in young children with ASD.

40 **137.040** Improved Executive Function over Time in Children with ASD and Relations with Mental Health and Functional Outcomes

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Background: Executive function (EF) is a high-order cognitive function including a number of subcomponents, such as set-shifting, response inhibition and working memory. Executive dysfunction is prevalent in children diagnosed with autism spectrum disorder (ASD) and may be an important predictor of functional independence in adulthood. Relationships between EF and adaptive functioning and mental health symptoms have been shown. However, little is known about the development of EF skills over time in children with ASD.

Objectives: We aimed to examine: 1) how EF skills change over time in a large longitudinal sample of children with ASD followed across school age; and (2) whether EF skills in school-age predict functional outcomes in pre-adolescence.

Methods: Our sample included data from 202 children prospectively followed in a large Canadian multisite longitudinal study (Pathways in ASD Study) from the time of clinical diagnosis of ASD in early childhood (2-4 years of age, T1) across 7 additional timepoints (T2-7). Data collected when children were age 6 (T4), and every 1-2.5 years thereafter (T5-8) was used (sample age=10-11.8 years at T8). The Behavior Rating Inventory of Executive Function(BRIEF) Behavioral Regulation (BRI) and Metacognitive Index (MCI) Subscales (T5-8), Vineland Adaptive Behavior Scale(VABS) Adaptive Behavior Composite Score (T8), Child Behavior Checklist(CBCL) Internalizing/Externalizing Scores (T8), teacher-report of academic performance (Teacher Report Form) (T8), and Wechsler Preschool and Primary Scale of Intelligence-measured full scale IQ (T4) were used. Repeated measures analysis was used to examine change in BRI and MCI T scores collected in participants across school-age (T5-8). Hierarchical regressions were used to examine whether BRI and MCI scores (collected at T5-7) predicted VABS composite, CBCL internalizing/externalizing and academic performance scores at T8 (N=71-88). FSIQ was entered in the first step for each model to control for effects of general intelligence.

Results: Repeated measures analysis showed a significant decline for both BRI (F3, 279= 4.88, p = .003) and MCI T-scores (F3, 250= 5.56, p = .001) across T5 to 8. Hierarchical regressions indicated that: BRI predicted both internalizing (β=.46, p<0.01) and externalizing (β=.37, p<0.01) behaviours in models controlling for MCI, FSIQ and internalizing or externalizing behaviours; and BRI (β=-.37, p<0.01), MCI (β=.17, p<0.05), and FSIQ (β=.26, p<0.01) were all significant predictors of academic performance. Only FSIQ was a significant predictor of VABS composite scores.

Conclusions: Our preliminary findings indicate that in children with ASD, EF skills improve across school age. Parent-reported EF skills collected across school age are also predictive of parent-reported mental health symptoms, and teacher-reported academic performance in the same children in pre-adolescence. EF skills may be an important cognitive domain to track in children with ASD as well as a novel treatment target with the potential for positive downstream effects on academic performance and mental health symptoms.

41 **137.041** Influence of Autism Spectrum Disorder and Anxiety on Perceptual Load Capacity

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Background: Perceptual load theory posits that there is a limited amount of information a person can perceive at any given time and information is processed automatically until reaching this capacity. Separate lines of research suggest that perceptual capacity may be enhanced in individuals with Autism Spectrum Disorder (ASD; Remington et al., 2009, 2012) and also in non-ASD populations with high trait anxiety (Berggren et al., 2015; Sadeh & Bredemeier, 2011).

Objectives: The present study represents a confluence of these two lines of research. We sought to examine whether enhanced perceptual capacity is unique to ASD, unique to anxiety disorders (with the ASD findings being a consequence of high comorbidity), or is attributable to a mechanism intrinsic to both of these conditions.

Methods: An established computerized paradigm (Remington et al., 2012; Berggren et al., 2015) was used to assess perceptual capacity limits in 56

high functioning male participants (28 with ASD). In the task, participants were shown visual arrays consisting of 1-6 letters (thus manipulating perceptual load). Participants were to respond as quickly as possible as to whether the target letter *X* or *N* was present in the array. On 50% of trials, an additional stimulus probe, a squiggle, was presented simultaneously with the letter display. Participants were also to monitor whether this probe was present or absent. Participants completed 4 blocks of 72 experimental trials each (total=288 trials).

Results: Detection sensitivity (d') for the 'squiggle' detection task served as the primary dependent variable. Data were entered into hierarchical linear model analyses with group (ASD and non-ASD) and STAI anxiety scores as between-subject factors and array size (1, 2, 4, or 6) as a within-subject factor. As anticipated, there was a main effect of condition [$F(3,165)=16.72$, $p<.001$], indicating that performance declined at higher set sizes. The main effect of autism group trended towards significance [$F(1,53)=3.32$, $p=0.07$] with generally lower d' scores for the ASD group. There were no main effects of anxiety, two-way, or three-way interactions between condition, group, and anxiety [all $F<1$]. When comparing highly elevated anxiety scores (>1.5SD above normative STAI score) with typical anxiety scores at array sizes 2 and 4, we found a significant interaction between array size and anxiety group [$F(1,52)=5.89$, $p=.019$] such that d' declined significantly from array size 2 to 4 for individuals with typical anxiety scores but not for individuals with elevated scores.

Conclusions: Consistent with recent literature, these findings indicate that elevated levels of anxiety are associated with superior perceptual capacity. This was true across both the ASD and non-ASD groups. A main effect of ASD diagnosis was also evident such that individuals with ASD showed poorer overall performance. Although speculative, comorbid anxiety may have contributed to previous reports of enhanced performance in samples of individuals with ASD. Additional research is needed to fully understand the interplay between ASD, anxiety, and perceptual capacity.

42 **137.042** Inhibitory Control in Young Children with Autism Spectrum Disorder

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Background: Inhibitory control (IC) is a higher-order executive function involved in suppressing a prepotent response in order to produce an appropriate, task-relevant response (Diamond, 2013). IC experiences rapid growth during the early school years (MacDonald et al., 2014) and is associated with social-emotional ability (Rhoades et al., 2009), emotion regulation (Carlson & Wang, 2007), and early mathematics (Clark et al., 2010) in young children with typical development (TD). While there is strong support for the presence of executive function deficits in autism spectrum disorder (ASD), the IC abilities of individuals with ASD is still debated (Christ et al., 2007; Ozonoff & Strayer, 1997). Very little is known about the IC profile of young children with ASD, but recent research found no group differences on a behavioral measure of inhibition in toddler- to early school-aged children with ASD compared to TD peers (Gardiner et al., 2017).

Objectives: Our primary objective was to explore the relation between different child factors (ASD vs. TD, chronological age, and sex) and IC in a sample of young children.

Methods: Participants included 159 children, 36- to 83-months of age, with TD (n = 102) and ASD (n = 57). Child's diagnostic status was determined by diagnostic reports provided or medically released by parents. Verbal ability was assessed using a composite verbal domain standard score obtained from the Differential Ability Scale-II (Elliot, 2007). Children were administered the Boy-Girl Stroop Task (Kerns & McInerney, 2007; adapted from Diamond et al., 2002) to measure IC, operationalized as the number of correct responses (highest score = 16).

Results: Multivariate regression analysis was used to examine the relations among status (ASD vs TD), age, verbal ability, and sex. The analysis indicated that verbal ability, sex, and age explained a significant proportion of unique variance in IC (R^2 = .11, $F(4,154)$ = 5.72, p < .001) with higher verbal ability predicting higher IC (b = .05, $t(154)$ = 2.19, p =.03), older children predicting higher IC (b = .08, $t(154)$ = 3.34, p = .001), and females (M = 13.61, SD = 3.15) outperforming males (M = 12.11, SD = 4.19; b = -1.34, $t(154)$ = -2.17, p = .03). No differences in IC were found between children with ASD (M = 12.11, SD = 4.33) and TD (M = 13.03, SD = 3.58; b = .59, $t(154)$ = 0.87, p = .38).

Conclusions: This study demonstrated that verbal ability, age, and sex predict IC in young children. No differences were found between children with ASD and TD peers for IC. These findings are consistent with research demonstrating that IC in school-aged, TD children improve with age (MacDonald et al., 2014) and that children with TD and ASD perform similarly on laboratory tasks of IC (Gardiner et al., 2017). This is the largest and youngest sample to date exploring the relation between ASD and IC. Further research is needed to better understand how inhibition develops in young children with ASD.

43 **137.043** Intact Use of Prior Information in Autism during Visual Search

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Background: Visual perception is influenced by prior experiences and learned expectations. One example of this is the ability to rapidly resume visual search after an interruption to the stimuli. It has recently been suggested that atypical visual perception in autism spectrum conditions (ASC) can be explained by attenuated use of prior information during perception. However, there is a current lack of empirical evidence to comprehensively evaluate this theory.

Objectives: We aimed to use an interrupted search paradigm to assess whether rapid resumption is intact in ASC. We hypothesize that attenuated use of prior information in perception would lead to a reduced ability to rapidly resume searches after interruption.

Methods: Participants with (N=24) and without ASC (N=26) were asked to complete a visual search task in which search displays were periodically interrupted by blank displays. Participants were required to locate a 'T' shaped target amongst 'L' shaped distractors and to report its color. Search displays contained either 16 or 32 distractors. During trials the search display would only be visible for 100ms presentations separated by a 900ms blank display. Participants completed a total of 300 trials, divided across 10 blocks.

Results: Reaction time distributions were normalized separately for responses occurring between the first and second exposures of displays and responses occurring after subsequent exposures. In both groups the distribution of responses immediately following the first exposure differed significantly from the distribution of responses following subsequent exposures (p<.001). Responses following subsequent exposures were found to be bimodally distributed, consisting of a combination of faster trials (in which prior exposure to the display facilitate search) and standard trials. An Expectation-Maximisation algorithm was used to fit a 2-component Gaussian mixture model to the bimodal data. This model was used to identify trials in which participates were influenced by prior exposures to the search display. We found no difference in the relative proportion of fast and standard trials between the two groups (p>.3).

Conclusions: Our results suggest that individuals with ASC show intact use of prior information during visual search. These findings are in contrast to the claims that individuals with ASC show attenuated use of prior information during perception.

44 **137.044** Legal Implications of Memory Deficits and Similarities in Youths with Autism

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Background: Individuals with high functioning Autism (HFA) exhibit deficits in eyewitness memory compared to typically developing individuals (TD). In adult samples, deficits are observed on recall tasks while performances in responses to direct question tasks may be undiminished, perhaps due to executive function compensatory strategies. Yet, younger HFA youths may evince deficits on both types of memory tasks, as compensatory mechanisms are still developing. Meanwhile, forensic interview protocols that assess eyewitness memory accuracy may be ineffective for those with HFA; such protocols employ mnemonic strategies reliant upon TD cognitive and social abilities that may be diminished in HFA samples, particularly HFA youths.

Objectives: This study compared eyewitness memory in youths with and without HFA, as well as assessed the efficacy of two forensic interview protocols.

Methods: Youths (age: M = 13.96, SD = 2.47, N = 48), half diagnosed with HFA, experienced a distressing event involving four confederates. Three weeks later, half received the Cognitive Interview (CI) or the 10-Step (a NICHD derivative) protocols to report everything they could remember. Following narratives, youths were asked a series of direct questions (DQ) about objects, people, and actions; the latter two categories were classified as self- or other-related details. Working memory, IQ, and pragmatic abilities were also assessed.

Results: Analyses employed a 2(Diagnostic groups: HFA vs. TD) x 2(Interview Protocol: 10 Step vs. CI) univariate/multivariate model, depending on the outcome variable(s). Narrative analyses found significant diagnostic group differences on **total details** [F(1, 43) = 19.26, p < .001, = .31, **actions** [F(1, 43) = 11.20, p < .003, = .21, **people** [F(1, 43) = 10.62, p < .003, = .20, **objects** [F(1, 43) = 18.56, p < .001, = .30, indicating HFA deficits (Figure 1). Memory protocols did not differ or interact with diagnosis, F's (1-3,41-43) ≤ 1.66, p =n.s. For DQ analyses, a significant Diagnosis group x Interview Protocol x Detail (self vs. other) interaction, F(1, 43) = 6.01, p < .02, = .12, revealed that, among HFA, youths in 10 step condition answered self action DQs more accurately than youths in CI condition, F(1,43) = 4.86, p < .04, = .10, HFA-10Step = .87(.11), HFA-CI = .80(.12); the opposite pattern was observed for other action DQs, F(1,43) = 10.88, p < .003, = .20, HFA-10Step = .70(.15), HFA-CI = .81(.14). Youths with and without HFA performed similarly on DQ outcomes, F's(1-3,41-43) ≤ 1.74. Among HFA youths, narrative accuracy for actions was associated with IQ (β = .47, t = 2.94, p < .01) and pragmatic difficulties (β = -.39, t = -2.32, p < .05). A similar model was observed for narrative total details, R^2 = .58, F(3,20) = 9.14, p < .001.

Conclusions: While narrative performance was diminished, HFA youths performed similarly to TD peers on DQs. Executive function skills (IQ and pragmatic abilities) predicted HFA narrative accuracy. Narrative performance did not benefit from either protocol's strategies but did influence responses to DQs about self- and other-actions; legal applications are discussed.

45 **137.045** Metacognitive Monitoring and Control in Autistic Eyewitnesses

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Background:

Providing eyewitness testimony involves effectively monitoring one's memory in order to provide the most *detailed*, yet *accurate* account possible; reporting details that one is sure of and withholding details that may be inaccurate. According to Koriat and Goldsmith's (1996) monitoring and control framework, an individual will provide fine-grained detail (e.g., navy blue) when their confidence of accuracy exceeds a criterion threshold; if not, they retrieve a less detailed, coarser-grained response (e.g., dark) (Ackerman & Goldsmith, 2008). Autistic individuals experience difficulties both in retrieving specific episodic memories (Bowler et al., 2000) and in monitoring the accuracy of their output (e.g., Grainger, Williams, & Lind, 2016). They also show a bias towards local, detail-focused processing (Mottron et al., 2006).

Objectives:

1. Do autistic and typically developing (TD) witnesses differ in monitoring the accuracy of their output?
2. Do autistic and TD witnesses differ in strategically controlling their output, weighting accuracy against informativeness?
3. Do both autistic and TD witnesses maximise accuracy over informativeness when explicitly instructed to do so?

Methods:

Based on an a-priori sample size calculation, 34 autistic adults and 34 age- and IQ-matched TD adults viewed a short video clip of a mock bank robbery before answering questions about it. In Phase 1, participants freely generated the granularity of their responses (i.e., fine- or coarse-grained). In Phase 2, participants answered the same questions again but this time they were asked to provide both a fine-and a coarse-grained answer to each question. Finally, in Phase 3, participants were shown their answers from Phase 2, and were instructed to select one of these as their final answer, and they were asked to maximise accuracy over informativeness by only reporting fine-grained details if they were absolutely confident they were correct. Confidence ratings were taken for each response in all phases.

Results:

Data collection is in the final stages but preliminary results from the existing data indicate that both groups showed a strong free reporting preference for fine-grained details in Phase 1 (ASD 87.5% fine-grained; TD 95.6%) and did so with similar rates of accuracy: ASD M accuracy =0.42, SD=0.17; TD M accuracy =0.43, SD=0.10 (p=.768). While autistic and TD witnesses showed similar confidence-accuracy correlations for reported fine-grained details (ASD M Gamma=.45, TD M Gamma=.46), there was some preliminary evidence that TD witnesses were better at judging the accuracy of coarse-grained information (M Gamma=.63) than autistic witnesses (M Gamma=.49), suggesting potentially subtle differences in the monitoring and regulation of output. Nevertheless, all witnesses were significantly more accurate in Phase 3 when explicitly instructed to maximise accuracy over informativeness, F(1,30)=34.32, p<.001, ηp^2=.53, and there was no Group x Phase interaction, F(1,30)=0.98, p=.331, ηp^2=.03, indicating that autistic and TD witnesses benefited similarly from this instruction. The improvement in accuracy was driven by an increase in coarse-grained reporting in Phase 3, F(1,30)=317.14, p<.001, ηp^2=.91.

Conclusions:

Findings have implications for the instructions that witnesses receive, with preliminary findings indicating that autistic witnesses can strategically regulate their output to maximise accuracy when explicitly instructedto do so.

46 **137.046** Non-Verbal Intelligence Is a Better Predictor of Cognitive Flexibility in Low Functioning Adolescents with Autism Compared to Adolescents with Intellectual Developmental Disability

***J. Oh**, S. Lung and A. Bertone, McGill University, Montreal, QC, Canada*

Background: Children and adolescents with Autism Spectrum Disorder (ASD) often have more difficulties with cognitive flexibility compared to their typically developing (TD) peers (Geurts et al., 2004). Cognitive flexibility is part of executive functioning (EF) skills and involves the ability to switch flexibly between mental states and take multiple simultaneous perspectives. Research in TD children has demonstrated that verbal abilities predict and mediate performance on tasks that measure cognitive flexibility both concurrently (Low & Simpson, 2012) and longitudinally (Watson, Painter, & Bornstein, 2001). This relationship is less understood in ASD in part because individuals with ASD rely more on visual rather than verbal abilities when completing executive functioning tasks (Kunda & Goel, 2011), and demonstrate predictive relationships between non-verbal abilities and switching performance (Campbell et.al., 2017).

Objectives: This study examined whether a relationship between non-verbal intelligence and cognitive flexibility exists that is specific to adolescents with ASD and lower cognitive abilities (low-functioning), compared to adolescents with Intellectual Developmental Disability (IDD), who also have comparable EF difficulties (Visser et.al., 2015). Specifically, we explored whether there are differences in the relationships between verbal and non-verbal intelligence and cognitive flexibility between groups, and if non-verbal intelligence can predict cognitive flexibility ability in either groups.

Methods: Fifty-three participants (37 males, 16 females; 12-17 years) with a primary diagnosis of either ASD (n= 20) or IDD (n= 33) completed the Wechsler Abbreviated Scale of Intelligence (WASI-II); all participants had a FSIQ of 70 and below (M_{FSIQ}= 53.7, SD= 10.4). Verbal and non-verbal intelligence were defined by Verbal Comprehension (VCI) and Perceptual Reasoning (PRI) WASI-II indices, respectively. All participants completed a computerized version of the Wisconsin Card Sorting Task (WCST) to measure cognitive flexibility ability.

Results: No significant group difference between ASD and IDD participants was found on either WCST performance (total correct T-score) or verbal intelligence (VCI score). However, the ASD group scored significantly higher on the non-verbal subtests (PRI: M = 65.6, SD = 15.3) compared to the IDD group (M = 56.6, SD = 9.7), $t(51)$=2.35, p <.05. A linear regression analyses revealed that verbal intelligence (VCI score) did not predict WCST performance for either the ASD (p = .10) nor IDD groups (p = .11). However, non-verbal intelligence (PRI score) was a significant predictor (R^2 = 36) of the WCST scores for the ASD group only (p =.005).

Conclusions: Non-verbal intelligence predicted performance on the WCST in a group of lower-functioning adolescents with ASD, but not in the adolescents with IDD. It is important to note that this relationship was present despite similar WCST performance across groups. Our study highlights the unique role of non-verbal intelligence in ASD when explaining cognitive flexibility ability. In addition, the relative non-verbal strength observed in our ASD sample suggests that individuals with ASD may solve cognitive flexibility tasks by relying on their non-verbal abilities.

Poster Session
138 - Diagnostic, Behavioral, Sensory and Intellectual Screening and Assessment
5:30 PM - 7:00 PM - Room: 710

47 **138.047** Diagnostic Overshadowing in Autistic Women

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Background:

Research indicates that females are diagnosed with Autism Spectrum Disorder (ASD) later than their male counterparts, and that many remain undetected until later in life. Autistic women are likely to experience comorbid mental health conditions, including eating disorders (ED), depression and anxiety, however it is unclear how these conditions impact the accurate detection and diagnosis of ASD.

Objectives:

The aims of this research were to understand how comorbid mental illness interferes with the accurate detection and diagnosis of ASD in women, and how they present now. It was hypothesised that autistic women would not receive a primary diagnosis of ASD, as it would be obscured by the presence of mental health issues, and that autistic women would currently display more severe mental health symptoms than neurotypical women.

Methods:

We recruited 672 women between 18 and 72 years online. The sample contained 350 autistic women (M=36.21 SD=10.10), and 322 neurotypical women (M=34.83, SD=9.93). Self-declared diagnoses were confirmed using the Autism Spectrum Quotient (AQ). Current levels of disordered eating were assessed using the Eating Attitudes Test (EAT-26), and current depression and anxiety symptoms were assessed using the Depression, Anxiety, Stress Scale (DASS-21).

Results:

Chi-square analysis found 32.09% of autistic women had also been diagnosed with an ED $\chi^2_{(1;\ N=112)}$ = 7.99, p<.005. Of the 112 autistic women, 86.36% received an ED diagnosis first, with an average of 12.86 years (SD= 9.68) delay before receiving an ASD diagnosis. The average age of ED diagnosis was 17.76 years (SD=6.27) in autistic women, which was not significantly younger than in neurotypical women (p=.480, d =.085.

Chi-square analysis found 82.29% of autistic women had also been diagnosed with either depression or anxiety $\chi^2_{(1;\ N=288)}$ = 28.28, p<.001. Of the 288 autistic women, 76.84% received a depression or anxiety diagnosis first, with an average of 13.14 years (SD= 8.98) delay before receiving an ASD

diagnosis. The average age of depression or anxiety diagnosis was 19.98 years (*SD*=7.98) in autistic women, which was significantly younger than in neurotypical women (p=.021, d=.214).

Independent sample t-tests found significant differences in current mental illness symptomology between autistic and neurotypical women in the EAT-26 Total Score ($t_{(942)}$=-3.09, p=.005) and Dieting subscale ($t_{(942)}$=-3.66, p=<.001), as well as in DASS-21 scores across all subscales: Depression ($t_{(643)}$=5.73, p=<.001), Anxiety ($t_{(643)}$=8.17, p=<.001), and Stress ($t_{(643)}$=7.83, p=<.001). This demonstrates that autistic women currently experience elevated symptomology across many domains.

Conclusions:

Autistic women were more likely to have received a primary diagnosis of a mental illness and not ASD. They faced substantial delays before their ASD was detected and diagnosed. This suggests that diagnostic overshadowing occurred, as ASD symptoms may have been misattributed to, or obscured by comorbid mental illness. Autistic women received some types of mental health diagnoses at an earlier age than neurotypical women, and displayed some current symptoms at a more severe level. It highlights the necessity for greater understanding of female ASD presentation, and the use of female-centric screening tools in women with mental health concerns.

48 **138.048** Dimensional Scoring of Parent Report Screens for Autism Improves Accuracy at the 18-Month Pediatric Visit

S. M. Attar[1], *R. A. Sturner*[2,3], *B. J. Howard*[1,4], *P. E. Bergmann*[5], *L. Stewart*[6], *K. Bet*[1], *S. Baron-Cohen*[7] *and C. Allison*[7], *(1)Total Child Health, Baltimore, MD, (2)Pediatrics, Center for Promotion of Child Development through Primary Care, Baltimore, MD, (3)Pediatrics, Johns Hopkins U School of Medicine, Baltimore, MD, (4)Pediatrics, The Johns Hopkins U Sch. of Medicine, Baltimore, MD, (5)ForesightLogic, Shoreview, MN, (6)Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (7)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background:

Screening for Autism is recommended by the American Academy of Pediatrics (AAP) at both 18 and 24-month check-up visits. The Modified Checklist for Autism in Toddlers-Revised (M-CHAT-R), which is a recommended and the most commonly used screening measure, has been shown to require a follow-up interview (M-CHAT-R/F) to reduce false positives (Kleinman, et. al., 2008); however, this interview is an implementation challenge. Additionally, the M-CHAT-R may be less accurate for 18-month olds than 24-month olds (Pandey, et. al., 2008; Sturner, et. al., 2017a). Since autism symptoms may emerge gradually in toddlers (Ozonoff, 2008) and most M-CHAT item failures in younger toddlers are for later emerging milestones (Sturner, et. al., 2017b), we reasoned that items allowing dimensional responses (e.g., "how much"), such as the Parent Observation of Social Interaction (POSI; Smith,.et. al., (2013)) and the Quantitative Checklist for Autism in Toddlers (Q-CHAT-10; Allison, et. al., 2012), might better capture signs of autism than the yes/no items used in the M-CHAT-R. Although the POSI and Q-CHAT comprise dimensional responses, they still use dichotomous scoring systems.

Objectives:

To compare the predictive utility at 16-20 months of the M-CHAT-R/F, which uses a yes/no response format, with the predictive utility of POSI and Q-CHAT-10, two screens which use dimensional response items.

Methods:

Parents of 16-20 month olds completed the M-CHAT-R and the Q-CHAT-10 before 18-month pediatric visits via an online system (CHADIS). Children with positive screens (96) on either the M-CHAT-R/F or Q-CHAT-10 were recruited along with age and practice-matched controls (314). Parents subsequently completed the POSI. Children were assessed with the Mullen Scales of Early Learning (MSEL; Mullen, 1995)) and Autism Diagnostic Observation Schedule - Toddler Version (ADOS-T; Lord, et. al. 2000). The ADOS-T and clinical judgement were used to determine whether a child met sufficient criteria for autism to be considered a positive. Comparisons of estimated ROCs were conducted between the tools using two one-sided tests of equivalence (TOST).

Results:

Dimensional scoring improved the specificity of Q-CHAT-10 with less benefit to the POSI. Although separately similar to M-CHAT-R, a combination of the QCHAT-10 and POSI that used dimensional scoring (D/Q-CHAT-10 + D/POSI) had better sensitivity than the currently recommended M-CHAT-R/F and better specificity compared to M-CHAT-R with comparable PPV and without requiring a follow-up interview.

Conclusions:

Autism screening measures for young toddlers that use dimensional response items may have advantages over the categorical yes/no item format. This combined dimensionally scored D/Q-CHAT-10+ D/POSI is not only more accurate than a widely used categorical screen, but also more efficient, as it uses a similar number of questions (17 for Q-CHAT-10+D/POSI and 20 for M-CHAT-R) but does not require the follow-up interview of the M-CHAT-R. However, none of these screens have improved the known problem of low PPV at this visit age.

49 **138.049** Discrepancy on Stanford Binet Intelligence Scales-Fifth Edition in Adults with ASD in Mid-Adulthood

K. M. Dudley[1], ***A. T. Meyer***[2], *P. S. Powell*[3], *M. R. Klinger*[4] *and L. G. Klinger*[5], *(1)Department of Psychology & Neuroscience, UNC Chapel Hill; TEACCH Autism Program, Carrboro, NC, (2)JFK Partners, University of Colorado School of Medicine, Aurora, CO, (3)School of Psychology, Georgia Institute of Technology, Atlanta, GA, (4)UNC TEACCH Autism Program, Chapel Hill, NC, (5)TEACCH Autism Program; Psychiatry, University of North Carolina, Chapel Hill, NC*

Background: Intelligence (IQ) tests are frequently used to evaluate cognitive functioning in persons with ASD. Studies show on the Stanford Binet Intelligence Scales-Fifth Edition (SB-5), children and adolescents with ASD exhibited higher nonverbal IQ skills compared to verbal IQ skills (Coolican et al., 2008; Matthews et al., 2015). It is unclear if these same discrepancies on the SB-5 are maintained through adulthood. It is important to understand the cognitive profile of adults with ASD to determine relative strengths and weaknesses as well as intervention and treatment strategies that may be appropriate for adults with ASD.

Objectives: The goal of this study was to evaluate discrepancy in verbal and nonverbal IQ in adults with ASD using the SB-5. This included evaluating discrepancies on the five individual subscales of the SB-5 (Fluid Reasoning, Knowledge, Quantitative Reasoning, Visual Spatial, and Working Memory).

Methods: Fifty-five adults with ASD (M age=37.12 years, SD=6.85 years) who were diagnosed as children completed adult evaluations of adaptive behavior, ASD symptoms, and IQ. Participants that received the lowest possible score on the SB-5 were excluded from analyses (n=16) due to limited ability to evaluate discrepancies of standard scores. The final sample of participants included 39 adults with ASD (M age=35.55 years, SD=6.06 years, range=26-49 years). Overall verbal and nonverbal IQ scores in addition to verbal and nonverbal subscales of the SB-5 were compared using pairwise comparison.

Results: Results indicated no significant differences in overall nonverbal and verbal IQ standard scores [$t(38)=.23, p=.82$]. However, when evaluating differences between nonverbal and verbal subscales, results are more complex. Using the t-scores for each subscale, verbal abilities were significantly higher than nonverbal abilities for the Knowledge and Working Memory subscales ($p=.002$ and $p=.03$, respectively). In contrast, nonverbal abilities were significantly higher than verbal abilities on the Quantitative Reasoning and Visual Spatial subscales ($p=.005$ and $p=.001$, respectively). (See Table 1).

Conclusions: Adults with ASD present with complex cognitive profiles that may not be represented by evaluating overall IQ scores alone. Rather, there are significant discrepancies on the subscale level that suggest more variable skills. However, clinical significance of these discrepancies must be considered given that all mean verbal and nonverbal subscales are within 1 standard deviation of each other. In addition, given the small sample size of this study, results must be interpreted with caution. Although more research is needed, this study is one of the first of its kind to examine these differences in adults with ASD across mid-adulthood and exemplifies the complexity and variability in these skills for adults with ASD.

50 **138.050** Disparities in the Identification of Autism: The Influence of Sex, Family Income, and Cognitive Abilities

C. G. McDonnell[1], *E. Anagnostou*[2], *R. Nicolson*[1], *E. Kelley*[3], *S. Georgiades*[4], *X. Liu*[5] *and R. A. Stevenson*[6], *(1)University of Western Ontario, London, ON, Canada, (2)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (3)Queen's University, Kingston, ON, Canada, (4)McMaster University, Hamilton, ON, Canada, (5)Genomics, Queen's Genomics Lab at Ongwanada, Kingston, ON, Canada, (6)Western University, London, ON, Canada*

Background:

Exciting evidence has accumulated documenting the power of early intervention to promote long-term outcomes in autism spectrum disorder (Dawson, 2008; Zwaigenbaum et al., 2015). Thus, early identification of autism spectrum disorder (ASD) is an essential healthcare priority. Although symptoms of ASD may be present as early as infancy (Barbaro & Dissanayake, 2009), diagnosis typically lags far behind, with the majority of children not being identified until school-age or later (Shattuck et al., 2009). Identifying factors that influence the timing of first concern for ASD and the age of diagnosis is a critical research priority with the potential to reduce disparities in the early identification of ASD.

Objectives:

The current investigation used a large sample of children with ASD to examine multiple variables associated with autism identification, including age of first parent concern, diagnosis, time to diagnosis (time between first parent concern and diagnosis), and parental and clinician judgment of when symptoms of ASD were first present in hindsight. Sex, socio-demographic factors, and child cognitive abilities were considered as possible contributors to identification.

Methods:

Children (N=653; 79% male) were identified with clinical diagnoses of ASD through the Province of Ontario Neurodevelopmental Disorders (POND) research network, a consortium of clinical and research sites in Canada. Parents reported on socio-demographic factors, age of first concern for ASD, and their judgment of when their child's symptoms were first present in hindsight. Clinicians reported on their perception of symptom onset. Cognitive abilities were measured using gold-standard IQ measures, depending on child's age at diagnosis.

Results:

Regarding descriptive statistics, age of first parent concern (M=21.71 months, SD=16.46 months) occurred early in development before year two. However, age of first diagnosis (M=58.84; SD=36.78 months) was delayed roughly three years after parents were first concerned. In hindsight, parents perceived that symptoms of ASD were likely present around one year (M=12.92 months), whereas clinicians reported that symptom onset likely occurred at around 18 months (M=17.97 months).

Regarding the role of sex in identification (see Table 1), females received their first diagnosis significantly later than males, and experienced a longer time to diagnosis despite no sex differences in age of first parent concern. Whereas there were no sex differences in clinician report of symptom onset, parents perceived an *earlier* age of first symptom onset for females than males in hindsight. Higher family income was associated with earlier first parent concern, earlier diagnosis, and earlier clinician report of symptom onset (see Table 2). Lastly, higher child verbal functioning related to later parent first concern, later identification, as well as later clinician report of symptom onset, with weaker and less robust findings for nonverbal cognitive abilities (see Table 2).

Conclusions:

Results underscore difficulties in autism identification, as the average age of diagnosis lagged over three years behind first parent concern. Moreover, disparities in ASD identification were identified, with females, children with higher cognitive abilities, and families with lower income experiencing later identification. Implications for understanding and reducing healthcare disparities in autism diagnosis will be discussed.

51 **138.051** Do Commonly Used Cognitive Assessments Accurately Estimate Intelligence in Autistic Boys and Girls?

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Background:

Estimates of intellectual disability in autism vary widely between 11 and 65% and are often not distinguished from language deficits (Lord et al,

2018). There is a higher incidence of intellectual disability in autistic females than males (Rivet & Matson, 2011) although it is unclear if this results from a bias in diagnosis or an underestimation of their abilities during assessments. Since being labelled as intellectually disabled at an early age can have a major impact on adult outcomes, it is important to have reliable assessment tools. Cognitive abilities are typically measured with Wechsler Intelligence Scales (WIS) in both children and adults. However, the reliability of these assessments in autism is questioned (Dawson et al, 2007), notably because some subscales require good language skills that are often impaired in autism. Raven's Progressive Matrices (RPM), a measure of fluid intelligence, do not require language skills and may therefore reflect a more veridical measure of cognitive abilities in autism.

Objectives:

The objectives of this study are to compare the results of two tests that are commonly used to measure intelligence in autistic and neurotypical children, and to explore whether the discrepancy between measures is influenced by sex.

Methods:

We compared the cognitive profiles of 41 autistic (17 girls and 24 boys) and 39 neurotypical children (16 girls and 23 boys) matched on chronological age (6-16) using WIS (WISC-III and IV) and RPM. We also ran preliminary analysis comparing results between boys and girls on the subscales of the WIS.

Results:

The autistic and neurotypical groups had average WIS IQs of 89 (36^{th} percentile) and 111 (72^{th} percentile) respectively, and RPM scores of 39 (62th percentile) and 41 (70th percentile) respectively. Preliminary ANOVAs showed no difference across genders on RPM and WIS results, and no difference across diagnosis on RPM. However, there was a main effect of diagnosis on the WIS ($p<.001$, $\eta^2=.333$). We computed the difference between RPM and WIS percentiles for each participant and used this variable as within-subject factor in an ANOVA with diagnostic group as between-subject factor. We found a main effect of diagnosis on the RPM-WIS difference ($p<.001$, $\eta^2=.239$), where the autistic group demonstrated a larger discrepancy (M=26.11) than neurotypicals (M=-1.26). Paired *t*-test analyses showed that WIS IQs were significantly lower than RPM scores in autistics but not in neurotypicals, suggesting that WIS underestimates intelligence for autistics. This difference cannot be attributed to lower verbal skills in autism, since it was also present in the non-verbal performance index of the WIS. There were no differences in IQ attributable to gender. However, preliminary analysis showed different patterns of strengths and weaknesses on WIS subscales for autistic males and females.

Conclusions:

These results show a large discrepancy between WIS and RPM scores in autistic children of both sexes. This may have consequences in clinical practice: in cases when Wechsler scales would diagnose intellectual disability, Raven's matrices might point to an average intelligence. Taking neurodiversity into account when assessing a clinical population's intelligence is an important question to consider.

52 **138.052** Drawing Patterns during a Smart Tablet Colouring Game: A New Analysis to Identify Autism Spectrum Disorders in Early Childhood.

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Background:

Evidence suggests the prospective motor organisation of intentional movements is be disrupted in Autism Spectrum Disorders (ASD) (Trevarthen and Delafield-Butt, 2013). Recently, machine learning analysis of children's motor patterns made during smart tablet gameplay was found to differentiate between children Typically Developing (TD) from those developing with ASD with 93% accuracy (Anzulewicz, Sobota, and Delafield-Butt, 2016). Here, we employed the same serious games in a new study to assess play patterns in the free-style colouring game, 'Creativity', which performed with greater predictive accuracy. We analysed children's motor patterns during colouring, implementing an observational approach.

Objectives:

A description of ASD colouring behaviours using a colouring serious game on an iPad.

Methods:

Participants. 70 children, 2 to 6 years-old (40=TD; 30=ASD). TD recruited from nurseries in Glasgow, UK; 24 ASD recruited through the Scottish Centre for Autism (NHS Greater Glasgow and Clyde), and 6 of collected at the Gillberg Neuropsychiatry Centre, Gothenburg, Sweden.

Procedure. The children were seated at a table with the iPad resting in front of them. The iPad was equipped with 2 game apps: (a) Sharing, that involved dividing food among 4 cartoon characters; and (b) Creativity, free-style colouring of chosen pictures. They played with each game for 5 minutes, plus 2 minutes for pre-test familiarisation. In Creativity, the children could choose to draw and colour one image or more during the play. Thus, Creativity was divided into two phases: (i) Tracing the chosen image and (ii) Colouring the chosen image.

Data Analysis. The number of image chosen, overall time spent in the Tracing and Colouring phases, and the amount of screen area touched were calculated. Subgroups were used to calculate Time spent in Tracing and Colouring phases per image as well as its Tracing accuracy.

Results: The Tracing phase duration appeared comparable between the two groups for each image, although ASD children spent cumulatively more time in this phase, because children with ASD generally made more drawings. Conversely, children with ASD spent less time in the Colouring phase compared to their peers. Further, they showed higher variance in Tracing accuracy. Interestingly, 6 children with ASD created "non-drawings", which were figures that did not match the set of colouring templates, and some adapted drawings into "non-drawing".

Conclusions:

Differences in the drawing patterns of children with ASD during the colouring game could be interpreted as a different approach to play that with TD children. ASD children would make their own scribbles, as "non-drawings", and use the Colouring phase as a "free drawing" task. The significant reduction of duration in Colouring in ASD children may indicate these children were "locked" in a loop of Tracing and/or picture choosing, comparable to repetitive behaviours. In sum, these behavioural features may provide new variables to be included in machine learning data analytics in future work to improve its predictive accuracy in identification of autism during early childhood.

53 **138.053** Early Manifestations of Autism Spectrum Disorder in Children with Congenital Heart Disease

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Background: An estimated one in 59 children in the US has autism spectrum disorder (ASD). Children with congenital heart disease (CHD) are at increased risk for neurodevelopmental and neurobehavioral impairment. A previous study suggested a higher rate of failed ASD screening in children with CHD [2] but the subsequent prevalence of confirmed ASD and age at diagnosis have not previously been reported in this population
Objectives: To determine the rate of ASD in children with congenital heart disease and the average age of diagnosis for children participating in a developmental outcomes program.

Methods: We examined the medical records of 422 children born between 2013 and 2016 who underwent surgery for CHD at Texas Children's Hospital and are part of our Cardiac Developmental Outcomes Program (CDOP) clinic. We evaluated the proportion of children with positive ASD diagnoses as determined by clinical diagnostic evaluation that included the Childhood Autism Rating Scale 2-ST (CARS2-ST) or Autism Diagnostic Observation Schedule, 2nd Edition (ADOS-2). We examined demographic data as well as clinic visit information to determine age at diagnosis and frequency of visits. The rate of positive ASD diagnosis was compared to the previously reported CDC population estimate using Chi square analysis.

Results: Of 422 CDOP clinic patients, 26 (6%) were diagnosed with ASD. When compared to the reported population prevalence of ASD (16/1,000), the rate of positive ASD diagnosis was significantly higher in children with CHD ($p<.001$). The majority of those diagnosed with ASD were male (n = 22; 85%) and had at least one clinic visit before diagnosis (n=19, 73%). Some of the children (n=7, 27%) were diagnosed with ASD during their initial evaluation. The average age at ASD diagnosis for all children was 2.6 ± 0.96 years, compared to the national average of 4 years.

Conclusions: We have shown that children with CHD are at higher risk of ASD compared to the general population, and can be diagnosed earlier than traditionally reported in the setting of a dedicated neurodevelopmental outcomes clinic. Early diagnosis can facilitate receipt of evidence-based interventions that can lead to improved outcomes for children with ASD.

54 **138.054** Effects of Age, IQ, and Sex on Autism Diagnostic Instrument Scores

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Background: There is growing recognition that scores on standard measures of autism spectrum disorder (ASD) symptoms are affected not just by level of ASD symptomatology, but by factors such as age and IQ. Recently, sex has been introduced to this discussion as important to consider in interpretation of scores on ASD measures. Some groups have even called for sex-specific algorithms, citing concerns that "male-biased" diagnostic instruments may lack sensitivity for identifying females with ASD. However, previous investigations of how sex affects scores have been hindered by small groups of females available for analysis. Small samples have also prevented adequate investigations of whether and how sex, age, and IQ interact in affecting scores on ASD instrument scores.
Objectives: To determine if, after accounting for age, IQ, and language level, scores on ASD diagnostic instruments systematically differ as a function of sex.

Methods: Data were obtained and merged from eight registries. Inclusion criteria were: ASD diagnosis by clinician best estimate, aged 12 months to 17.99 years, nonverbal intelligence quotient (NVIQ) assessment, and Autism Diagnostic Observation Schedule (ADOS)/ADOS-2 assessment. The final study sample had 8,944 participants (including 1,458 girls).

A linear mixed-effects model, including a random effect for site, was fit to 10 different outcomes within the ADOS (Social Affect and Restricted and Repetitive Behavior Calibrated Domain Scores), Autism Diagnostic Interview—Revised (ADI-R; Algorithm A, B, and C raw total scores), and Social Responsiveness Scale (SRS; Social Communication/Interaction (SCI) and Mannerisms raw total scores). The sample was split for the ADI-R analyses into age<4 years and age ≥4 years, to reflect differential scoring. The SRS models were restricted to children who were at least 4 years old. Initial models included age, quadratic age (as appropriate), NVIQ, language level, and all interactions. Sex and all interactions were added to the model backwards stepwise. Final model selection was determined by interpretability of the results, considering statistical significance ($p<0.05$) of model variables and Akaike and Bayesian information criterion (AIC and BIC) fit statistics.

Results: The effects of age, IQ, and language level emerged in almost all models, occasionally with significant interactions. Adding sex to all models was justified by the fit criteria. Sex interactions were suggested by fit criteria for ADI-R C total (restricted and repetitive behaviors (RRB)), but the interactions were not statistically significant. Boys received more severe scores than girls on both ADOS and ADI-R RRB domain scores, and girls received more severe scores than boys on SRS SCI. Although fit criteria supported including sex in the models for ADOS social affect (SA), ADI-R A and B (for both age algorithms), and SRS Mannerisms, the coefficients were not statistically significant.

Conclusions**::** In a large sample of children with ASD, previously identified developmental factors (age, IQ, and language level) were confirmed to impact ASD symptom scores. Additionally, measures from three diagnostic instruments differed by sex, primarily in the RRB domain with girls receiving lower (less severe) scores. However, effects of sex were small and likely of limited clinical significance.

55 **138.055** Evaluating Validity of the Autism Observation Scale for Infants (AOSI) Among Infants Identified with Possible Autism By Community Care Professionals

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Background: The Autism Observation Scale for Infants (AOSI; Bryson et al., 2008) is a brief, play-based assessment developed to quantify the behavioural manifestation of autism among 6-18-month-olds. From the first birthday – though not before 12-months – AOSI Total scores exceeding a threshold of 9 have been associated with likely later diagnosis (e.g., Brian et al., 2006; Bryson et al., 2008). Developers note the AOSI

is not yet validated for clinical use (Bryson & Zwaigenbaum, 2014). Further, only one validation study exists beyond the development group (Gammer et al., 2015). The AOSI has also been included predominantly within prospective 'high-risk sibling' studies, and there is growing recognition of the need to investigate whether inferences from these generalise to the broader population of infants developing autism (e.g., Sacrey et al., 2017).

Objectives: To conduct an independent evaluation of validity of the AOSI in a community-referred sample.

Methods: Infants aged 9-16 months (n=103; 68% boys) were referred due to showing early signs of autism according to the Social Attention and Communication Surveillance (SACS) protocol (Barbaro & Dissanayake, 2010). Specifically, all infants showed ≥3 (of 5) key markers on the SACS 12-month checklist (i.e., absent/atypical eye-contact, response to name, imitation, pointing, other gestures). Infants attended two assessments, 6-months apart. We administered the AOSI, Mullen Scales of Early Learning (MSEL) and Vineland Adaptive Behavior Scales (VABS) at Time 1 (T1) and Time 2 (T2), with the Autism Diagnostic Observation Schedule–Toddler Module (ADOS-T) also administered at the latter. AOSI assessments were coded live and from video, with 20% of tapes double-coded.

Results: Very high agreement was observed for live vs. video scoring of T1 AOSIs (within-rater live/video agreement on 100% assessments, r=.89; inter-rater agreement on 20% tapes, r=.79). At both T1 and T2, AOSI Total scores approximated a normal distribution, centred on the previously-reported threshold score of 9 (T1: M=9.44, SD=4.05; T2: M=9.32, SD=4.68). At T1, AOSI scores were significantly – though only weakly – associated with concurrent MSEL (r= -.23, p=.017) and VABS totals (r= -.23, p=.023), but were elevated among children with ≥4+ (vs. only 3) SACS markers at referral (F[2,102]=6.73, p=.002). At T2, AOSI scores were moderately associated with MSEL (r= -.36, p<.001) and VABS totals (r= -.43, p<.001), and more strongly associated with ADOS-T Algorithm totals (r=.627, p<.001). AOSI scores showed only moderate T1-T2 association/stability (r=.441, p<.001) and T1 AOSI scores only moderately predicted T2 ADOS-T totals (r=.412, p<.001).

Conclusions: The AOSI is reliably scored and shows some validity for quantifying autism behaviours in a community-referred sample of infants. We observed an approximately normal distribution of AOSI scores in our sample – centred on the previously suggested threshold for likely later diagnosis – but with only moderate/weak within-participant stability over time. Like 'high-risk siblings', community-referred infants with early signs of autism may experience variable trajectories of early development. The high-level reliability of video (vs. standard/live) ratings supports the AOSI as a viable measure for inclusion in protocols necessitating blinded evaluation; for example, as a primary outcome measure for pre-emptive intervention trials.

56 **138.056** Evaluating the Cognitive Profile of Autism Spectrum Disorder

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Background: It was previously believed that autism spectrum disorder (ASD) was related to significantly limited cognitive functioning (Goldberg Edelson, 2006). However, it is now understood that individuals with ASD can have a range of intelligence levels (Klinger, O'Kelley, & Mussey, 2009). While not a core symptom, the intelligence level of an individual with ASD has a large impact on their symptom severity (Harris & Handleman, 2000; Klinger et al., 2009; Lincoln, Allen, & Kilman, 1995). Mixed findings on the relationship between intelligence and ASD range from finding higher levels of intellectual disability in the population to significant differences between verbal and nonverbal intelligence (Tsatsanis, 2005; Volkmar, Lord, Bailey, Schultz, & Klin, 2004).

Objectives: The current study examines the cognitive functioning of multiple groups with ASD in order to add to the body of literature and update it to be relevant to DSM-5 changes in our conceptualization of ASD. Overall differences in IQ performance were compared between ASD and non-ASD groups. Age and IQ performance were compared, as well as sex differences and IQ performance. It was hypothesized that individuals with ASD will have significant differences in their nonverbal and verbal IQ scores, overall IQ differences would not be found between individuals with ASD and non-ASD individuals, younger children with ASD would have a significant strength in nonverbal IQ scores, and females with ASD would have higher verbal IQ scores than males with ASD and experience greater differences in their verbal and nonverbal IQ performances compared to non-ASD females.

Methods: From data gathered from comprehensive diagnostic evaluations for ASD performed in upstate New York, the present study examined ASD using the *Autism Diagnostic Observation Schedule, Second Edition* (ADOS-2; Lord, Rutter, DiLavore, Risi, Gotham, & Bishop, 2012) and cognitive performance using the *Stanford-Binet Intelligence Scales, Fifth Edition* (Roid, 2003). There were n = 125 males and n = 53 females in the sample. Of those who were evaluated, n = 76 males and n = 20 females received an ASD diagnosis. The data were evaluated using multiple t-tests.

Results: The results supported some of the study's hypotheses and not others. Overall, individuals with ASD were found to have a significant difference in their nonverbal and verbal IQ scores, t(95) = 3.12, p = .002. This is particularly present in older individuals with ASD compared to their typically developing peers, t(117) = 2.54, p = .01, and in females with ASD compared to typically developing females, t(51) = 2.17, p = .04.

Conclusions: This study provides important information on the cognitive functioning of individuals with ASD. The results indicate that older individuals with ASD are more likely to have discrepant cognitive profiles, as are females with ASD. Given that cognitive functioning remains a critical predictor of outcomes for individuals with ASD, it continues to be an important area to explore. This study provides new information on how individuals with ASD compare to a clinical sample of non-ASD individuals, further uncovering details on the complex cognitive profile of individuals with ASD.

57 **138.057** Evaluating the Prevalence of Social Communication Disorder in Children at Risk for Autism Spectrum Disorder

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Background:

In the years since the DSM-5 was released, concerns have been raised about the relationship between Social Communication Disorder (SCD) and Autism Spectrum Disorder (ASD).

Objectives:

In the present study, we examined rates of DSM-5 SCD symptoms and diagnoses in youth at risk for ASD. We also compared how participants with and without diagnoses of ASD scored on the Children's Communication Checklist (CCC) in order to explore differences in social communication

and pragmatic language as this might inform diagnosis of SCD.

Methods:

Data for this study come from an epidemiological study examining the prevalence of ASD. Diagnostic evaluations were performed on 292 participants who had previously screened at risk for ASD via the Social Communication Questionnaire-Lifetime Version (SCQ). Diagnoses were assigned by clinician best-estimate procedures by one of three doctoral level clinicians. Measures of autism symptoms, cognitive and adaptive skills, and behavioral checklists, including the CCC were included in assessment. The CCC was completed by all English-speaking parents whose children had at least phrase speech (n = 258) in order to measure communication and language issues common to both ASD and SCD.

Results:

Out of 292 youth at risk for ASD, only 1 met diagnostic criteria for SCD. While 20 participants met all 4 clinical criteria for SCD, 19 of these (95%) also met criteria for DSM-5 Autism Spectrum Disorder, effectively ruling out a diagnosis of SCD. Analyses of the CCC scores indicated that participants with ASD also experienced impairment in scales measuring pragmatic communication (the hallmark feature of SCD) as well as impairment in the social relations and interests scales.

Conclusions:

Results indicated that while a number of child may children meet SCD criteria, they were almost entirely children with ASD, suggesting that the SCD diagnosis may not represent a unique diagnosis. Further investigation is needed to establish if different therapies and interventions are needed for individuals with SCD vs ASD as currently, a diagnosis of autism opens the door to services often not available to individuals with SCD.

58 **138.058** Examination of Sex Differences on the Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview-Revised (ADI-R) in a Clinic-Referred Sample

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Background: Current studies examining sex differences in autism spectrum disorder (ASD) have yielded conflicting results. While some evidence suggests that females exhibit fewer symptoms in social communication (Lai et al., 2011; Zwaigenbaum et al, 2012) and restricted and repetitive behaviors (Frazier et al., 2014; Hartley et al., 2009; Mandy et al., 2011; Tillmann et al., 2018), others have found similar levels of symptom presence and severity across males and females (Anderson et al., 2013; Baron-Cohen et al., 2003; Lord et al., 1982; Reinhardt et al, 2014). Further exploration of sex-specific behavioral manifestations of ASD is critical given that females are more likely to be under-identified and diagnosed later than males (Begeer et al.; 2013, Giarelli et al., 2010; Wilson et al., 2016).

Objectives: To examine potential sex differences on gold-standard assessments for ASD (i.e., the ADOS and ADI-R) in a clinic-referred sample using symptom domain scores, overall severity level, and cutoffs for optimal sensitivity and specificity.

Methods: Analyses were conducted using a sample of 257 participants, comprised of 199 males (77.4%) and 58 females (22.6%), who received a comprehensive evaluation at a university-based clinic specializing in ASD and other neurodevelopmental disorders. Calibrated severity scores (CSS) were used as a measure of severity, both overall and within each symptom domain (i.e., Social Affect and Restricted and Repetitive Behaviors). Subscale scores from the ADI-R were included to examine caregiver-reported symptom severity across Social Interaction, Communication, and Repetitive Behavior domains. MANOVA analyses were completed to assess main effects for sex and diagnostic group (i.e., ASD and non-ASD) on ADOS and ADI-R scores; sensitivity, specificity, and cutoff scores were examined for CSS scores using ROC curve analyses for males and females separately.

Results: No significant differences were found on ADOS CSS or ADI-R subscale scores between male and female groups with ASD. However, ROC curve results suggested that a lower cutoff on the ADOS CSS maximized sensitivity and specificity for accurately detecting ASD in females (cutoff=4, area under the curve (AUC)=.90, sensitivity=.94, specificity=.84), compared to males (cutoff=6, AUC=.86, sensitivity=.89, specificity=.72). While ideal for males, a cutoff of 6 decreased sensitivity (.83) for females without improving specificity. The optimal cutoff for females (i.e., 4) fell within the "ASD" ADOS classification range, while a cutoff within the more severe "autism" classification range (i.e., 6) best predicted ASD in males.

Conclusions: Results support previous findings that sex differences are often not readily apparent when comparing scores on gold-standard assessments, despite prevalent clinical observations that girls with ASD seem to present differently than their male counterparts. However, variability across groups in optimal CSS cutoffs suggests that subtler symptom severity and scores may be expected when using the ADOS as a diagnostic tool for girls. This could be especially relevant in high acuity clinical populations with comorbid neurodevelopmental and psychiatric disorders in order to reduce false negatives in girls with complex presentations. Future analyses should consider sex differences by age to examine implications of developmental trajectory on male and female symptom presentation.

59 **138.059** Examining Test-Retest Reliability of the Autism Diagnostic Observation Schedule (ADOS) Calibrated Severity Score (CSS)

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Background: Calibrated severity scores (CSS; Gotham, Pickles & Lord, 2009) of the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1999, 2012) provide a measure of autism symptom severity that is less influenced by developmental characteristics and allow for a more valid comparison of scores across different Modules when compared to the ADOS raw algorithm totals. Separate CSS for the ADOS social affect (SA) and restricted and repetitive behavior (RRB) domains have also been created (Hus, Gotham & Lord, 2015). Although test-retest reliability for the ADOS algorithm total scores were found to be strong in previous studies (Lord et al, 1989; Gotham et al, 2007; Brugha et al., 2012; McCrimmon & Rostad, 2013) and CSS were stable over time in a recent meta-analysis of 40 studies (Bieleninik et al., 2017), test-retest reliability of the ADOS CSS has not been directly tested.

Objectives: We aim to examine the test-retest reliability of the ADOS CSS across all Modules of the ADOS.

Methods: Repeated ADOS assessments were gathered for all Modules: Toddler Module included 302 observations from 75 children (48 ASD cases; Mean age=20 months, SD=4.7); Module 1 included 72 observations from 30 children (29 ASD; Mean age=37 months, SD=13.2); Module 2 included 88 observations from 31 children (26 ASD; Mean age=34 months, SD=10.9); Module 3 included 120 observations from 57 children (35 ASD; Mean age=8

years, SD=2.8); and Module 4 included 38 observations from 19 adolescents/adults (19 ASD; Mean age=21 years, SD=4.7). Considering the variability in developmental effects across different age and language groups, the duration between test-retest observations was 2 months on average for the Toddler Module, Module 1 and 2, 4 months for Module 3 and 8 months for Module 4. Absolute Intraclass Correlation Coefficients (ICCs) for test-retest reliability were calculated for CSS total, CSS SA and CSS RRB.

Results: ICCs for all Modules fell in the moderate to high range. The overall CSS showed the highest ICCs ranging from .71 (Module 2) to .87 (Toddler Module). The ICCs of CSS SA ranged from .64 (Module 4) to .88 (Toddler Module). The ICCs CSS RRB were lower, but still in moderate rages, from .58 (Module 4) to .68 (Module 2). All these values were significant with *p*-values less than .05. ICCs for different age and/or language groups are reported for each Module in Table 1.

Conclusions: Our results demonstrate moderate to high test-retest reliability and low measurement error of the ADOS CSS across all Modules. Such precision of the ADOS CSS suggests minimal variability in CSS obtained from ADOS sessions repeated within relatively short periods of time. Results support the use of the ADOS CSS as a reliable and accurate tool to track trajectories of ASD symptoms over time that can be utilized in research and clinical settings.

60 **138.060** Exploring Differences in the Factor Structure of the ADOS-2 By Gender

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Background:
Autism Spectrum Disorder is diagnosed using the same criteria (e.g., DSM-5, ICD-10) for males and females. An emerging and inconclusive body of literature suggests differences in symptom presentation and related areas (e.g., cognitive ability, behavioral regulation). The consistently disproportionate male-to-female ratio may reflect a true difference in incidence, or suggest that females with ASD are under-diagnosed because of a unique symptom presentation not captured by standardized tools. Conclusions are difficult to make considering limitations in the current body of research, including smaller sample sizes, inconsistencies in participant ages, and the use of mixed sets of measures with a strong reliance on parent report. Currently, most studies within this body of research use the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2), considered the gold standard in direct assessment of autism related symptoms. These studies have reached varied conclusions regarding gender differences as measured by standardized tools, for example, finding no significant gender differences or finding fewer reported repetitive and restricted behaviors (RRBs) (Duvekot et al., 2016). However, to date, there is limited research with large sample sizes of early intervention age children that examines differences in the ADOS-2 algorithm items by gender.

Objectives:

The current study examined the factor structure of the ADOS-2 algorithm items by gender to determine if the Social Affect (SA) and Restricted and Repetitive Behavior (RRB) subscales demonstrate a different factor structure.

Methods:

A retrospective analysis of evaluation data was conducted from a large, urban sample of early intervention age children who met criteria for ASD. Participants included 252 children, with 177 males and 75 females, ($M_{age\ males}$ = 42.4 months; $M_{age\ females}$ = 41.2 months). Evaluation measures included the ADOS-2, caregiver interviews, and rating scales. An exploratory factor analysis was conducted to determine if individual items included in the algorithm of the ADOS-2 (Module 1) loaded into the same factors for both males and females. Two factors were forced to align the data with the two subscales of the ADOS-2 (SA and RRB).

Results:

Results indicated differences, by gender, in how the algorithm items loaded into the two factors, which likely represent the SA (Factor 1) and RRB (Factor 2) subscales. The greatest differences were noted in Factor 2 (RRB scale), with fewer items loading overall and stronger eigenvalues for specific items (repetitive/stereotyped language) in the female sample. Furthermore, specific items that are included in the RRB subscale on the ADOS-2, did not factor into either structure for females, for example, items that address sensory seeking behavior and repetitive motor movements.

Conclusions:

This study illustrates in a large, urban sample of early intervention age children, that female and male presentation as indicated in the ADOS-2 algorithm, load differently on a forced, two factor model. This provides additional evidence to support possible differences in RRB symptom presentation by gender, as measured through the ADOS-2. Future research may include prospective analyses testing the hypothesis that ASD symptom presentation differs as observed on the ADOS-2 algorithm, specifically within the RRB subscale.

61 **138.061** Exploring Social Subtypes in Autism: A Preliminary Study

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Background: Impairments in the social domain are considered a hallmark diagnostic feature of autism spectrum disorder (ASD). Yet, individuals diagnosed with ASD vary widely with respect to specific presentation, severity, and course across different dimensions of this complex symptom domain. Given that wide phenotypic variability likely reflects diverse etiological mechanisms, identifying more homogenous ASD subgroups based on social domains is necessary for understanding the underlying etiology and pathophysiology.
Objectives: The aim of the current investigation was to utilize the Stanford Social Dimensions Scale (SSDS), a newly developed quantitative measure of social processes, in order to explore the existence of homogeneous subgroups of individuals with ASD who share distinct patterns of strengths and weaknesses across distinct dimensions of social domains. Identified subgroups will be further characterized by examining their association with cognitive ability, severity of core ASD symptoms and impairments in self-regulation.

Methods: Parents of 172 individuals with ASD (31 females, 141 males; M_{age} = 7.97 years, *SD* = 5.02) completed the SSDS, the Social Responsiveness Scale (SRS-2) and the Child Behavior Checklist (CBCL). Data on children's verbal and non-verbal intellectual functioning (FSIQ) was also collected.

Results: The *k*-means cluster analysis was used to classify participants according to the pattern of SSDS subscale scores (Social Motivation [SM],

Social Affiliation [SA], Expressive Social Communication [ESC], Social Reception [SR] and Unusual Approach [UA]). The optimal number of clusters to be specified was derived by plotting the within-group sum of squares for each cluster by applying the *k*-means. Analysis suggested 6 clusters as optimal solution. There were significant differences between the clusters across all SSDS subscales: SM (F= 51.86, p< .001, Partial η^2= .61), SA (F= 55.031, p< .001, Partial η^2= .62), ESC (F= 41.09, p< .001, Partial η^2= .55), SR (F= 49.48, p< .001, Partial η^2= .60) and UA (F= 40.53, p< .001, Partial η^2= .55). Both severity and shape differences among six clusters were identified. Derived clusters did not differ in terms of gender distribution ($\chi 2$= 3.15, p= .68, Phi= .13) nor chronological age (F= .93, p= .46, Partial η^2= .027). Clusters showed distinct profiles of strengths and difficulties across FSIQ (F= 4.62, p= .001, Partial η^2= .248), self-regulation (F= 4.08, p= .002, Partial η^2= .121), and across SRS-2 factors (social avoidance [F= 9.77, p< .001, Partial η^2= .241], emotion recognition [F= 24.17, p< .001, Partial η^2= .440], interpersonal relatedness [F= 7.90, p< .001, Partial η^2= .204], insistence on sameness [F= 6.75, p< .001, Partial η^2= .180] and repetitive motor mannerisms [F= 9.47, p< .001, Partial η^2= .235]).

Conclusions: Our study provides a significant contribution by identifying six subgroups of individuals with ASD who shared distinct social domain profiles. Importantly, these clusters reflect differential individual variability in terms of cognitive ability, severity of ASD symptoms, as well as self-regulation skills, and represent an initial step toward reducing phenotypical heterogeneity in the autism spectrum which promises to lead to more personalized interventions.

62 **138.062** Factors Associated with Missed ASD Identification Among Children in Colorado

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Background: One in 72 8-year-old children were identified with autism spectrum disorder (ASD) in 2014 by the Colorado Autism and Developmental Disabilities Monitoring (ADDM) Project as part of the Centers for Disease Control and Prevention's ADDM Network – a population-based surveillance system of ASD. Of the children identified with ASD in Colorado in 2014, 42% did not have a documented ASD diagnosis in their education and/or health records, indicating that a significant number of children with ASD in Colorado may not be receiving optimal intervention services. Although several factors (e.g., symptom severity) have been identified as correlates of delayed or missed ASD diagnoses (Daniels & Mandell, 2014), it is unclear what factors are associated with the disparities in the identification of children with ASD in Colorado.
Objectives: (1) To describe and compare the sociodemographic and clinical profiles of children identified with ASD through the Colorado ADDM Project who did and did not have a previous ASD diagnosis. (2) To identify factors associated with missed ASD identification among children in Colorado.

Methods: The current study analyzed data collected by the Colorado ADDM site for the 2014 surveillance year (the most current data available). Our sample included 562 8-year-old children who resided in Colorado in 2014 and met the ADDM Network ASD case definition. Children were grouped according to whether they had a previous ASD diagnosis (educational or clinical). Latent class analysis (LCA) was used to identify distinct classes of 8-year-olds among the two groups of children (i.e., those with and without a previous ASD diagnosis). All analyses controlled for relevant child characteristics.

Results: For children who did not have a previous ASD diagnosis, the 2-class solution was the best fit for the data (Fig. 1). For children who had a previous ASD diagnosis, the 3-class solution was the best fit (Fig. 2). Median household income had a significant effect on latent class membership for children who had a previous ASD diagnosis. Specifically, given membership in class 2 or class 1, children from lower income families were more likely to be in class 1 (i.e., the group of children with higher symptomatology) than children from more affluent families. Clinician reviewers' ratings of the quality of information available in the records of children without a previous ASD diagnosis were significantly lower (M = 2.52, SD = .525) than that of children with a previous ASD diagnosis (M = 3.30, SD = .661), t = -14.941, p < .001.

Conclusions: With the exception of a documented social and/or language delay prior to the age of three, the two groups of children (i.e., those with and without a previous ASD diagnosis) identified with ASD in 2014 through the Colorado ADDM Project presented with similar patterns of ASD related features, suggesting that ASD evaluation practices may be related to missed ASD diagnoses among children in Colorado. Notably, an income disparity was observed in the latent class membership of children who had a previous ASD diagnosis.

63 **138.063** Factors Influencing Quality of Behavior Intervention Plans for Children and Adolescents with Autism Spectrum Disorder

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Background: Autism Spectrum Disorder (ASD) is associated with maladaptive behaviors that may interfere with student learning. According to the Individuals with Disabilities Education Act, a Behavior Intervention Plan (BIP) must be developed and implemented based on the outcome of a Functional Behavior Assessment (FBA) for any student with a disability who engages in behaviors that impede their learning or the learning of others. The research on FBAs and BIPs provide specific recommendations as to what should be included in a BIP. However, there is a paucity of research investigating the quality of BIPs for students with ASD.
Objectives: 1) Evaluate the quality of BIPs developed for children and adolescents with ASD at an autism clinic. 2) Determine factors associated with high-quality BIPs.

Methods: BIPs (n=60) written for children with ASD evaluated at a community autism clinic were randomly selected from low, medium, and high SES groups in Connecticut (n=20 per group). The Behavior Support Plan Quality Evaluation Guide-II (BSP-QEII) was used to assess BIP quality, as its items correspond to the most highly recommended elements for inclusion in BIPs. Two raters rated the BIPs, resulting in a BSP-QEII total score that fell into the following categories: weak, underdeveloped, good, or superior, as specified by the BSP-QEII. Raters also noted whether the BIP author was a board-certified behavior analyst (BCBA) and whether an FBA was conducted to inform the development of each BIP.

Results: The two raters had good interrater reliability (r=.697, p<.01); therefore, their BSP-QEII scores were averaged for subsequent analyses. 31% of BIP scores fell into categories of superior or good while 69% were classified as underdeveloped or weak. An FBA was conducted prior to BIP development in 70% of the sample. BIP total scores written by BCBAs (M=16.30, SD=5.071) were significantly higher than those written by non-BCBAs, (M=9.60, SD=5.144), t(51)=4.639, p<.001. BIP total scores in which an FBA was conducted prior to BIP development (M=14.60, SD=4.02) were significantly higher than when an FBA was not conducted prior to BIP development (M=11.42, SD=5.04), t(58)=2.60, p=.01. A one-way ANOVA revealed

no differences in BSP-QEII scores across the three SES groups (*p*s>.148).

Conclusions: Findings suggest that many BIPs written for children and adolescents with ASD may be weak or underdeveloped and fail to consider FBA input. BCBAs were more likely to write higher quality BIPs than other professionals, and the BIPs based on an FBA were more likely to have higher quality ratings. School district SES does not appear to be associated with BIP quality, suggesting the need for further training in BIP development is a requirement regardless of the potential resources available to the school district.

64 **138.064** First Years Inventory: Examining Measurement Invariance across Age, Sex and Prematurity Status

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Background: The heterogeneous nature of infants at risk for autism indicates a need to better understand variation in early risk markers, yet there are few studies testing measurement invariance on parent-report or self-report autism screeners. The evaluation of item invariance across individual characteristics is important to assess the impact of diagnostic bias. Recent research has indicated item functioning differences by age for the M-CHAT (Sturner et al., 2017) and by sex for the AQ-10 on adults (Murray et al., 2017), which suggest the need to further assess how these factors influence the utility of autism screeners for very young populations.

Objectives: To examine whether items on the First Years Inventory (FYI) version 3.1, a parent questionnaire designed to assess behaviors in 12-month-olds that suggest risk for a later diagnosis of autism, function differently with infants of different age, sex, and prematurity status.

Methods: A community sample of 6,395 parents who had a child 8 to 16 months of age completed the FYI consisting of 69 items, which can be classified into two domains: *Social Communication (SC)* or *Sensory Regulatory Functioning (SR)*. Differential Item Functioning (DIF) as an indicator of measurement invariance was assessed using a hybrid ordinal regression-item response theory (IRT) method across age (8-10, 11-13, 14-16 months), sex (male or female) and prematurity status (<36 or ≥36 gestational weeks) groups, separately for each domain. The cumulative impact of DIF on domain scores was evaluated if DIF was detected, where ΔR^2 exceeded the thresholds generated through Monte Carlo simulations of DIF-free samples.

Results: 30 out of 36 SC items and 18 out of 26 SR items were detected as having DIF across age groups, 15 among them showed large DIF ($\Delta R^2 \geq .07$), while only 2 SR items showed moderate DIF ($.035 \leq \Delta R^2 < .07$). 12 SC items and 5 SR items were flagged as having negligible DIF ($\Delta R^2 < .035$) by sex. Regarding prematurity status, 3 SC items were flagged as having negligible DIF, while none of the SR items were flagged. The impact of cumulative individual-level DIF on SC domain scores (differences between scores accounted for and not accounted for DIF) varied by the level of measured trait (theta), while the mediation effect of trait was not significant for SR domain scores (Figures).

Conclusions: Results suggest significant differences in the responses of parents with infants of different ages, particularly for behaviors related to social communication. The SC domain scores were overestimated if DIF by age was not accounted for in the younger group (8-10 months). Furthermore, the level of overestimation increased as children showed less actual risks in social communication. In contrast, there was an underestimation of SC scores for the older groups (11-13 and 14-16 months), which became more significant as children showed more actual risks in social communication. On the other hand, the item functioning was found to be invariant by sex and prematurity status for both domains. The findings revealed the potential utility of the FYI with very young infants, especially in consideration of the developmental effects on social communication.

65 **138.065** Gender Similarities: Impact of Autism Symptoms on Everyday Functioning

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Background: There continues to be a need for more research to clarify whether symptomatology presents differently in males and females with autism spectrum disorder (ASD). Prior research has yielded mixed results with regard to whether boys and girls score differently on diagnostic measures of ASD. A few studies have found that girls demonstrate relatively better social reciprocity than boys, whereas others have found no gender differences in this area. Furthermore, previous studies of gender differences have been conducted with diagnostic instruments that measure frequency of ASD symptomatology. It is also important to examine gender differences on instruments that measure the impact of ASD symptoms on everyday functioning, especially given that some prior work suggest girls may camouflage symptoms.

Objectives: The study's purpose was to determine whether gender differences exist in social communication symptoms on the Autism Impact Measure (AIM), a parent-report scale that measures ASD symptom frequency and impact.

Methods: The sample of 470 children ages 2 to 12 consisted of 386 males and 84 females diagnosed with ASD. Mean age was 6.8 years and mean overall IQ score was 85. Female and male groups did not differ significantly on mean age or IQ. AIM measures of frequency and impact were considered as a combined score and as separate scores for the Social Reciprocity and Peer Interactions subscales. Measurement invariance (MI) tests were used to examine whether each AIM subscale functioned differently by gender. Once the measurement model was established, latent means of Social Reciprocity and Peer Interactions were compared across gender when controlling for age and overall intelligence.

Results: The MI tests revealed partial invariance for the Social Reciprocity subscale and full invariance for the Peer Interactions subscale. When controlling for age and IQ there were no significant differences between boys and girls on the AIM Social Reciprocity or Peer Interactions domains. This was true when frequency and impact were combined or considered separately for each domain. IQ was a significant predictor of parent report of social reciprocity and peer interactions, as parents of children with higher IQ reported them to have fewer ASD symptoms and less symptom impact.

Conclusions: Findings highlighted that IQ is more predictive than gender with regard to social reciprocity and peer interactions in ASD. This large sample of boys and girls with ASD did not differ significantly in social reciprocity or peer interactions. Parent-reported similarities in symptom frequency add to the small body of evidence that boys and girls with ASD are more similar than different in core social symptoms of ASD, at least in children who have received diagnoses. Furthermore, findings suggest that social reciprocity and peer interaction problems are just as impactful for girls as for boys, despite possible symptom camouflaging by girls. These results also demonstrate that the AIM, a relatively new measure, is sensitive to social communication symptoms in both boys and girls with ASD. Future research will include an analysis of age as a possible mediator for gender differences in ASD symptoms.

66 **138.066** Heterogeneity in Autism: How to Deal with It? a Systematic Review

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Background: Heterogeneity within the autism spectrum is universally recognized as an obstacle to research and practice. Subgrouping methods are used to organize individuals into more homogeneous subgroups, making use of similarities and dissimilarities between participants.
Objectives: The objectives of this study were to compare the results of various subgrouping methods, and compare the results of establishing subgroups using different (domains of) variables.

Methods: A systematic review was conducted of 108 papers published after 2001 that have subgrouped participants, of which at least some had a diagnosis of ASD. A specific interest of this review was the method that was used to validate subgroups.

Results: Almost all articles validate subgroup results using variables that were measured concurrently, but were not included in the subgrouping procedure. Investigations into stability over time and replication studies are rarer, aside from some remarkable exceptions.

Conclusions: For many of the subgrouping results, we cannot be sure that results generalize, and that subgroup membership will not change from one measurement occasion to the next. In this presentation, recommendations are made for the interpretation and validation of subgrouping results in autism.

67 **138.067** How Does Child Sex Play a Role in Early Detection of ASD? Evidence for Sex Disparities in Timely Screening Access

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Background: Females appear to experience delayed diagnosis of autism spectrum disorders relative to males. Existing research indicates that age of first parental concern does not differ by sex (Ramsey et al., 2018); however, a greater delay was observed for females in receiving an ASD diagnosis (Begeer et al., 2013). The ABCD Early Screening Project, a multi-stage screening protocol embedded within Early Intervention (EI) agencies, provides a platform to study how sex disparities may emerge during the early ASD detection process.
Objectives: We examined how child sex predicts movement through a three-stage, ASD screening and assessment protocol, considering sex differences in retention versus drop-out between stages, time between stages, and child age at each stage. Secondly, we assessed whether symptomatology and demographic factors predicted sex differences in rates of retention or in time elapsed between stages.

Methods: Participants were 1,590 males and 859 females screened through the ABCD Project; eligible children were aged 14-36 months and enrolled in EI programs. At Stage 1, parents completed the Brief Infant-Toddler Social Emotional Assessment (BITSEA) and Parents' Observation of Social Interaction (POSI); those screening at-risk for ASD (scores above cut-points) were referred to Stage 2, a brief play-based observational screener (the Screening Tool for Autism in Toddlers; STAT). Those with at-risk STAT scores were referred for a comprehensive diagnostic assessment (Stage 3).

Results: Among those screening positive for ASD risk at Stage 1, males (65.2%) were more likely than females (56.6%) to proceed to Stage 2, $X^2(1,566)=5.22$, $p<0.05$, indicating an initial disparity in screening follow-through; see Figure 1. Within these screen-positive children at Stage 1, females had higher parent-reported ASD-related competencies, $t(356.79)=-2.36$, $p<.05$ but similar parent-reported ASD-related problems $t(353.29)=1.36$, *ns,* on the BITSEA. Demographic factors (child race, language, SES) did not contribute to the differential drop-out. At Stage 2, among those screening positive on the STAT, males (83.5%) and females (76.5%) were similarly likely to proceed to Stage 3, X^2 (1,N=391)=2.66, *ns*, suggesting that the initial follow-through disparity is not further exacerbated at Stage 3. In terms of ASD symptomatology among screen-positive children at each stage, Stage 2 STAT scores [$t(138.337)=1.89$, *ns*] and Stage 3 ADOS scores [$t(77.663) = 1.11$, *ns*] did not differ by sex. In terms of age at screening, males and females did not differ, resulting in mean diagnostic ages of 28.1 months for both males and females; see Figure 2.

Conclusions: Among children screening positive for ASD risk, females were less likely than males to proceed with subsequent screening and assessment. Within those screening positive, females also had higher ASD-related competencies than males, perhaps reducing urgency among parents and EI providers to pursue further screening. Of interest, there were no sex differences in observed ASD behaviors among boys and girls on the STAT or ADOS-2.

68 **138.068** How Has DSM-5 Affected Autism Diagnosis? a Five-Year Follow-up Systematic Literature Review and Meta-Analysis

ABSTRACT WITHDRAWN

Background: Autism spectrum disorder (ASD) is the fastest growing development disability, and its increasing prevalence during the last two decades has prompted public health concerns. Despite the marked increase in ASD research, its diagnosis remains behaviorally based on clinical diagnostic criteria. The 2013 publication of the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) significantly revised autism criteria with vastly fewer options to obtain a diagnosis. This has caused concern that DSM-5 criteria may fail to capture some individuals who would have previously met ASD diagnostic criteria under DSM-IV, Text-Revised (DSM-IV-TR), but may still benefit from services. Most recent data estimate ASD prevalence to be 1 in 59 children; however, these data primarily included those evaluated under DSM-IV-TR, leaving the effect of DSM-5 unknown.
Objectives: The purpose of this systematic literature review and meta-analysis were to: (1) determine the changes in frequency of ASD diagnosis in the first five years after publication of the revised DSM-5 ASD criteria, and (2) identify the DSM-IV-TR autism subtypes most affected by these new diagnostic criteria.

Methods: Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, we searched the literature for studies published between April 2013 and July 2018 that applied both DSM-IV-TR and DSM-5 ASD diagnostic clinical criteria to study samples. Scientific rigor was rated using the Quality Appraisal of Reliability Studies. Data on sample size, individuals meeting DSM-IV-TR ASD criteria, and those no longer meeting an ASD diagnosis under DSM-5 criteria were extracted. Pooled effects were estimated for ASD and DSM-IV-TR subtypes of autistic disorder (AD), Asperger's Disorder, and pervasive developmental disorder-not otherwise specified (PDD-NOS) using random effects meta-analysis models. Heterogeneity of each model, subtype analyses to explore reasons for heterogeneity if present, and publication bias was

assessed.

Results: Of 898 studies identified, 33 met inclusion criteria for the review and meta-analysis; of these, 19 studies specifically examined DSM-IV-TR subtypes (AD n=17; Asperger's Disorder n=14; PDD-NOS n=18). Overall risk of bias across studies was unclear. Most studies utilized the Autism Diagnostic Interview–Revised (ADI-R) and the Autism Diagnosis Observation Schedule (ADOS) as evaluation tools. There were statistically significant pooled decreases in ASD diagnoses under DSM-5 criteria [20.8% (95%CI 16-27), p<0.001] and for the DSM-IV-TR subtypes of AD [10.1% (95%CI 6.2-16.0), p<0.001] and Asperger's [23.3% (95%CI 12.9-38.5), p=0.001]; however, the pooled decrease for PDD-NOS was not significant [46.1% (95%CI 34.6-58.0), p=0.52]. Two variables contributed to heterogeneity across ASD and subtype models: age group and type of clinician who made the diagnosis. Notably, when the diagnosis was made by a team of a physician and a psychologist, the decrease in diagnosis rates between DSM-IV-TR and DSM-5 was lowest.

Conclusions: While all previous literature reviews that examined this topic found ASD rates could decrease by at least one-third, findings from this five-year follow-up demonstrated smaller pooled decreases for ASD and all DSM-IV-TR subtypes. Nevertheless, future research is needed as concerns remain for impaired individuals without a specific diagnosis as well as to stratify for future clinical intervention studies.

69 **138.069** Identifying Barriers to Families Receiving Diagnoses and Services after a Positive Autism Screen in a Community Screening Study

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Background:

1 in 59 children are identified with Autism Spectrum Disorder (ASD). The earliest signs of ASD, delays in social communication milestones that appear in the first 2 years, are routinely screened for at 18 months (AAP, 2007).Yet most children are not diagnosed until 4-5 years of age (Baio et al., 2018), and so miss out on the considerable positive impact of early intervention (EI) (Dawson et al., 2010). Underserved families are significantly underrepresented in research and are identified even later, restricting their access to EI (Hilton et al., 2010). The community faces many barriers to early screening and detection, including limited uptake of ASD screeners in pediatric practices and conflicts with the realities of EI services. While research shows that at age two, diagnoses are generally reliable and stable, sometimes professionals prefer to wait and see, due to uncertainties in subtle symptom-expression early on and the stability of an early diagnosis (Zwaigenbaum et al., 2009). Even with screening at 18 months, there are other barriers to children being diagnosed and receiving services, including the capacity of professionals to recognize red flags for diagnosis of ASD at a young age, the ability of Part C EI providers to recognize ASD in toddlers and provide evidence-based EI, and parental ambivalence and the ability to act on referral recommendations.

Objectives:

To explore outcomes for children who screen positive for ASD concerns on a community screening tool for the early detection of autism and communication delays and are invited for an evaluation at a local autism center.

Methods:

As part of an ongoing multi-site community screening study, an electronic screener for early signs of ASD and communication disorders was offered to families with children aged 12-20 months online and in community settings, such as primary care practices and early learning centers. Families receiving a positive screening result were referred to EI and offered a no-cost diagnostic evaluation. The research team contacted families to schedule their evaluation and tracked whether or not families chose to participate and the results of the evaluation. Demographic questions on the screening tool allowed researchers to explore differences between those who did and did not participate in the evaluations.

Results:

Currently 2,632 families have taken the screener. Of the 223 families whose child had a positive outcome on the screening, 164 had been offered evaluations at the time of this abstract-56 completed the evaluation, 51 were not interested, 49 could not be reached, and 8 were cancellations/no-shows. Group differences based on parental age, race, family income, child's age at screening and the amount of time between completing the screener and being offered the evaluation will be explored. Evaluation results for children who received the evaluation will also be presented.

Conclusions:

Less than half of families who received a positive result on an early screener for ASD chose to participate in a no-cost diagnostic evaluation. As the first advocate for their children, parental ambivalence is a significant barrier to children receiving early diagnosis and services they need.

70 **138.070** Identifying Broader Phenotype Features: A Comparison of the ADOS and BPASS in School-Age Children

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Background: The Autism Diagnostic Observation Schedule (ADOS) has often been used to detect broader autism phenotype (BAP) in high-risk (HR) and low-risk (LR) children at 3 years of age (Messinger et al., 2013; Ozonoff et al., 2014; Charman et al., 2016). Likewise, the BPASS – a parent questionnaire assessing features of the BAP – has been used to detect BAP in older children (Dawson et al., 2007). Although both measures assess a number of similar constructs, little research has explored their concordance in identifying BAP features.

Objectives: The main objective is to examine the convergent validity of the BPASS with the ADOS for identifying BAP features in a school-age sample of high and low-risk children. Specifically, we examine the correlation between ADOS and BPASS scores, and use ROC methods to identify a threshold on the BPASS that maximizes sensitivity and specificity when compared to the ADOS.

Methods: Given the focus on the broader phenotype, all participants diagnosed with autism spectrum disorder (ASD) were excluded from the sample. We administered both the ADOS module 3 and the BPASS to 59 school-age children: 36 high-risk (HR) participants– those with an older sibling with ASD, and 23 low-risk (LR) children– those with no known family history of ASD. Following prior research (Messinger et al., 2013, Ozonoff et al., 2014), an ADOS Social Affect + Restricted Repetitive Behavior (SARRB) score >= 4 was used as a cutoff indicative of possible BAP features. The BPASS has two sections, one based on parent report of BAP features, the other based on examiner judgments of eye contact, communication style, voice prosody, etc., after a brief conversational interaction. The variable used in analyses was the summed total of the examiner-scored

BPASS items 8-13. To assess the convergent validity of the BPASS, we first examined the correlation between each participant's ADOS SARRB and BPASS subtotals. Next, we used ROC analysis to identify the optimal cutoff for the BPASS in classifying the children identified by the ADOS BAP cutoff.

Results: Findings showed a .75 correlation between ADOS SARRB and BPASS subtotals. Using the ADOS cutoff of 4, 30.5% of children were classified with BAP (15 HR and 3 LR). ROC analysis yielded a BPASS threshold of 8.5 as the optimal cutoff, with an Area Under the Curve (AUC) of 0.9. Using this BPASS cutoff, 40% of children were classified with BAP (17 HR and 6 LR). Table 1 shows the contingency table of classifications; Figure 1 shows the ROC curve.

Conclusions: The BPASS has strong convergent validity with the ADOS. The ROC analysis revealed that the BPASS identified participants with BAP features, as indexed by the ADOS, with strong sensitivity, specificity, and negative predictive value, and adequate positive predictive value. These findings suggest that the BPASS is a valid tool in detecting BAP outcomes.

71 **138.071** Identifying Learning Profiles in Adolescents with ASD Associated with Distinct Social Communication, Behavioral and Academic Support Needs in High School

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Background: For individuals with ASD, extant research has demonstrated that post-secondary educational and vocational outcomes are often not commensurate with their cognitive abilities. This may be due in part to inadequate behavioral and academic supports during and after their high school years. Academic achievement, particularly reading comprehension, for children and adolescents with ASD has been shown to be more strongly associated with social and communication competence than with IQ, but little is known about differentiating classroom support in high school due the heterogeneity within ASD.
Objectives: The purpose of the current study was to identify unique profiles of high school students with ASD that are associated with distinct behavioral and academic support needs using standardized assessments of cognitive, social communication, and academic abilities.

Methods: Participants included a large sample of adolescents with ASD ages 14-21 years (**N=547**, mean chronological age=16.2 years, SD=1.44 years) and their teachers who were part of a RCT of a comprehensive treatment model for high school students with ASD. Research staff assessed non-verbal IQ using the Leiter International Performance Scale, Third Edition (Leiter-3) and academic abilities using the Passage Comprehension and Academic Knowledge subtests of the Woodcock Johnson Tests of Achievement III (WJIII). Teachers completed the Vineland Adaptive Behavior Scales- 2nd edition Teacher Form (VABS-II) as a measure of adaptive behavior and the Social Responsiveness Scale-2nd edition (SRS-2) as a measure of autism symptoms.

Results: Latent profile analysis was used to identify subgroups of participants using the Passage Comprehension and Academic Knowledge standard scores on the WJIII; Receptive, Expressive, and Written *v*-scale scores from the Communication subdomain of the VABS-2; and SRS-2 T-score controlling for NVIQ at baseline. Four groups were identified using fit criteria statistics. Group 1(N= 143) had average IQ, communication, passage comprehension and academic knowledge, and mild autism symptoms. Group 2(N=118) had average NVIQ and passage comprehension and academic knowledge, below average communication, and moderate autism symptoms. Group 3(N=172) had below average NVIQ and communication, low passage comprehension and academic knowledge, and moderate autism symptoms. Group 4(N=110) had far below average NVIQ, communication, passage comprehension and academic knowledge, and severe autism symptoms.

Conclusions: The current study provides evidence that**,** while NVIQ was generally associated with academic skills in the subgroups, teacher-reported ASD symptom severity and communication skills within classroom settings differentiated student profiles. Groups 1 and 2 displayed average NVIQ and academic abilities; however, Group 1 exhibited mild ASD symptoms and average communication skills, while Group 2 exhibited more severe ASD symptoms alongside poorer communication skills in school. Students in Group 2 would benefit from more adaptive behavior and communication supports to successfully engage in learning even though their WJIII scores were like those of Group 1. Group 3 performed >1SD lower on WJIII subtests than NVIQ would predict, alongside moderately high ASD symptom severity and poor communication skills, indicating need for more intensive academic, behavioral and communication supports. Finally, Group 4 demonstrated severe difficulties across all measures indicating the need for the most intensive supports across all areas of functioning in school.

72 **138.072** Identifying and Diagnosing Autism Spectrum Disorder in Cognitively and Verbally Able Adults: An Exploratory Vignette-Based Study of Clinicians' Judgment, Experience & Perspectives

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Background: Despite recent improvements in identifying Autism Spectrum Disorder (ASD) across age and ability level, there remains a potentially large number of cognitively and verbally able adults with an unidentified ASD who are either undiagnosed or misdiagnosed due to challenges experienced by professionals in appropriate, timely and valid identification and diagnosis.
Objectives: To date and to our knowledge, no published studies have examined the factors influencing the likelihood that an ASD diagnosis will be considered by general mental health professionals in adult clients, nor the experiences and perspectives of these professionals. The present study aimed to utilize a vignette diagnostic activity to investigate the thinking and decision-making process of identifying possible ASD in cognitively and verbally able adults by clinicians and clinicians-in-training. Research in this area could help to improve identification and diagnosis of ASD of undiagnosed adults in general adult mental health settings and in professional training.

Methods: Using a mixed methods design comprising a quantitative survey (n=21) and qualitative focus groups (n=5), this study examined the client- and clinician-related factors influencing clinicians and clinicians-in-training in considering a possible ASD diagnosis in three case vignettes of adults with ASD. Participants' experiences with and perspectives regarding the identification of ASD in adults were also explored.

Results: ASD was considered as a diagnostic possibility only 22% of the time in the vignette activity. Factors that prompted a consideration of ASD fell into four themes: 1) impairments in social communication and interaction; 2) restricted, repetitive patterns of behaviour, interests, or activities; 3) history and pervasiveness of difficulties; and 4) family history of ASD. Even though more recently trained professionals were more

likely to consider an ASD diagnosis, most participants reported several challenges and concerns faced in the identification of adults with suspected ASD.

Conclusions: Results suggest several specific areas for training of general mental health professionals in order to improve the overall identification and diagnostic process for adults with a suspected ASD.

73 **138.073** Impact of Race/Ethnicity on Diagnostic Outcomes for Children Evaluated at an Autism Center

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Background: Autism Spectrum Disorder (ASD) is a phenomenon that occurs across race and ethnicity with consistent biological symptoms (Bernier, 2010). Practitioners must be prepared to work with racially and linguistically diverse populations as developmental perspectives are not applied equally across cultures (Bronheim, 2015). Historically, there have been disparities in rates and age of ASD diagnosis based upon race. Mandell (2002) found that on average, black children were diagnosed 1.4 years later than their white counterparts. Furthermore, Mandell (2007) found that after entry into specialty care, black children who would ultimately receive a diagnosis of ASD were three times as likely as white children to receive another diagnosis first. High patient volume centers focusing on ASD care regardless of patients' ability to pay offer unique opportunities to study demographic implications on diagnosis and treatment.
Objectives: To investigate differences in diagnostic outcomes based on race and ethnicity at a high-volume autism center in the Western United States.

Methods: Participants were drawn from a de-identified clinical records dataset of children (n=4986) who visited an autism center for diagnostic evaluation over an 8-year period from 2010 to 2018. Diagnoses (n=184) were collapsed into categories and coded as to whether such diagnoses were made. Categories included ASD (including Autistic Disorder, Asperger's Disorder, and PDD-NOS from the DSM-IV-TR and Autism Spectrum Disorder from the DSM-5), ADHD, Behavior/Conduct, Anxiety, and Mood Disorders.

Results: Participants ranged in age from 1- to 27-years-old (M=7.70, SD=4.21) and the mean age at first visit was different across racial/ethnic categories (F(5, 4980)=16.399, p<0.001). The clinic population had higher rates of racial/ethnic minorities than would be expected compared to census rates for the region. A chi-square test was performed to examine the relationship between race/ethnicity and various diagnostic outcomes. The relationship between race/ethnicity and ASD was significant, χ^2=(5, N=4,986)=19.01 p<0.001. See Table 1 for proportions of those receiving a diagnosis. The relationship between race/ethnicity and ADHD, Behavior/Conduct, Anxiety, and mood disorders were also all significant and ranged from p<0.05 to p<0.001.

Conclusions: The present study found differences in diagnostic outcomes based upon race/ethnicity. However, the findings were inconsistent with previous reports (Mandell, 2009) and may be explained by a range of factors. The first may be that practitioners at the center practice with high levels of multicultural competence. A second explanatory factor could be specific to the clinic population. The mean sample diagnostic evaluation age of 7.7 years is older than mean age of diagnosis in the community, suggesting that many children are detected and diagnosed earlier in other programs such as birth to three centers. The higher racial/ethnic minority rate and higher rate of ASD diagnosis of underserved communities observed in this clinic sample may suggest that the center, and similar centers nationally and internationally, may play a role in providing services to children with ASD that are missed in the community.

74 **138.074** Implementation of Screening in Pediatric Primary Care

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Background: Since the American Academy of Pediatrics (2006) recommended universal toddler screening for autism spectrum disorder (ASD) coupled with broad developmental screening and surveillance, surveys of pediatric providers report increased use of standardized tools such as the Modified Checklist for Autism in Toddlers (M-CHAT) during toddler well child care visits. However, although many providers value the contribution of screening to pediatric care, providers often encounter barriers to conducting systematic screening (Silver et al., 2017; Miller et al., 2011) and to using standardized algorithms to guide referral decisions. For example, in a study exploring nationwide implementation of developmental screening, King and colleagues (2010) noted that as many as 80% of the children within the targeted age ranges were screened. However, in some practices, as few as 27% of children who screened positive were referred for further evaluation. Beyond these survey results, there is limited literature examining fidelity of developmental screening in community practice.
Objectives: The current study utilized a brief interview to evaluate pediatric providers' implementation of universal, standardized, high-fidelity screening during toddler well child care visits.

Methods: Pediatric primary care providers (n = 27) in community practice in three geographic regions were interviewed about screening practices. Providers completed the interview in order to determine eligibility for a study, although they were not aware of the criteria for inclusion or exclusion. One open-ended question asked how providers identify ASD in their patients, and seven questions asked about specific aspects of screening administration, scoring, interpretation, and subsequent referrals for ASD evaluation. Responses were coded to indicate degree of concordance with universal, standardized, high-fidelity procedures using a 3-point scale to indicate no, partial, or full fidelity.

Results: Intraclass correlation between coders was excellent (ICC = .908). The majority of providers reported using screening tools to identify ASD symptoms (85.2%), using all items in a given tool (75%), and using the tool universally, rather than for children with prior concerns (82.6%). However, of the 24 providers using the M-CHAT or M-CHAT-Revised, only 12.5% reported using the Follow-Up algorithm. Furthermore, few providers

(14.3%) followed referral algorithms based on screening results; most used clinical judgment to determine need for referrals to an ASD evaluation, rather than referring all screen positive children. Only one provider (3.7%) reported complete adherence to universal, standardized, high-fidelity screening.

Conclusions: Although most providers reported using screening tools to identify ASD risk in toddlers, many combine screening results with clinical judgment to guide referrals for ASD evaluations. This practice deviates from high-fidelity implementation of screening, and may impede the earliest identification of ASD. Future research aimed at understanding barriers to universal screening and testing of appropriate implementation methods could support dissemination of screening practices.

75 **138.075** Influence of IQ on Discrepancies and Inter-Rater Agreement of Comorbid Symptoms on Self- Versus Caregiver-Report on the Aseba DSM-Oriented Subscales Among Adolescents with Autism Spectrum Disorder

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Background: Discrepancies in self- versus caregiver-report of comorbid internalizing and externalizing symptoms have been uncovered among people with autism spectrum disorder (ASD) with results often showing greater symptom endorsement via caregiver-report (May et al., 2015; Pisula et al., 2017). Additionally, inter-rater agreement has ranged from low to high (Ozsivadjian et. al., 2014; Pisula et al., 2017). Furthermore, IQ may influence these effects. A recent meta-analysis found better inter-rater agreement of comorbid symptoms among youth with ASD without intellectual disability than among those with only intellectual disability (Stratis & Lecavalier, 2015). Literature on the influence of IQ on discrepancies and inter-rater agreement in ASD, however, is sparse.

Objectives: 1) Examine the influence of IQ on discrepancies between self- and caregiver-report in a sample of youth with ASD. 2) Probe significant interactions of Reporter and IQ at the subscale level. 3) Determine inter-rater agreement across IQ groups.

Methods: One-hundred ten adolescents with ASD aged 11 to 16 and their caregivers participated. Descriptive statistics are found in Table 1. Data were collected as part of a larger randomized controlled trial. Data for the present study were collected during the pretest research appointment, prior to the adolescents in the experimental group receiving the intervention. Data presented include the Achenbach System of Empirically Based Assessment (ASEBA; Achenbach & Rescorla, 2003) Child Behavior Checklist (CBCL) and Youth Self-Report (YSR) DSM-oriented subscales.

Results: A Repeated Measures MANCOVA of Reporter with IQ as the covariate revealed a significant main effect of Reporter further qualified by a significant Reporter by IQ interaction effect. Univariate follow-up showed significance for the Affective Problems, Conduct Problems, and Post-Traumatic Stress Problems subscales only. Probing using ANOVAs of the interaction between Reporter and IQ revealed the difference between caregiver- and self-report was larger at higher levels of IQ (i.e., 1 SD above the mean) and smaller at lower levels of IQ (i.e., 1 SD below the mean). Partial correlations between Reporters controlling for IQ revealed moderate associations on all seven ASEBA DSM-oriented subscales included. Table 2 shows the descriptive statistics, *F* values, effect sizes, and significance values for the MANCOVA as well as correlation coefficients and corresponding significance.

Conclusions:

Results demonstrated an influence of IQ on discrepancies between adolescent self- versus caregiver-report of comorbid symptoms. A probe of the interaction effect showed a pattern of larger discrepancy between reporters at higher levels of IQ with caregivers reporting higher. This may be partially a product of higher ASD symptoms being associated with lower emotion perception (Gökçen, et al., 2014), when considering that higher ASD symptom endorsement via self-report has been associated with higher IQ (Bishop & Seltzer, 2012). Therefore, comorbid symptoms are likely present across cognitive ability among youth with ASD, but those with higher IQ may have more challenges reporting upon such symptoms. Moderate inter-rater agreement between reporters, when controlling for IQ, indicates that both reporters report in the same direction for symptom severity. Taken together, adolescents and their caregivers may both recognize the presence of symptoms but may disagree regarding symptom endorsement.

76 **138.076** Language and Executive Function As Predictors for Concurrent and Future Academic and Social Outcomes in Cognitively-Able Kindergarteners with ASD

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Background: Executive function (EF) and language are critical for academic and social development in typically developing (TD) children (e.g., McClelland et al., 2007). However, EF and language vary in young children with ASD (Konstantareas et al., 2006; Venter, Lord, & Schopler, 1992). Thus, more in-depth examinations of how school-entry EF and language predict academic and social outcomes have strong implications for early interventions for young children with ASD.

Objectives: To (1) examine the development of academic/social outcomes in cognitively-able children with ASD throughout kindergarten; (2) observe how school-entry EF and language predict these outcomes.

Methods: Participants included 54 cognitively-able children with ASD at kindergarten-entry (M=62.3 months; SD=4.8). Kindergarten-exit evaluations were completed for 36 participants (M=71.4; SD=3.9). EF was assessed based on innovative, tablet-based tasks, “EF-Touch” (Willoughby et al., 2010), targeting inhibitory control (“Spatial Conflict Arrows”; SCA), working memory (“Pick the Picture”; PTP), and attention shifting (“Something’s the Same”; STS). The Woodcock-Johnson III tests of achievement (WJ; Woodcock et al., 2001) was used to measure academic achievement in reading (passage comprehension [PC], letter-word identification [LW]) and math (math fluency [MF], applied problems [AP]). Social outcomes were assessed using the Brief Observation of Social Communication Change (BOSCC; Grzadzinski et al., 2016). Kindergarten-entry ASD symptom severity, cognitive skills (NVIQ), and language were assessed with the Autism Diagnostic Observation Schedule-2 (ADOS-2; Lord et al., 2012), the Differential Ability Scale (DAS; Elliott, 2007), and the Children’s Communication Checklist-2 (CCC-2; Bishop, 1998), respectively. Regression analyses were conducted to examine whether EF and language significantly predicted concurrent and future academic and social outcomes.

Results: Preliminary results showed that from kindergarten-entry to -exit, children made significant improvements (p<0.05) in reading and math (WJ), and social communication (BOSCC) with moderate-to-large effect sizes (Cohen’s d=0.6-0.9). Kindergarten-entry attention shifting (STS)

significantly predicted concurrent and future math performance at kindergarten-exit (AP). Working memory (PTP) significantly predicted concurrent math performance (MF). Inhibitory control (SCA) significantly predicted concurrent math performance (AP) and social communication (BOSCC). Kindergarten-entry inhibitory control (SCA) significantly predicted math performance at kindergarten-exit (AP). Phonological skills (CCC-2 Speech) significantly predicted concurrent reading (LW). Pragmatic language (CCC-2 Initiation, Interests) predicted concurrent social communication (BOSCC). Kindergarten-entry phonological and syntax skills (CCC-2 Speech, Syntax) significantly predicted reading (PC) and social communication (BOSCC) at kindergarten-exit, respectively. Predictors were significant after controlling for maternal education, gender, NVIQ, and symptom severity ($p<0.05$).

Conclusions: Cognitively-able children with ASD demonstrated academic and social gains throughout kindergarten. Kindergarten-entry EF and language were strong predictors of concurrent and future academic and social outcomes, above and beyond symptom severity, gender, and NVIQ. Inhibitory control, attention shifting, and working memory consistently predicted math skills, similar to past studies of TD kindergarteners (e.g., Passolunghi et al., 2012). Kindergarten-entry pragmatic language and phonological skills predicted concurrent and future reading as well as social communication. Results highlight the importance of targeting EF and language even before school-entry to maximize academic and social outcomes in children with ASD (Jones et al., 2017; Blair & Razza, 2007). Final analyses will be with a larger sample from an on-going study.

77 **138.077** Literacy in Minimally Verbal Young Adults with ASD Revealed By Eye Movements but Not Pointing: A Pilot Study

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Background: Autistic children and adults with little or no spoken language, labeled 'minimally-verbal' (MV), are typically judged 'low-functioning' or cognitively impaired, after failing the conventional assessments. However, it is yet unclear whether these failures reflect a true cognitive impairment, or alternatively a severe deficit in behavioral expressions of cognitive skills. One hypothesis, inspired by case descriptions and the similarity to Catatonia, suggests an "output problem" or a core action-control deficit for voluntary behavior, which results in a significant gap between the observed and actual cognition. In the current pilot study, we investigate this hypothesis by analyzing small eye-movements, possibly unintentional or reflexive that may bypass the action-control deficit.

Objectives: Assess basic reading and lexical-semantic knowledge in young adults with MV-ASD using eye movements measures in comparison to pointing performance.

Methods: Young adults with MV-ASD (N=12, 2 females, ages 15-24, all with less than 30 communicative words) were tested on a novel "cued looking" paradigm (adaptation of "looking-while-listening"; Fernald et. al., (2008)). Participants watched a sequence of stimuli while their eyes were tracked (Tobii tracker, short calibration), and their position of gaze was superimposed on the stimuli to attract attention. In each trial, a text word was presented at fixation (1s), followed by a pair of familiar objects pictures (fruits, animals, vehicles etc., 20 pairs) presented (1s) side by side (~6 deg each side), with next trial following after 800ms. There were 4 short runs (<1 min) repeated 3-6 times in random order with breaks. In a second experiment, the written words were replaced by recorded words. In a third (reading) and fourth (listening) experiments, the same pictures and text were used on 20 cards to measure performance via pointing. We analyzed the lateralization of the eye-gaze according to target side, the time course of correct gaze side, saccade direction and rate modulation. Statistics were obtained via non-parametric permutation tests.

Results: 9 of the 12 MV participants showed a significant effect of reading as reflected by correct lateralization estimates of 65-85% (average 75%), significant from 250-800ms post stimulus onset (average 350ms, $p=0.001$). In comparison, a control group of young adults (n=10) showed correct lateralization of 70-96% (average 85%). Overall, the MVs made smaller lateral eye movements (3 vs 6 deg.), were slower to start the movement (350ms vs 250ms), had a smaller peak of lateralized saccades and were less accurate (75% vs. 85%, implying ~90% of normal performance). The results in experiment 2 (vocal words) were similar for the 9 MV participants. In a striking contrast, 8 of the 9 MVs who showed significant reading with the eyes were at chance or near chance (50-70%, 59% on average, compared to 100% of controls).

Conclusions: Our pilot results from a small group of 12 young adults with MV-ASD provide the first systematic evidence for reading ability in individuals typically assumed to be severely language and cognitively impaired. The results demonstrate a striking gap between pointing performance and gaze-fixation, which opens the way for uncovering unknown cognitive abilities in people with MV-ASD.

78 **138.078** Mapping the Research Domain Criteria Social Communication Sub-Constructs to the Social Responsiveness Scale

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Background: Impaired social functioning is an early and prominent feature of autism spectrum disorder (ASD) and a wide array of other neurodevelopmental and neuropsychiatric disorders. Given the pervasive negative impact on affected individuals and their families, social deficits constitute an important intervention target. However, current diagnostic systems offer an imprecise characterization of social domains, limiting their utility for etiologically based research and stifling the development of individually tailored treatments. Research Domain Criteria (RDoC) operationalizes a set of basic social dimensions that can be used to deconstruct sources of variation in social impairments across affected individuals, regardless of their diagnostic status. Despite the significant promise, the translation of the RDoC framework into research and clinical practice has been impeded by the lack of dedicated measures for assessing proposed dimensions. Therefore establishing effective means of capturing and extracting relevant RDoC domains from already collected data can offer an important bridge towards providing initial testing of the explanatory power of this framework.

Objectives: To derive estimations of the RDoC social constructs from the Social Responsiveness Scale (SRS) and explore their utility in capturing individual patterns of strengths and weaknesses across the identified factors in a large, clinically diverse sample.

Methods: Data from six distinct databases were combined resulting in total N= 27953 (M_{age}= 9.55, SD= 3.79; 71.7% male). The sample comprised of individuals with ASD (60%), other neurodevelopmental and neuropsychiatric disorders (NDD/NPD; 6.2%) and normative development (33.8%). Variable-centered (Confirmatory Factor Analysis [CFA] and Exploratory Structural Equation Modeling [ESEM]) and person-centered (Latent Profile Analysis [LPA]) approaches were conducted using individual SRS items. CFA and ESEM explored the following models: (1) a 1-factor model; (2) a 3-factor model with separate Attachment and Affiliation (AA), Social Communication (SC), and Understanding of Mental States (UMS) factors, (3) a

4-factor model where SC was further split into Production of Facial (PFC) and Non-Facial (PNFC) communication, and (4) a bi-factor model with general social processes factor and 4 specific AA, PNFC, PFC, and UMS factors.

Results: The 1-factor solution showed a poor fit. The 3-factor solution had adequate fit (comparative fit index [CFI]= .952, Tucker Lewis index [TLI]= .937, root mean square error of approximation [RMSEA]= .054), however, 4-factor solution had superior fit (CFI= .973, TLI= .961, RMSEA= .042). Finally, the bi-factor model with general and specific AA, PNFC, PFC and UMS factors provided the best fit (CFI= .984, TLI= .975, RMSEA= .034). The identified factors were then utilized in the LPA that suggested a 5-profile solution (based on the BIC and the Bootstrap Likelihood Ratio Test) for the clinical sample (ASD and NDD/NPD). Identified profiles were distinguished in terms of the distinct pattern of peaks and troughs across AA, PNFC, PFC and UMS constructs, rather than being defined only by general severity gradient.

Conclusions: To our knowledge, this is the first study examining estimations of the RDoC social constructs from the existing measures. Our findings show promise for capturing important RDoC social constructs using the SRS and the utility of the identified factors in capturing clinically meaningful subgroups.

79 **138.079** Maternal Perinatal Depression and Risk of Autism: Preliminary DATA of a Longitudinal Evaluation in Offspring

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Background:

Autism Spectrum Disorder (ASD) is the final consequence of cascade events impacting brain development from gestation to early post-natal life. The high prevalence of maternal perinatal depression (PD) within pregnant women (10-25%), the steadily increasing use of psychotropic medications during pregnancy and the potential long-term effects on offspring neurodevelopment and behavior gives this topic public health importance. Studies investigating possible associations between maternal PD and higher risk of ASD show inconclusive and contrasting results. This controversy highlights the need of longitudinal and well structured studies evaluating the ASD risk in offspring of perinatal depressed women.

Objectives:

Primary aim of the study was to longitudinally evaluate possible long-term effects of maternal PD on socio-communicative and behavioral phenotype of the offspring with a specific focus on the increase of ASD risk. Secondary objective was to characterize the clinical phenotype of: Offspring of Perinatal Depressed women pharmacologically Treated during pregnancy (OPD-T) compared to offspring not exposed to drug treatment (OPD-NT).

Methods:

A total of 30 mother-child pairs were enrolled in the study. Psychiatric clinical evaluation of the women was performed during the 2nd trimester of pregnancy (Edinburgh Perinatal Depression Scale-EPDS, State Trait Inventory for Cognitive and Somatic Anxiety – TRAIT, STICSA T). Standardized clinical assessment of the children at a mean age of 5 years was performed in order to measure the presence of: autistic symptoms (Autism Diagnostic Observation Schedule-ADOS-2; Social Responsiveness Scale-SRS) and behavioural features (Conners' Parents).

Results:

We report preliminary results on: 16 women (mean age 37 years) and their 16 children (mean age 5 years) (Figure1). In the group of women affected by PD, two children received diagnosis of autism, while in the group of healthy control women (HC), only one child was affected by ASD. No significant statistical difference emerged, between the offspring of women affected by PD (O-PD) and the children of HC women (O-HC), in the level of autistic symptoms and socio-communicative difficulties, measured by ADOS total score (mean: 4,00 O-PD vs 3,00 O-HC), ADOS calibrated severity score CSS (mean: 2,11 O-PD vs 2,20 O-HC), SRS total score (mean: 58,50 O-PD vs 52,60 O-HC), However, children of PD mothers not pharmacologically treated in pregnancy (OPD-NT) scored higher compared to offspring of pharmacologically treated women (OPD-T) on: ADOS total (mean: 6,00 OPD-NT vs 2,86 OPD-T), CSS (mean: 3,67 OPD-NT vs 1,33 OPD-T), SRS total (mean: 64,00 OPD-NT vs 56,14 OPD-T), Defiant (mean: 53,67 OPD-NT vs 46,71 OPD-T) Hyperkinetic behaviours (mean: 63,33 OPD-NT vs 52,00 OPD-T) and Inattention score of Conners' (mean: 68,00 OPD-NT vs 48,57 OPD-T).

Conclusions:

Our preliminary results don't show a significant increased risk of autism in the children of women affected by perinatal depression compared to offspring of healthy control mothers. However, a different clinical phenotype came out within the offspring of women affected by perinatal depression and exposed to psychotropic medications during pregnancy compared to offspring not prenatally exposed to pharmacotherapy. Specifically, lower sub-threshold autistic symptoms and less defiant-inattentive-hyperkinetic behaviours emerged within offspring exposed to psychotropic medications in pre-natal period.

Poster Session
139 - Early Development (< 48 months)
5:30 PM - 7:00 PM - Room: 710

80 **139.080** Emergent Executive Function Amongst Two-Year-Olds with and without a Familial History of Autism Spectrum Disorder

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Background: Executive Function (EF) underpins the ability to work towards goals by co-ordinating thought and action. Children and adults with Autism Spectrum Disorder (ASD) often experience EF difficulties but it is not known whether these are primary or secondary to ASD. Research with young children with a familial history of ASD ('ASD-siblings') affords the possibility of investigating how early differences in EF development relate to ASD traits, but until now has been hampered by a scarcity of suitable measures of emergent EF.
Objectives: To identify associations between EF and ASD traits at their earliest emergence.

Methods: Fifty-nine 2-year-old ASD-siblings and 22 2-year-olds with no familial history of ASD completed a behavioural measure of impulse control (Prohibition), a touchscreen working memory game (Delayed Alternation), and a problem-solving task that elicits variation in generativity, perseveration and persistence (Problem-Solving Box). Parents reported on EF-related aspects of temperament (Early Childhood Behavior Questionnaire; ECBQ) and ASD traits (Quantitative Checklist for Autism in Toddlers; Q-Chat), and toddlers were assessed using the Toddler Module of the Autism Diagnostic Observation Schedule – Second Edition (ADOS-2).

Results: Two-year-olds demonstrating low impulse control on the Prohibition task had higher ADOS-2 Restricted and Repetitive Behaviours (RRB) scores than two-year-olds with high impulse control (U = 223, p = .013). Lower parent-reported impulse control (ECBQ Inhibitory Control) was associated with more parent-reported ASD traits in the social-communication domain (r = -.355, p = .006) and higher ADOS-2 Social Affect (SA) scores (r_s = -.414, p = .001). No significant associations were found between Delayed Alternation performance and ASD trait scores. Greater perseveration on the Problem-Solving Box was associated with more parent-reported RRBs (r =.302, p = .046). Persistence positively correlated with ADOS-2 RRB score (r_s = .317, p = .021). No significant associations were found between generativity and ASD trait scores. Lower parent-reported attentional control (ECBQ Attention Shifting) was associated with more parent-reported ASD traits in both the social-communication (r = -.729, p <.001) and RRB domains (r = -.351, p =.006) and with ADOS-2 SA scores (r_s = -.302, p =.020). The ASD-sibling group did not significantly differ from the control group on any EF measure, and all estimated group differences were small.

Conclusions: ASD traits are linked to variation in EF from as early as 2 years, in both the social-communication and RRB domains. These findings run counter to 'secondary-deficit' accounts that suggest difficulties with EF cannot be observed until after behavioural symptoms of ASD are well-established. Consistent with the literature that working memory difficulties are linked with developmental delay and not ASD specifically, in this study working memory performance did not associate with ASD traits.

Our results indicate that toddlers with ASD traits may benefit from interventions to support the development of attentional and behavioural control. Interventions should take into account strengths as well as difficulties associated with ASD traits – such as our finding that greater RRBs are associated with greater persistence.

81 **139.081** Early Differences in Manual Behaviours in Infants at Risk for ASD and/or ADHD

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Background:
Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterised by social communication difficulties, restrictive and repetitive behaviours and sensory anomalies (DSM-5, 2013). Whilst there is a body of literature demonstrating motor difficulties in ASD (Ming et al., 2007), comparatively this domain has received little attention. This seems an oversight given the important cascading effects that have been linked to motor delays in ASD (Bedford et al., 2016; Leonard et al., 2014).

Objectives:

In this study, we report findings from a prospective longitudinal infant sibling study (infants at a higher familial likelihood of developing ASD – ASD-L and/or ADHD – ADHD-L, compared to a Control – CTL - group). We examined a specific manual behaviour; midline crossing. Midline crossing refers to the act of placing one's hand in the contralateral side of space, thus crossing the body midline. These behaviours are important as they can elucidate the relationship between motor behaviours and hemispheric specialisation/brain maturation (Morange & Bloch, 1996; Provine & Westerman, 1979).

Methods:

164 infants (29 CTL, 91 ASD-L, 44 ADHD-L) at 5-, 10- and 14-months took part in this study. Infants were seated in a high chair and were presented with blocks to play with for 3 minutes. Video data was coded offline for every manual movement that infants engaged in. Broadly, behaviours were coded with respect to three categories: reaching, hand movements and object manipulation. Of particular importance was whether these manual movements involved crossing the body midline (if the movements occurred in the ipsilateral or contralateral side of space to the usual placement of the hand, with the right hand acting in the left side and vice versa).

Results:

Our findings show that midline crossing behaviours increase with age across the two familial risk groups (supporting previous research; Carlier et al., 2006; Van Hof et al., 2002). However, the CTL group demonstrated an n-shaped developmental pattern, showing a greater number of midline crossings at 10-months before this significantly decreased at 14-months (Fargard et al., 2009). Further, this increase in midline crossing behaviours is significantly greater than those exhibited by the ASD-L [t(112) = 4.27, p <.001, d = .84] and ADHD-L [t(61) = 3.51, p =.001, d = .85] groups, Figure 1). Particularly of note was that midline crossing behaviours were not related to gross and/or fine motor skills (as measured by the Mullen and the VABS; Mullen, 1995 and Sparrow, 1989 respectively).

Conclusions:

Our findings show that, at 10-months, infants at familial risk for ASD or ADHD perform significantly fewer midline crosses compared to CTL infants. This provides evidence of motor differences between the familial risk and typically developing groups, albeit at a specific time point in the first year of life. Somewhat surprisingly, midline crossing seems to be independent of gross and fine motor skills. This has important implications in terms of the relationship between motor and multisensory *spatial* development. Further, we discuss the potential cascading effects of these early differences with respect to how infants process, and engage with, the world around themselves.

82 **139.082** Early Identification of ASD in Males and Females: Sex-Specific Behavioral Phenotypes in Toddlers Assessed with the STAT and STAT-Q Parent Questionnaire

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Background:
Recent research suggests that a two-tiered screening method utilizing the STAT shows strong positive predictive value and sensitivity as well as a reduction in the false positive rate of diagnosis. Previous research at our clinic examining the STAT and STAT-Q identified a possible specific behavioral phenotype in boys and girls. Literature comparing the male to female ratio of diagnoses of ASD suggests that girls who meet the diagnostic criteria of ASD are at a disproportionate risk of not receiving the diagnosis. The majority of literature on sex differences among children diagnosed with ASD examines differences after the age of 6 years. These differences include less restrictive, repetitive, and stereotyped behaviors, namely less meltdowns, decreased frequency in occurrence, symptom masking, and more age and gender-appropriate interests and play. Given the importance of early identification and intervention, an improved understanding of sex differences in young toddlers is needed to ensure children are being more accurately diagnosed and receive early intervention.

Objectives:

This study aims to examine sex differences in toddlers assessed by clinicians using the STAT and the STAT-Q parent questionnaire to further refine potential diagnostic markers for the early identification of ASD in males and females.

Methods:

This retrospective record review examines 139 children aged 18 to 36 months who were assessed through a multidisciplinary medical diagnostic evaluation utilizing the STAT and STAT-Q. Multivariate regression was used to examine the relationships between the STAT and biological sex adjusted for developmental age, mother's language and STAT-Q.

Results:

Among a sample of 139 children (median age 33 months, range 19 – 36 months), boys (N=109, 78%) displayed a higher median score (2.75 vs 2.25 in girls, p=0.047) on the STAT, indicating greater severity of symptomatology associated with ASD. Adjusted for other factors, boys on average scored 0.4 higher on the STAT than girls (p=0.009). Furthermore, an average female score of 2.4 among 34 girls assessed suggests a greater likelihood that females may be missed. While a preliminary item analysis is inconclusive with the current sample size, an item analysis will be repeated upon obtaining additional participants to further examine if specific items on the STAT and STAT-Q strongly correlate with a diagnosis of ASD for males and females.

Conclusions:

Improved understanding of sex differences among male and female toddlers on the STAT and STAT-Q may improve clinical judgment combined with these assessment tools to assist in appropriately diagnosing both males and females with ASD. An understanding of the sex-specific behavioral phenotypes in the presentation of ASD in young children will help improve early identification and early implementation of the necessary interventions needed to enhance outcomes throughout the lifespan.

83 **139.083** Early Identification of Clinical Predictors for Autism Spectrum Disorders in Infants with Tuberous Sclerosis Complex: Final Results from Epistop Project

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Background: One of the most common genetic causes of syndromic Autism Spectrum Disorders (ASD) is Tuberous Sclerosis Complex (TSC), a single-gene syndrome often associated with autistic phenotype and developmental delay (DD) since very early stages of life. The possibility of prenatal/perinatal diagnosis of TSC has facilitated investigation of pathogenetic mechanisms of ASD, but there are still lacking evidences of predictive factors for ASD or DD occurrence. The EPISTOP project promoted the prospective investigation of clinical predictors that could be able to individuate early deviation of developmental trajectories before the appearance of symptoms of ASD or DD/cognitive impairment.
Objectives: The main objective of the work package 7 in EPISTOP was to identify early prognostic factors of neurodevelopmental outcome in TSC patients. The specific goals were to promptly detect deviation in developmental trajectories and in specific skills potentially predictive of ASD and DD/cognitive impairment.

Methods: 97 TSC subjects were prospectively followed from 6 to 24 months of age with detailed neuropsychological assessment for evaluation of developmental level with the Bayley Scales of Infant Development (BSID) and identification of ASD risk with Autism Diagnostic Observation Schedule (ADOS). Comparisons between groups were performed, as appropriate, with two-sample t test, ANOVA models, and Spearman's correlations. An alpha level of 0.05 was used for all statistical analyses, which were performed using SPSS v.23.0 (IBM Corp., Armonk, NY, USA).

Results: Final data at 24 months were available for 82 children. BSID results have been carefully analyzed to identify early deviations in specific areas potentially predictive for DD/cognitive impairment. In particular, impairment in fine-motor, expressive and receptive language areas at 6 months were significantly correlated to DD diagnosis at 24 months (see Table 1). Infants with TSC who were diagnosed with ASD at age 24 months had impaired fine motor quotients on the BSID-III at age 6 months and their developmental trajectories differed significantly in all areas explored (cognitive: Spearman coefficient -,446; p < 0,001; language: Spearman coefficient -,438; p < 0,001; motor: Spearman coefficient -,540; p < 0,001) at age 12 months (see Table 1). ADOS score at 12 months of age showed a significant association with final ASD outcome (positive predictive value (PPV): 57,1%; negative predictive value (NPV): 85,7%). Specific ADOS items, particularly those representing social communication deficits related to

visual impairment (e.g. integration of eye contact, joint attention) were more impaired in infants with ASD compared to infants without.

Conclusions: A deviation from the normal developmental trajectory can be detected in infants with TSC at high risk for ASD from as early as age 6 months, particularly in the motor area. Impairment in cognitive level and emerging atypical behaviors in visual-related social skills at 12 months can be significative predictors of subsequent ASD at 24 months in these high-risk children. Our findings strongly support the need for prospective neuropsychological assessments in infants with TSC, in order to early identify children at high risk for ASD and to develop treatment protocols targeting social communication function, as well as specific developmental domains, before the onset of autism symptoms.

84 **139.084** Early Interventions for Infants with, or at Risk of, Neurodevelopmental Disorders : A Systematic Review

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Background:

Over the past few years, support for very early intervention of infants at risk for neurodevelopmental disorders (NDD) has begun to emerge in the literature as an attempt to positively modify the natural history of these disorders. Indeed, very early intervention seeks to modify environment and experience that can shape brain development and outcomes across the lifespan. Growing prevalence of NDD and greater awareness of their impact effects have led to the development of early intervention programs with the aim of taking action as early as possible to tackle these conditions.

Objectives:

The review seeks to establish, through the available literature, available intervention programs for infants 0-3 years recently diagnosed with a NDD, those at risk, and their families.

Methods:

We conducted a systematic review of the published work according to the PRISMA statement. Relevant studies were identified by searching the following data sources: PsycINFO, Embase, Medline via Ovid, CINAHL (Cumulative Index to Nursing and Allied Health Literature) and the Cochrane Database of Systematic Reviews, from 2000 to Jan 2018. Search terms were arranged relating to disorders, population, and interventions. Reference lists from identified trials and review articles were manually scanned to identify other relevant studies.

Results:

The review includes 122 studies with controlled trial design from 15 countries. A quantitative analysis (e.g. meta-analysis) of the results could not be performed due to differences in the design, duration and intensity of interventions, as well as the heterogeneity in outcome measurement tools used. Findings from the studies were reported narratively. Nearly half of the intervention programs identified were parent-mediated. Among other delivery characteristics, we examined the implementation settings such as session formats and implementers' qualifications: 81% of the studies implied individual training sessions, 9% as a group, and 10% both types, and most of the interventions were implemented by a professional. High risk was evident in the studies in relation to reporting, attrition biases, and blinding of participants. Overall, we found gains in language development, social communication and play skills as well as adaptive functioning for some programs, with findings largely inconsistent across studies and time points.

Conclusions:

The review finds some evidence for the effectiveness of early interventions programs in promoting behavioral, social and play skills in infants at risk for a NDD and their families. Our results highlight the importance to develop and implement such programs with the aim of taking action as early as possible to tackle these conditions.

85 **139.085** Early Language Exposure Supports Later Language Skills in Infants with and without Autism

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Background: Parents play an important role in supporting infant language development through the way they talk to and communicate with their infants (Hart & Risley, 1995; Huttenlocher et al., 1991).

Objectives: Our objective was to extend this previous work by characterizing the impact of home language environment on later language function in high familial risk infants who developed autism spectrum disorder (ASD)

Methods: There were three groups of infants in this study: those who were at high-familial-risk by having an older sibling with ASD but did not have ASD themselves (n = 46); those who were at high-familial-risk and had ASD themselves (n= 14); and those who were at low-familial-risk and exhibited typical development (n = 36). Diagnoses were made by clinical best estimate at age 2 years. Two days of home language recordings were collected at 9 and 15 months. Software was used to automatically process infant and adult vocalizations (LENA Pro software suite V3.3.4). The current study focuses on the richness of the home language environment, operationalized as amount of language exposure (adult word counts, AWC) and caregiver-child interactions (conversational turn counts, CTC).

Results: Across all infants in the study, including those with ASD, increased AWC at 9-months was associated with Mullen Scales of Early Leaning verbal developmental quotient scores at 24-months (F= 8.70, q= .005). A similar pattern was found for AWC at 15-months (F= 16.78, q = .0002), CTC at 9-months (F= 7.61, q = .007), and CTC at 15-months (F= 16.53, q = .0002) (Fig. 1 A-D) controlling for clinical data collection site, maternal education,

and sex of the infant. *Q*-values are FDR corrected *p*-values. Generalized linear models revealed that across all groups, higher maternal educational attainment was associated with richer home language environment at 15-months (i.e., AWC at 15-months, χ^2= 9.92, *q* = .018; and CTC at 15-months, χ^2= 9.25, *q* = .018), but not 9-months. A similar pattern of results was found for paternal education (i.e., AWC at 15-months, χ^2= 10.08, *q* = .024; and CTC at 15-months, χ^2= 8.65, q = .026). Mediation analyses revealed that the effect of parental education on child language skills was explained by the richness of the home language environment at 15-months (Fig. 1 E-F).

Conclusions: There is a prodromal period for children with ASD during the first year of life where the core behavioral features of ASD are not yet present. The current study reveals that parent verbal behavior during the first years of life and educational attainment can have a significant impact on later language development, highlighting the home language environment as a means to support language development in HR and LR infants, including those who go on to develop ASD.

86 **139.086** Early Motor Trajectories in High-Risk Infants: A Case Study

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Background: Early emerging motor skills are prerequisites for learning about the environment and for interacting with others (Gibson, 1988; Libertus & Hauf, 2017). Slow onset-patterns for key motor milestones have the potential to impact development across domains, especially communicative and language development (Zuccarini et al., 2018). Previous research has identified slower motor milestone achievement in high-risk (HR) infant siblings later diagnosed with Autism Spectrum Disorder (ASD). For example, HR infants later diagnosed with ASD show slower development of grasping behavior (Libertus, Sheperd, Ross, & Landa, 2014), and of sitting and standing skills (Nickel, Thatcher, Keller, Wozniak, & Iverson, 2013). Despite these findings, early motor development is not considered a diagnostic criterion for ASD (American Psychiatric Association, 2013) as motor delays are not specific to ASD (Ozonoff et al., 2008). However, motor delays may impact outcomes by impacting developmental cascades initiated by self-produced motor acts (Soska, Adolph, & Johnson, 2010). Therefore, more detailed research on the trajectories and developmental pathways of motor skills in infants later diagnosed with ASD is warranted.
Objectives: Examine the developmental trajectory of motor skill development during the first year using high-density sampling in HR infants with known outcome diagnoses.

Methods: Three HR infants participated in a longitudinal assessment of grasping behaviors over eight weeks starting at 3-months of age. Assessments were conducted in the family's own home using video conferencing. At ten months of age, parents completed the Early Motor Questionnaire (EMQ) about their child. One HR infant received a subsequent diagnosis of ASD in a research setting (HR-ASD), one received a subsequent diagnosis of language delay in a community setting (HR-LD), and one received no diagnosis of developmental delays (HR-No). Three age and gender-matched typically developing infants (TD-matched) and to a larger sample of 40 TD infants (TD-GrandAv) served as comparison groups.

Results: Given the case study nature of the current HR sample, results are descriptive. Growth patterns show a prolonged (6 week) period of absent grasping-skill growth in HR-ASD and HR-LD infants, followed by a sudden "catch-up" burst. This contrasts with the HR-No and TD-Matched infants, who show gradually increasing motor-skill growth (see Figure 1). Parent-reported motor skills at ten months of age show low EMQ scores for HR-ASD and HR-LD infants, but not different from TD infants. A notable exception is the HR-No case, showing strong motor performance in all domains (see Figure 2).

Conclusions: The current study provides a detailed description of the developmental trajectory of grasping skills in HR infants with different outcomes. It appears that HR infants who go on to develop developmental delays show slower motor development followed by catch-up bursts in early infancy. By ten months of age, strong motor skills may be a protective factor for some HR infants – especially in the Perception-Action domain that measures skills such as hand-eye coordination. These findings suggest that unusual patterns of motor growth in HR infants could serve as early indicators for subsequent diagnoses of developmental delays. Implications and applications of the findings will be discussed.

87 **139.087** Early Object Exploration and Later Social Concerns within the Context of Elevated ASD Risk

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Background:
With the current prevalence of an autism spectrum disorder (ASD) diagnosis at 1 in 59 (CDC, 2018), early developmental monitoring studies are committed to identifying early behavioral risk markers that may inform later developmental concerns. Previous research highlights atypical play behaviors during object exploration as potential risk markers for ASD (e.g., unusual sensory interests, repetitive movements; Wetherby et al., 2004). Within prospective infant sibling designs, previous research has documented atypical object exploration as early as 18 months in children who subsequently received an ASD diagnosis (e.g., spinning, prolonged rotation, unusual visual interests; Ozonoff et al., 2008). However, it is unclear if object exploration atypicality is a unique risk marker for ASD or if it is also present in children with other developmental concerns or those with sub-clinical social difficulties.

Objectives:

The present study expands our understanding of atypical object exploration as an early risk marker of ASD by assessing whether (1) high-risk infant siblings with developmental concerns, as indexed by standardized developmental assessments, also exhibit atypical play behaviors, compared to their typically developing peers, and (2) if atypical object exploration informs continuous measures of social difficulty, as indexed by a parent-report measure.

Methods:

As part of a prospective longitudinal study, 63 infants/toddlers (high-risk group *n*= 31; low-risk group *n*= 32) completed an object exploration task at 12, 15, and/or 18 months of age. The task included five objects: rattle, ring, metal lid, sticks, and cars. Each object was presented to the infant/toddler for 30 seconds and in the final 30 seconds of the task all objects were presented together. Play behaviors were recorded and coded for evidence of object spinning, mouthing, and rotating—following an existing coding scheme (Ozonoff et al., 2008). Mothers completed the Vineland Adaptive Behavior Scales (VABS) when infants were 24 months to index adaptive functioning in the socialization domain. Between 24 and 36 months, children completed an outcome visit and, following previously established criteria, children were assigned to either developmental

concerns (*n*= 20) or typically developing (*n*= 43) groups.

Results:

Regression analyses were conducted with terms for infant sex and maternal education. Overall, there were significant group differences for select atypical play behaviors. Specific to Aim 1, infants/toddlers with developmental concerns demonstrated more object spinning than their typically developing peers. However, infant/toddler object mouthing and rotating were comparable across groups (Table 1). Specific to Aim 2, continuous VABS scores were not associated with the assessed behaviors (Table 2).

Conclusions:

Infant object exploration in the first two years of life may inform later developmental risk. Although this sample was small, object spinning still differentiated children with developmental concerns from those with typical development. Intriguingly, infant play behaviors did not predict social competence more globally. Therefore, the prospective risk associated with object exploration may not be specific to social skills but rather may capture other elements of ASD (e.g., repetitive behaviors and interests). This study adds to a growing body of work documenting how early object exploration may inform ASD and other developmental risks.

88 **139.088** Early Screening for Autism Spectrum Disorders (ASD) in Two-Year-Old Children with Visual Impairment and Longitudinal Outcomes

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Background: Children with congenital profound or severe visual impairment (VI) are at high risk of ASD and social-communication difficulties (prevalence of ASD ~30%). Existing tools used to measure socio-communicative development and ASD are highly vision-dependent and not valid for children with VI. We recently validated a novel visual impairment social-communication observational schedule (VISCOS), drawing on principles of ADOS but specifically designed for 4-7 year olds with VI. We developed initial validation against expert clinician formulation and have identified children who are at high risk of ASD. A proportion of children who participated in the VISCOS at 4-7 years, also participated at 2-years-old in standard behavioural items and social 'presses' to elicit social and communicative behaviours and coded using the Social Communication Schedule (SCS-2), which was non vision-dependent. The SCS-2 includes a Social-Communicative ability Scale (SCS) and a Negative Behavioural Screener (NBS) of repetitive and restricted behaviours.

Objectives: To carry out longitudinal analyses between the SCS-2 and clinician and VISCOS outcomes, to establish construct validity between tools. To examine whether the SCS-2 could act as a potential early screener to identify children at-risk of ASD.

Methods: Preliminary data from 39 children at 24 months (M=25.51, SD=2.36) with VI from the longitudinal OPTIMUM project were rated using the SCS (high scores indicated better social communicative abilities) and a negative behaviour screener (NBS – higher scores indicated more negative behaviours), whilst engaging in social and independent play tasks. The same children participated in the VISCOS assessments at 4-7 years (M=64.04, SD=8.12) - DAiSY study.

Results: A Kruskal-Wallis test examined differences in the 3 clinician categories (Non-ASD, Borderline, ASD) and SCS and NBS. A significant difference was found between groups on SCS scores, with a difference present between the Non-ASD group and the ASD group $\chi^2(2)=8.2$, $p=0.17$; children in the ASD group (N = 6; M=16.83 SD=9.13) scored lower SCS scores than children in the Non-ASD group (N= 28; M=26.14 SD=5.75). A Mann-Whitney U-test comparing the combined ASD+Borderline group to the Non-ASD group found the ASD+Borderline group scoring lower (N=11; M=18.63 SD=7.47) on SCS than the Non-ASD group (N=28; M=26.14 SD=5.75), U=63.00 p=.004. No significant findings were found for the NBS. A ROC analysis on VISCOS scores based on the clinician formulation groups had revealed excellent predictive discriminant validity (AUC=0.92), with a sensitivity/specificity of 0.86 for clinician ratings and identified a VISCOS threshold score for *High Risk for ASD* (≥13.5) or *Low Risk for ASD* (<13.5). Using this cut-off (at or above 13.5 indicating difficulties) the two groups did not differ significantly on SCS scores (ASD+Borderline N=13; M=23.31, SD = 7.12 vs Non-ASD N=20; M=26.40, SD = 6.01) U= 94.00 p = .184. Despite the nonsignificant p value, a Cohen's d effect size of 0.475 suggested a medium effect.

Conclusions: The SCS-2 scores at 2 years showed significant differentiation of the clinician diagnostic categories (drawing on the VISCOS tool) at 4-7 years. Findings suggest that this 'early stage' tool may provide a potential screener for early signs of ASD in children with VI.

89 **139.089** Early Social Skill Developmental Trajectories and Developmental Differences across the Social Spectrum

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Background:

Autism Spectrum Disorder (ASD) is characterized by deficits in social communication and interactions; these deficits are often first identified when children fail to reach certain developmental milestones. Yet milestone achievement varies across individuals, and little is known about the developmental progression of specific social skills within either typical development or ASD. Furthermore, social functioning is not binary; rather social functioning exists along a full spectrum (Social Spectrum; Dowd et al., 2018) from typical development to clinical severe impairment. Research is needed to identify the early developmental trajectories of crucial social skills and how this development varies across the Social Spectrum.

Objectives:

Evaluate the progression of four social skills (Response to Name; Sharing Interests; Showing/Pointing; Coordinating Eye Contact with Nonverbal Communication) from 9 to 24 months and identify the extent to which development varies across the Social Spectrum.

Methods:

High-risk (N=111) and low-risk (N=131) infants were assessed at 9, 12, and 18 months. The Systematic Observation of Red Flags of Autism Spectrum Disorder (Wetherby et al., 2016) is an observational screening measure that detects red flags of ASD based on a communication assessment. Four

items were identified and reversed scored (0-3) to assess for positive social skill development. These items had corresponding items on the Autism Diagnostic Observation Schedule–Toddler Module (Luyster et al., 2009), administered at 24 months. Of note, there were differences in the coding of items across measures; therefore, data was analyzed both with and without the inclusion of the 24-month data. The Early Screening for Autism and Communication Disorders (Wetherby, Woods, & Lord, 2012) is a parent measure that ranks infant skills as Not Yet/Rarely, Sometimes, or Often occurring for 22 items related to Social Interacting and Communicating. For this project, the sum of items was used as a measure of Social Spectrum at 9 months. Linear mixed-effects models were conducted separately for each skill, with Age, Social Spectrum, and their two-way interaction as predictors. Non-significant interactions and main effects were removed to yield optimal models.

Results:

See table for preliminary results with limited 24-month data (N=137); remaining data will be included by April 2019. There were significant main effects of Age and Social Spectrum, with and without the 24-month data, on Sharing Interests, Showing/Pointing, and Coordinating Eye Contact with Nonverbal Communication. For Response to Name, there was a significant interaction of Age and Social Spectrum utilizing the 9- to 18-month data, yet there was only a significant main effect of Age with the 24-month data included.

Conclusions:

These crucial social skills are developing between 9-24 months. Additionally, higher social functioning at 9 months is related to better social initiation skills across 9-24 months. While Response to Name improves over time, this development varies based on infants' social functioning at 9 months. Identifying the developmental trajectories of crucial early social skills, particularly deviations in development across the Social Spectrum, may inform our understanding of the developmental model of ASD and help establish timeframes and target areas for early invention for children with varying degrees of social impairment.

90 **139.090** Early Developmental Trajectories of Social Communication Skills and Developmental Differences across the Social Spectrum

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Background:

Autism Spectrum Disorder (ASD) is characterized by deficits in social communication and interactions, including responding to and initiating social overtures. Little is known about the developmental progression of these skills within the second year of life for either neurotypical children or children with ASD. Furthermore, social functioning is not binary; it is not restricted to typical development (TD) and severe impairment. Rather social functioning exists along a full spectrum, known as the Social Spectrum (Dowd et al., 2018), to account for the variability in social functioning within TD and also within ASD. Research is needed to identify the developmental trajectories of crucial early social skills and the deviations in development across the Social Spectrum.

Objectives:

Evaluate the developmental progression of five social skills (responding to and initiating joint attention [RJA, IJA]; responding to and initiating social interactions [RSI, ISI]; initiating behavioral requests [IBR]) from 12 to 24 months, and the extent to which early differences in social functioning impact these developmental trajectories.

Methods:

Infants at high-risk (N=19) and low-risk (N= 22) were assessed using the Early Social Communication Scales (ESCS; Mundy et al., 2003) at 12, 15, 18, and 24 months, and the Autism Diagnostic Observation Schedule – Second Edition –Toddler Module (ADOS-2-T; Lord et al., 2012) at 12 months. The ESCS is a semi-structured, play-based assessment that is behaviorally coded offline from video; it yields frequency scores for IJA, RSI, ISI, and IBR, as well as a percent correct score for RJA. Additionally, IJA is comprised of the sum of higher and lower level skills (i.e., IJA = HighIJA + LowIJA). The Social Affect section of the ADOS-2-T algorithm was used as a measure of Social Spectrum at 12 months. Linear mixed-effects models will be conducted separately for each skill, with Age, Social Spectrum, and their two-way interaction as predictors. Non-significant interactions and main effects will be removed to yield optimal models.

Results:

See table for preliminary results from 12 to 18 months; 24-month data will be available by April 2019 to supplement these analyses. There was a significant main effect of Age on RJA, RSI, ISI, and HighIJA, a significant main effect of Social Spectrum on RJA, a significant Age*Social Spectrum interaction for IBR.

Conclusions:

Identifying the developmental trajectories of crucial early social skills and deviations in development across the Social Spectrum, may inform our understanding of the developmental model of ASD and help establish timeframes and target areas for early invention for children with varying degrees of social impairment. Results suggest that while some social skills (RJA; ISI; HighIJA) are improving over time, other skills are either declining (RSI), perhaps as more advanced skills emerge, or not progressing (IJA), perhaps as mastery has already occurred. Additionally, developmental differences were apparent across the Social Spectrum for some (RJA; IBR), but not all social skills, suggesting that these skills may be important intervention targets for infants with greater social impairment at 12 months and may provide meaningful information about later development.

91 **139.091** Empathic Response in High-Risk Siblings and Preterm Born Children at the Ages of 24 and 36 Months

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Background: Children with autism spectrum disorder (ASD) are impaired in their empathic understanding and responses. When a researcher hurts him/herself, children with ASD show less concern for and awareness of the adult's distress than typically developing (TD) children (Sigman et al.,1992;Charman et al.,1997). Also high-risk (HR) siblings, later diagnosed with ASD, are less responsive and pay less attention to the other's distress (e.g.,Hutman et al.,2010). Delays or deficits in emerging empathy thus seem to be an early sign of ASD. Previous studies used global rating scales to qualitatively measure attention and empathic behaviour. To get a more detailed picture of these behaviours, the current study used frequency ratings.

Objectives: To compare the empathic response (ER) of two groups of infants at risk for ASD (HR-siblings, preterm born children (preterms) < 30 weeks gestational age) with low-risk (LR) children (having only TD-siblings) using frequency coding.

Methods: 62 LR-siblings, 47 preterms and 65 HR-siblings participated in an ER-task (based on Sigman et al.,1992) at the ages of 24 and 36 months. Child and researcher were playing with a hammer toy. The researcher pretended to hurt her finger by hitting it with the hammer. Interactions were video-taped and coded by two independent raters for attention and behaviour.

Results: At both ages, children showed more prosocial behaviours after hurting. The total time of social behaviours became shorter, resulting in more time for non-social behaviours after hurting.

At 24M, there was no group difference in the presence of prosocial behaviour ($\chi^2(2)=.166, p=.92$). However, more subtle differences could be detected. Group x condition interactions showed that HR-siblings tend to direct their attention away longer than preterms after the hurting occurred ($F(2,167)=5.49, p=.005, \Delta=.07$) and that HR-siblings looked less long to the researcher's face after hurting than LR-siblings ($F(2,167)=5.29, p=.006, \Delta=.05$). After hurting, HR-siblings also played more with other toys by themselves than LR-siblings ($F(2,167)=4.18, p=.016, \Delta=.05$), and with other toys also involving the researcher than preterms ($F(2,167)=3.004, p=.052, \Delta=.15$). Group differences could be found in latency to looking at the parent's face ($F(2,16)=6.14, p=.010, \Delta=.016$) and the hammer ($F(2,168)=3.89, p=.022, \Delta=.05$). LR-siblings looked faster to their parent than HR-siblings, while preterms looked later to the hammer compared to HR- and LR-siblings.

At 36M, there was again no group difference in the presence of prosocial behaviour ($\chi^2(2)=.866, p=.649$). A significant group x condition interaction ($F(2,160)=8.554, p=.000, \Delta=.05$-06) showed that preterms looked longer to the researcher's face after hurting than HR- and LR-siblings. There was a trend for a shorter latency until starting to play again in preterms compared to LR-siblings ($F(2,159)=2.83, p=.062, \Delta=.05$).

Conclusions: Although no group differences in prosocial behaviours were detected, the empathic response seemed to be different in a more subtle way in HR-siblings at 24 months, mainly with regard to their attention shifted away from the researcher. The other high-risk group, the preterms, showed an empathic response that was more similar to LR-siblings, highlighting the difference in the social development and ASD-related behaviours of different high-risk groups. At the conference, frequency-coded data will be compared with qualitative ratings and group comparisons based on ASD outcome at 36 months will be presented.

92 **139.092** Evidence for an Infant Construct of Social Motivation and Predictive Validity for Autism Spectrum Disorder

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Background: According to the social motivation hypothesis, deficits in social motivation during infancy constrain early social learning, thereby contributing to canalization of atypical social development and the emergence of autism spectrum disorder (ASD). A major barrier to studying social motivation's role in the ontogeny of ASD is the lack of measurement tools to assess individual differences in this important aspect of social behavior during early development.

Objectives: To investigate the evidence for a social motivation construct in infants, we leveraged existing data to 1) derive a parent-report index of social motivation in infants and 2) quantify the extent to which early social motivation accounts for variation related to ASD outcome at age 24 months.

Methods: Behavioral data were analyzed from over 400 participants in the Infant Brain Imaging Study, a prospective, multisite study of infants at high and low familial risk for ASD. High-risk infants have an older sibling with ASD; low-risk infants have no first-degree relatives with ASD. Participants were assessed at 6, 12, and 24 months of age, and items were selected from multiple parent-report measures, including the Vineland Adaptive Behavior Scales, First Year Inventory, Infant Behavioral Questionnaire-revised, and Macarthur-Bates CDI, based on face validity for indexing social motivation. Social motivation was operationalized as the disposition to preferentially orient to social stimuli; to seek, want, and like social interactions; and to exert effort to maintain social engagement (Chevallier, 2012). Item scores were uniformly weighted and summed to generate a "social motivation index" (SMI) score. A clinical-best-estimate procedure including the Autism Diagnostic Observation Schedule (ADOS) was used to diagnose ASD at age 24 months.

Results: The SMI demonstrated a continuous, unimodal score distribution, good internal consistency (Cronbach's α=0.75-0.89) at all three ages (Fig. 1), and significant cross-age correlations (6-12 months: r=.58, p<.001, n=171; 12-24 months: r=.45, p<.001, n=183; 6-24 months r=.27, p<.001, n=210), suggesting trait-like stability (Fig. 2). Lower SMI scores were observed by age 6 months for infants later diagnosed with ASD (6 months: t(298)=-3.15, p=.002) and 6-month SMI scores significantly correlated with ADOS calibrated severity scores at 24 months (r=-.21, p<.001). A binary logistic regression model testing the effect of sex and 6-month SMI on categorical ASD diagnosis at 24 months was significant ($\chi2(2)=18.52$, p<.001), with sex and SMI each accounting for 5% of the variance. The effect of SMI remained significant when the 6-month Mullen Early Learning Composite, a measure of general cognitive development, was added to the model. The 6-month Vineland Socialization subscale, a parent-report metric of social function, did not significantly predict ASD diagnosis when substituted for SMI in the model.

Conclusions: These findings provide initial evidence for a measurable social motivation construct in infancy which shows predictive validity for ASD by 6 months of age. ASD-related SMI score differences suggest that further characterization of social motivation in infancy could promote earlier identification of children with ASD who would benefit from intervention.

93 **139.093** Examination of Multiple Birth As a Predictor of Autism Symptoms and Developmental Functioning

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Background: Multiple birth is recognized as a significant risk factor for autism spectrum disorder (ASD). However, no one factor, including perinatal risks, has demonstrated etiological causality; this is particularly evident when considering the expansive heterogeneity of the population. Given autism's multiple etiologies and the fact that ASD remains a behaviorally-defined disorder, understanding similarities and distinctions in

behavioral presentation between those who do and do not experience certain risk factors may be beneficial in our continued efforts to subtype ASD.

Objectives: Using a population-level sample, this study aimed to identify discrepancies in demographic and clinical variables among four groups of young children: those who were the product of a multiple birth with and without ASD, and those who were born singly with and without ASD.

Methods: Over 7,000 children, aged 17-37 months old, receiving services through a state-wide early intervention program in Louisiana, USA were included. Information was collected on their family and medical histories as well as their ASD symptomology and developmental functioning. Categorical data were compared across groups using Chi-Square tests; continuous data were examined with univariate and multivariate analyses of variance, using appropriate corrections where applicable.

Results: Significant between-group differences were found in the occurrence of prematurity, parental age at birth, and the presence of several medical conditions, including seizures and cerebral palsy. Discrepancies in autism symptom severity and developmental functioning among the four groups were primarily explained by the presence of an ASD classification; multiple birth status did not contribute meaningfully to the presentation of social and communication impairments and restricted, repetitive behaviors nor to functioning across a number of developmental domains.

Conclusions: While multiple birth was associated with a number of medical factors, it was not predictive of poorer developmental functioning or greater ASD severity during young childhood. Rather, differences found between groups were largely attributable to the presence of ASD. Given the difficulties teasing apart pre-, peri-, and postnatal complications as potential contributors to autism risk and that obstetric optimality was assumed for singletons, ongoing analyses are continuing on the clinical characterization of variably at-risk groups. A composite measure of risk comprising multiple pregnancy and birth complications rather than considering single factors may perform better in delineating diverse trajectories to ASD.

94 **139.094** Executive Function and Brain Relationships in Very Young Children at High and Low Familial Risk for ASD

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Background: Individuals with ASD have impairments in executive function (EF) that are present throughout the life span (Demetriou et al., 2018). As previously reported, young children at high familial risk for ASD (HR), irrespective of whether or not they develop ASD, demonstrate slower EF development than young children at low familial risk (LR; St. John et al., 2016). Neuroimaging studies investigating EF function implicate the frontal and prefrontal regions (Best et al., 2010; Diamond & Goldman-Rakic, 1989); however, to date, the relationship of early brain development to EF in HR children has not been reported.

Objectives: To investigate the relationships between frontal and prefrontal brain regions at 12 months to EF function at 24 months in HR and LR children.

Methods: Participants were part of the multi-site (UNC, CHOP, WUSTL, UW), longitudinal Infant Brain Imaging Study. Age-matched comparison groups having complete imaging and EF data (HR n=99; LR n=39) with clinical-best-estimate diagnosis at 24 months were evaluated. EF was assessed using the A-not-B at 24 months (total correct/total trials; Diamond, 1985). High-resolution 3-D T1 & 3-D T2-weighted MRI data (1mm3) acquired using a Siemens Trio 3T scanner at 12 months were used to determine volumes for the frontal lobe (FL), prefrontal cortex (PFC), and occipital lobe (OL; a control region). Right and left hemispheric volumes were averaged. Analyses employed logistic regression with developmental functioning (MSEL) and total cerebral volume (TCV) included as co-variates.

Results: Group status (HR vs. LR) moderated the relationship between 12-month FL volume and 24-month A-not-B performance ($\chi^2 = 6.51$, $p = 0.011$), controlling for MSEL and TCV. The likelihood of better performance on the A-not-B increased as FL volume increased for the LR group. In the HR group, greater 12-month FL volume did not increase the likelihood of better performance on the A-not-B at 24 months. Group status similarly moderated the relationship between 12-month PFC volume and 24-month A-not-B performance ($\chi^2 = 7.95$, $p = 0.005$), controlling for MSEL and TCV. In the LR group, the likelihood of better performance on the A-not-B increased as PFC volume increased. For the HR group, greater 12-month PFC volume did not increase the likelihood of better 24-month A-not-B performance. There was no significant main effects or interactions with the control region (OL; $\chi^2 = 3.19$, $p = 0.074$, $\chi^2 = 3.52$, $p = 0.061$).

Conclusions: Increased frontal lobe and prefrontal cortex volumes at 12 months were related to better EF function at 24 months in LR children but not HR children. These findings may, at least in part, lead to better understanding of why HR children show slower growth in their EF abilities compared with LR children (St. John et al., 2016). Further investigation is underway to evaluate brain-EF relations in HR children who develop ASD as compared with HR-NonASD and LR children. Longitudinal studies are needed to understand the relationship of slower EF development and differential brain growth in Frontal Lobe and Prefrontal cortex to functional outcomes in school-age.

95 **139.095** Gender Differences in Language Development Among Toddlers with Autism, Autism Features, Developmental Delay, and Language Delay

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Background: Among typically developing children, females have more advanced language than males (Zambrana et al., 2012). Conversely, among children with autism, males may have an advantage over females (Lawson et al., 2018). Differences in language development may suggest gender differences in phenotypic presentations of autism, or that certain females (e.g. those with more advanced language skills) are being missed by current diagnostic practices. Examination of gender differences in language development among toddlers referred for developmental assessment may shed light on this matter.

Objectives: To examine whether language scores on the Mullen Scales of Early Learning (MSEL) differed between male and female toddlers with no delays, autism, autism features (i.e. toddlers with sub-clinical characteristics of autism), developmental delay, and language delay.

Methods: Data were collected as part of a larger study designed to screen, evaluate, and treat autism within the first two years of life. Analyses focused on a sample of toddlers ($n = 302$, mean age 20.77 months), matched on age and gender, diagnosed with autism (n males = 51, n females =

48), autism features (*n* males = 30, *n* females = 19), developmental delay (*n* males = 37, *n* females = 42), language delay (*n* males = 24, *n* females = 27) and no delays (*n* males = 9, *n* females = 15). Factorial MANOVA was used to determine the effect of gender and diagnosis (and their interaction) on MSEL receptive and expressive language scores.

Results: Depicted in Figures 1 and 2, a significant main effect of diagnosis on language development emerged, V = 0.34, $F(8,582) = 14.88$, $p < .001$. Bonferroni-corrected *post hoc* tests revealed that receptive language was significantly lower among toddlers with autism than those with autism features ($p < .001$), developmental delay ($p < .05$), language delay ($p < .001$), and no delays ($p < .001$). Expressive language was also significantly lower among toddlers with autism than those with autism features ($p < .05$), developmental delay ($p < .05$), language delay ($p < .001$), and no delays ($p < .001$). Both receptive and expressive language were significantly higher among toddlers with no delays than those with any delay (all *p*s < .001). Females had more advanced expressive language than males ($p < .05$), but the overall main effect of gender was not statistically significant ($p = .09$). *Post hoc* analyses restricted to toddlers with autism features revealed a significant gender difference (V = 0.16, $F(2,46) = 4.32$, $p < .05$), where females scored approximately 8 points (~ 0.8 SDs) higher than males.

Conclusions: Inconsistent with previous research, no significant gender differences emerged for language development among typically developing toddlers or toddlers with autism. Interestingly, females with autism features had the highest scores when compared to toddlers with any delay. This observed female advantage may be related to later diagnosis among females with autism who present without delayed language in toddlerhood (Goodwin et al., 2017). Future research should examine the developmental trajectory of toddlers demonstrating sub-clinical features of autism to improve early diagnostic practices.

96 **139.096** Imitation Deficits in Children with Autism Spectrum Disorder: How Relevant Is Social Motivation?

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Background: Children with autism spectrum disorder (ASD) display significant deficits in imitation. The presence of these deficits may be explained in part by impaired social motivation. That is, typically developed (TD) children imitate not only to learn something but imitate also in order to satisfy the social motivation to affiliate with others. Especially, one indicator of social motivation is when children imitate the exact actions of a demonstrator even when the actions are unnecessary to achieve a goal. According to one view, children do this out of a wish to socially engage with the demonstrator. As children with ASD exhibit significant impairment in social communication, the social interaction that occurs may not be sufficiently motivating for children to engage in imitative behavior. So far, however, little research has been devoted to examine the relation between social motivation and imitation deficits in ASD compared to TD children.

Objectives: We sought to answer two broad questions: (1) What is the role of social factors in motivating imitation in TD children? (2) Is there evidence suggesting an association between imitation deficits and impaired social motivation drive in children with ASD compared to TD children?

Methods: To address (1) data of 66 TD children (*M* = 18 months 22 days; *SD* = 33 days) are reported. It was assessed whether TD children's imitation behavior of unnecessary actions to achieve a goal differs upon an interactive and social play period versus a non-interactive and non-social play period with the model prior to the imitation task. To address (2) data of 20 TD children (Developmental age in months: *M* =28; *SD*= 9,88) and of 20 children with ASD (*M*= 32; *SD* = 9,70) are reported. It was assessed how TD children and children with ASD imitate necessary actions compared to unnecessary actions to achieve a goal

Results: Results regarding (1) demonstrated that TD children profit from a model's social behavior compared to a non-social behavior in a prior play period: TD children in the social condition (*M* = 1.42, *SD* = .77) showed a significantly higher imitation rate of unnecessary actions than children in the non-social condition (*M* = .68, *SD* = .82), $t(36) = -2.858$, $p = .007$. Results regarding (2) demonstrated that children with ASD (*M*=3.90, *SD*=2.03) and TD children (*M*= 4.05, *SD*= 1.40) showed no difference in imitation rate of necessary actions, $F(1, 38) = .13$, $p = .719$. However, TD children (*M* =2.05, *SD*=2.21) showed a significantly higher imitation rate of unnecessary actions than children with ASD (*M* = 3.45, *SD*=1.54), $F(1, 38) = 5.40$, $p = .026$.

Conclusions: First, the results provide evidence that TD children are motivated by social interactions and that this motivation influences imitation. Second, as children with ASD show a diminished inclination to imitate unnecessary actions, the present results give some further insight that decreased social motivation in children with ASD can explain deficits in imitation. The findings underline the importance of therapies to incorporate social skills while focusing on improving imitation in children with ASD.

97 **139.097** Infant-Directed Speech and Infants Who Are at-Risk or Later Diagnosed with Autism Spectrum Disorder: A Scoping Review

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Background: In infants later diagnosed with autism (LDA), differences in language and social-communication development may be apparent in the first year of life and well before diagnosis, which usually only occurs after two years of age. Infant-directed speech (IDS) used by primary caregivers is a crucial component in an infant's early life, contributing to language and social-communication development. IDS is the universal speech register used when interacting with an infant. It involves the use of specific prosodic, lexical, and syntactic characteristics which aid in infant language and socio-communicative development. Parents use IDS that is matched to their infant's developmental status, and they react and adjust their IDS based on infant cues. As such, knowledge about the characteristics of IDS use with infants at-risk for Autism Spectrum Disorder (ASD) may inform our understanding of the early emergence of ASD.

Objectives: The aim of this study was to conduct a scoping review of the literature examining IDS use with infants who are either high-risk (HR) for ASD or LDA.

Methods: Six databases were searched, and articles were screened against inclusion and exclusion criteria. Studies were selected that examined IDS with an infant aged 4 years or younger and who was at HR (familial, genetic, screened as HR) for ASD or LDA. Articles that were focussed on parent intervention involving a change in interaction quality, or examined infant preference for IDS without reporting on the IDS characteristics of the speaker, were excluded. Grey literature was included.

Results: 30 articles met the final inclusion criteria and were included in the scoping review. Most of the articles (*N*=26) focussed on maternal IDS, although four studies also analysed paternal IDS. Four studies reported that the amount of follow-in comments (utterances synchronous with the infant's focus of attention) spoken by parents predicted infant language outcomes in LDA infants. Parents were reported to respond less contingently to HR or LDA infants (*N*=4). Parents of HR or LDA infants were also reported to speak more directive and intense IDS (*N*=4), used less melodic prosody (*N*=2) and used more non-verbal behaviours alongside IDS when compared to parents of typically developing or low-risk (LR) infants (*N*=2). Parents were also often reported to elicit less name calling but more attention bids during interactions with their HR or LDA infant (*N*=5). Articles reported mixed results in terms of the amount of IDS spoken by parents, some studies found parents spoke less or used less IDS overall to their HR or LDA infant (*N*=5), however some studies did not report any differences (*N*=4).

Conclusions: The findings from this review indicate that parents of HR or LDA infants use IDS differently to parents of a LR or typically developing infant. These studies strongly support the idea that even before infants are diagnosed with autism, parents can pick up on differences displayed by their infant. The findings of these studies provide evidence that they are related to infant language and social-communication outcomes and should therefore be considered as an important factor when considering interventional strategies.

98 **139.098** Investigating the Association of Early Attentional Control and Autonomic Arousal in a Sample of Low- and High-Risk Infants

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Background: An emerging body of literature suggests hyperarousal of the autonomic nervous system in autism spectrum disorder (ASD). At the same time, studies of non-ASD cohorts indicate that autonomic arousal is negatively associated with attentional control, a mechanism that may contribute to the development of ASD features.
Objectives: The objective of this study was to examine the association between autonomic arousal and attentional control in a sample of high-risk infants.

Methods: Data from a sample of participants from an ongoing longitudinal study of ASD were used for the analyses. The data included infant behavioural and physiological data at three time points: 6 (n=12), 12 (n=23), and 18 months (n=8) of age. Participants were designated as high risk if they had an older sibling with ASD (n=36) or as low risk if they did not (n=7). Behavioural data included scores on items related to engagement, disengagement, and sustaining of attention on the Autism Observation Scale for Infants (AOSI; items 2 and 19) and the Autism Parent Screen for Infants (APSI; item 20). Physiological data consisted of heart rate and heart rate variability extracted from electrocardiography signals collected as participants watched a 2-minute calming video clip. Repeated measures linear regression was used to examine the association between heart rate /heart rate variability and the behavioural scores.

Results: There were no significant effects of group (high risk/low risk) or visit (6, 12, 18) on the APSI or AOSI items. The low-risk group had significantly higher heart rate variability compared to the high-risk group (low-risk: 6.1(0.6) (CL: 4.9-7.3); high-risk: 4.7(0.3) (CL: 4.2-5.2); p=0.04). Parent-reported levels of sustained attention (APSI item 20) were significantly correlated with heart rate variability (beta=-1.4(0.4); p=0.006), with lower levels of sustained attention associated with lower heart rate variability. Associations between heart rate variability and engagement/disengagement of attention scores of the AOSI were not significant. No significant associations were found between heat rate and any of the behavioural scores.

Conclusions: Consistent with findings in non-ASD samples, our preliminary results suggest that decreased levels of sustained attention may be associated with decreased heart rate variability in a sample of low- and high-risk infants. Replication with larger sample sizes is needed. Our analyses are a first step in understanding physiological underpinnings of attentional control difficulties in ASD. If replicated in a larger sample, these results may also suggest physiological differences in high-risk infants.

99 **139.099** Item-Level Positive Predictive Value of MCHAT-R/F in Younger and Older Toddlers

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Background: The Modified Checklist for Autism in Toddlers, Revised with Follow Up (M-CHAT-R/F) is a screener for autism spectrum disorders (ASD) for children aged 16-30 months and uses the same scoring algorithm for all ages. A few studies have considered the M-CHAT-R/F's performance in both younger and older age groups within the validation window, finding higher screen positive rates in children younger than 20 months and higher positive predictive value (PPV) and sensitivity at older ages (Sturner et al., 2017; Sturner et al., 2017). Given variable performance at different ages, it is valuable to understand where differences arise at the item level; that is, which items on the M-CHAT-R/F best discriminate between ASD and other diagnoses at each age group. These data may have implications for improving scoring at younger ages and better understanding age of symptom onset.
Objectives: The present study aims to determine items on MCHAT-R/F that best discriminate between ASD and other diagnoses or no diagnosis in both younger and older toddlers.

Methods: Participants were 384 children ages 16-30 months, evaluated as part of a larger study on the early detection of ASD. Children who screened positive on the M-CHAT-R/F at their 18 or 24-month pediatric well-child care visit were offered a free diagnostic evaluation. Item level PPV and frequency of items endorsed were determined in children aged 20-months and younger (n=234; 149 ASD, 85 other diagnosis or no diagnosis) and older than 20 months (n=150; 87 ASD, 63 other diagnosis or no diagnosis).

Results: In both age groups, items endorsed in more than 50% of ASD cases include items 6, 7, 16, 17, 18 (pointing, joint attention, understanding directions). In younger toddlers, items with highest PPV include 1 (joint attention; PPV=0.648), 10 (response to name; PPV=0.646), 15 (imitation; PPV=0.574), 2 (wondered if deaf; PPV=0.556), and 8 (social interest in peers; PPV=0.548). In older toddlers, items with highest PPV include 18

(understands directions; PPV= 0.849), 15 (imitation; PPV= 0.774), 2 (wondered if child might be deaf; PPV=0.759), 10 (response to name; PPV=0.758), 4 (motor activity; PPV=0.750). PPV for all items was higher in the older vs. younger group.

Conclusions: Results revealed lower PPV for M-CHAT-R/F items in younger toddlers than older toddlers. The most frequently endorsed items in the ASD group did not differ between the younger and older groups; however, items that best discriminated between ASD and other diagnoses were different between age groups, except for items 2 (wondered if deaf), 15 (imitation), and 10 (response to name). Items regarding interest in peers and joint attention are more effective than other items in discriminating ASD in younger children. Items regarding understanding directions, eye contact, and social referencing are more effective than other items in discriminating ASD in older children. Results suggest that different items may be more indicative of ASD in younger and older toddlers. Despite higher false positive results in younger toddlers vs. older toddlers, it is crucial to continue screening at the 18-month checkup, as early screening facilitates early diagnosis and ASD-specific early intervention.

100 **139.100** Joint Attention in Typical and Atypical Early Development: An Eye-Tracking Study

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Background:

Joint attention (JA) is defined as the ability to share interest about an object or an event, by following ("response to joint attention (RJA)") or directing ("initiation of joint attention (IJA)") the gaze of a social partner. In Autism Spectrum Disorders (ASD), a deficit in the JA skills represents one of the core and earliest symptoms and a specific target of early treatments. Younger siblings of children with ASD have around the 20% of risk of developing ASD themselves and, even if they don't receive a clinical diagnosis, they might show subclinical developmental problems, commonly related to the Broader Autism Phenotype (BAP).

Objectives:

The aim of this eye-tracking study was to evaluate the visual patterns during tasks eliciting initiating joint attention in High Risk – non ASD (HR-nASD) subjects as compared to ASD and typical development (TD) children, to correlate these eye-tracking data with clinical measures, and finally to describe the clinical phenotype of these HR-nASD toddlers.

Methods:

This was a prospective multicenter observational study. Fifty-two children participated in the study: 17 ASD, 19 HR-nASD and 16 TD. The sample age range was 18-33 months. All subjects underwent a comprehensive clinical assessment and eye tracking experiments, composed by two video-task eliciting IJA (IJA1 and IJA2 respectively) and RJA. Fixations, Transitions and alternating gaze were analyzed.

Results:

In the **RJA task** no differences were found between groups. In the **IJA1 task** alternating gaze between target object and the model's face was statistically different between HR-nASD and ASD subjects (p<0,001) as well as between TD and ASD subjects (p= 0,029). Alternating gaze between the non-target object and the model's face and between non-target object and target object differed significantly between the HR-nASD and TD groups (p= 0,012 and p= 0,003, respectively) with lower values for the HR- nASD population. In the **IJA2 task** alternating gaze between face and target object differed significantly between HR-nASD and ASD subjects (p <0,001) as well as between the TD and ASD groups (p= 0,004). Moreover, in ASD group the rate of alternating gaze between the face and the target object was associated with more core ASD symptoms (p=0,004), in particular social and communicative impairment (p= 0,015).

Conclusions:

High risk subjects who do not develop ASD at 36 months show lower non-verbal cognitive skills than typical development children and similar levels of restricted and repetitive behaviors and better social and communicative skills as compared to ASD children. During initiating joint attention tasks, HR-nASD toddlers exhibit visual patterns similar to TD in terms of target-object-to-face gaze alternations, while their looking behavior was similar to ASD toddlers regarding not-target-object-to-face gaze alternations. Furthermore, as shown in the literature, IJA seems to be more useful to capturing differences between ASD and TD infants. The study of alternating gaze in typical and atypical development can shed light on how children begin to visually explore the world around them and how they share interest in objects and/or events with other people.

101 **139.101** Language Regression Is Associated with Faster/Normal Motor Development Among Toddlers with Autism

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Background: Language regression (LR), which is defined as a loss of acquired language skills, is a consistent and reproducible phenomenon that is reported by ~25% of parents of children with Autism Spectrum Disorders (ASD). However, it is not clear whether ASD children with LR exhibit additional distinct physiological or behavioral characteristics that may justify studying them separately from ASD children without LR.
Objectives: To examine whether ASD children with LR differ from ASD children without LR in achieving early developmental milestones.

Methods: We studied 218 children with ASD who are part of the Negev Autism Center cohort (www.negevautism.org). ASD diagnosis was determined using DSM-5 criteria and confirmed by the Autism Diagnostic Observation Scale-2 (ADOS-2) test. Parents of all children in this sample completed a detailed intake questionnaire that included questions regarding language development, language regression (LR), and the timing of other developmental milestones. LR was further confirmed by examining the clinical report of the family's initial intake meeting with a clinician and by an additional phone interview of the parents. Children with no regression (NR) were defined as cases where there was no indication of regression in the clinical history or intake form.

Results: Overall, 37 children with ASD (17.0%) had confirmed LR and 119 children with ASD (54.6%) did not have any concern of regression (NR). Examination of the birth records of these children revealed a remarkably higher rate of premature births (<35 weeks) among the NR group compared to the LR group (12.6% vs 2.7% respectively; p=0.12). Since premature birth is a known risk factor for both ASD and delayed motor

development, we excluded these cases (1 LR and 15 NR) from our analyses. Diagnosis of ASD in the LR group took place 8.5 months earlier, on average, than in the NR group (32.1±9.1 vs. 40.6±15.6 months; p<0.005). Comparison of developmental milestones between the groups revealed that LR children developed faster than NR children exhibiting earlier crawling (7.41±2.06 vs. 8.90±3.24; p=0.02), walking (12.7±1.95 vs. 16.1±4.76; p<0.001), and use of words (12.4±3.67 vs. 19.9±11.4, p<0.001, even when excluding 27 non-verbal children from the NR group). Finally, 7 children in the NR group and 0 children in the LR group had hypotonia during the first year of life.

Conclusions: These findings suggest that ASD children with LR exhibit a variety of distinct early developmental characteristics in comparison to ASD children with NR. Stratifying ASD children into these groups is likely to be of great importance when assessing potential early markers of autism risk (such as premature birth, hypotonia, and motor difficulties), which do not seem to appear in the LR subgroup. Similarly, these differences motivate additional research into the potentially distinct etiology of ASD children with LR.

102 **139.102** Links between Positive Emotionality and Later Comorbid Symptoms in Toddlers with ASD

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Background: Although generally, positive emotions are protective against both stressors and the development of psychopathology (Hernandez et al., 2015; Rutter, 1987), more intense positive emotionality in infancy may predict later internalizing and externalizing behaviors (Stifter et al., 2008). Positive emotionality in response to real-world situations in toddlers with ASD appears comparable to that of peers with typical development (TD) and developmental delay (Macari et al., 2018), but prospective links between joy and later psychopathology remain unexplored. By preschool age, many children with ASD exhibit internalizing and externalizing symptoms (Gadow et al., 2004; Simonoff et al., 2008); thus the present study aimed to address this gap in knowledge.
Objectives: To examine relationships between directly-assessed and parent-reported positive emotional expression in the second year and symptoms of internalizing and externalizing problems at age 3 in young children with and without ASD.

Methods: Participants included 94 toddlers (Time1: M_{age}=22mo, range:13-30mo; Time2: M_{age}=39mo, range:33-47mo), 52 ASD and 42 TD. At Time1, frequency of joy was characterized via parent report (Early Childhood Behavior Questionnaire (ECBQ): Low-Intensity Pleasure subscale (ECBQ_LIP)). Intensity of joyful emotional expression (iEE-Joy) was characterized via direct observation (Laboratory Temperament Assessment Battery (Lab-TAB); Goldsmith & Rothbart, 1999). iEE-Joy across facial and vocal channels was coded during three Lab-TAB episodes designed to elicit joy. At Time2, parents completed the Preschool Anxiety Scale (PAS-R; Total Anxiety score) and the Early Childhood Inventory (ECI-4; Internalizing and Externalizing composites).

Results: In TD children, greater iEE-Joy expressed during the Lab-TAB at Time1 was associated with higher Time2 ECI-4-Internalizing symptoms (r(22)=.665, p<.001) and PAS-R Anxiety (r(27)=.396, p=.041) but not Externalizing symptoms. In the ASD group, iEE-Joy was positively associated with ECI4-Externalizing symptoms (r(30)=.363, p=.049) but not Internalizing or Anxiety symptoms. In the TD children, parent-reported ECBQ-LIP scores at Time1 were negatively associated with ECI-4-Externalizing (r(34)= -.479, p=.002) and PAS-R Anxiety (r(42)= -.360, p=.019) but not Internalizing symptoms. In the ASD group ECBQ-LIP did not significantly predict any later symptoms (ps>.443).

Conclusions: Positive emotionality is a largely neglected area of study in autism research. In toddlers with ASD, directly-assessed intensity of joy was associated with later externalizing symptoms. This finding contrasted with the results for typically-developing toddlers, where, as in previous literature, expression of joy appeared to serve as both a risk and a protective factor: directly-assessed intensity of joy was associated with later internalizing symptoms, while parent-reported frequency of joy during calm activities predicted lower externalizing and anxiety symptoms. Although preliminary, these results suggest that directly-assessed *intensity* of joy in toddlerhood may be a risk marker for later internalizing and externalizing symptoms in children with and without ASD, while parent-reported *frequency* of joy during low-key situations may serve as a protective factor against development of externalizing and internalizing symptoms such as anxiety only in typically-developing children. Thus, this study suggests that the pathways to affective and behavioral psychopathology are different for children with and without ASD. Finally, the results underscore the value of a multi-method approach to understanding the development of comorbid symptoms in very young children with ASD.

103 **139.103** Longitudinal Dynamics in Atypical Development: Mutualistic Coupling in Autism?

M. K. Deserno[1], *D. Fuhrmann*[2], *D. Borsboom*[1], *S. Begeer*[3], *H. M. Geurts*[4], *R. Bedford*[5] *and R. A. Kievit*[2], *(1)Department of Psychology, University of Amsterdam, Amsterdam, Netherlands, (2)MRC-CBU, Cambridge, Cambridge, United Kingdom, (3)VU University Amsterdam, Amsterdam, Netherlands, (4)University of Amsterdam, Amsterdam, Netherlands, (5)King's College London, London, United Kingdom*

Background: Autism is a behaviorally-defined neurodevelopmental condition based on diagnostic criteria such as social and communication difficulties and repetitive and restrictive behavior. Currently, the field is moving away from the theoretical stance that these behaviors have a common cause, yet little is known about the dynamic processes that drive the co-development of these characteristics.
Objectives: Using a longitudinal design, the aim of the study presented here was to model the parallel growth of social and non-social autism-related behaviors in a cohort of infants at-risk for atypical development.

Methods: Receptive language and fine motor skills were assessed on four measurement occasions in a group of 239 infants (122 girls and 117 boys, aged 6-36 months). Longitudinal growth curve analyses were applied to investigate the cross-domain coupling of longitudinal changes in these domains.

Results: Our results suggested that improvement in language goes hand-in-hand with improvement in motor skills, and vice versa. We did not, however, find compelling evidence for mutualistic coupling between these skills. Group differences were observed in the variance of both, the trajectories and the initial starting values of both language and motor skills.

Conclusions: Our results suggest that those children receiving a diagnosis of atypical development at age three are not specifically characterized by increased or decreased coupling between language and motor skills compared to their at-risk peers who do not receive a diagnosis.

104 **139.104** Maternal Lexical Diversity and the Language Development of Children with ASD and DLD

***H. L. Fipp-Rosenfield**, M. K. Jones and M. Roberts, Communication Sciences and Disorders, Northwestern University, Evanston, IL*

Background: Quantity and diversity of maternal linguistic input are related to child language outcomes. However, less is known about maternal and child characteristics that may impact this relationship in children with ASD. Current research suggests that in children with ASD, quantity and diversity of maternal linguistic input impact child language skills (Fusaroli et al., 2018). In typically developing children, maternal socioeconomic status (SES) relates to maternal language input, which impacts child language outcomes (Hart & Risley, 1995). The impact of SES on maternal linguistic input in children with ASD is not well studied. Child characteristics, such as social communication deficits inherent to ASD, may be an important factor to consider (Arunachalam & Luyster, 2018). By comparing children with ASD to children with developmental language disorder (DLD) we are able to examine the unique impact that social communication difficulties, above and beyond language delays, may have on maternal language input.

Objectives: The current study aims to (1) examine the relationship between mother's use of language type (number of unique words), token (frequency of words) and type/token ratio (TTR) and child's use of language type, token, and type/token ratio (2) investigate differences in maternal linguistic input based on SES (3) to examine the extent to which ASD status moderates the relationship between maternal input and child language.

Methods: The current study included 184 mother-child dyads: 111 children with ASD (M=2.77 years, SD= .53) and 73 children with DLD (M=2.66 years, SD=.50). 10 minute mother-child interactions using a standardized set of toys were transcribed and analyzed using SALT (Systematic Analysis of Language Transcripts; Miller & Iglesias, 2008). From the transcription, type, token and TTR of total words, adjectives, nouns, prepositions, and verbs were analyzed for both the mother and child. Mothers completed a questionnaire indicating their household income. Income status was defined as follows: low income $0-$25,000, middle income $25,001-$100,000, high income greater than $100,000.

Results: We computed pearson correlations to determine the relationship between maternal input and children's lexical diversity across both populations (see Table 1). We used two-sample t-test to examine the differences in maternal input based on household income (Table 2). Linear regressions revealed that ASD status moderates the relationship between maternal language measures and children's language measures for preposition token ($F(1, 180) = 4.745$, $p < .05$) and preposition TTR ($F(1, 180) = 7.284$ $p < .05$).

Conclusions: This research highlights the importance of investigating maternal and child characteristics that may impact the relationship between maternal linguistic input and language development in children with ASD. Future research should include longitudinal approaches to investigate the relationship between maternal linguistic input and later child language outcomes to examine the extent to which types of linguistic input change based on the child's developmental level. Further research is necessary to characterize the differences in maternal linguistic input based on SES in children with communication disorders. It is essential to continue to investigate the extent to which social communication deficits may moderate the relationship between input and children language levels.

105 **139.105** Measuring Parent-Child Transactions for Early Identification of Autism Spectrum Disorder

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Background: Several early behaviors of ASD can be identified when a child is engaging with their parent (Baranek, 1999), and Wan et al., (2013) suggest that using the context of parent-child engagement to assess ASD risk may be a more sensitive reflection of early atypical behavior compared to structured measures given in unfamiliar contexts. Transactions are a specific aspect of parent-child engagement that are promising in assessing for signs of ASD. Transactions are coordinated turn-taking behaviors where the behavior of one partner is influenced by the previous behavior of the other partner in a reciprocal manner over time. Features of transactions, such as the mean length (i.e., mean number of turns) or miscues (i.e., partner passively observing without providing a physical or communicative indication to the other partner), may offer a more comprehensive view into the atypical interaction behavior associated with ASD, and thus aid in earlier identification of the disorder.

Objectives: The study objectives are to determine if (1) the mean length of transaction at one-year of age is predictive of later ASD symptomatology at preschool age, and (2) the proportion of parent responses followed by child miscues at one-year of age is predictive of later ASD symptomatology at preschool age.

Methods: This study is using extant data from a study of young children with elevated symptoms of ASD screened at 12 months (Watson et al., 2017) with the First Year Inventory 2.0 screener (FYI; Baranek et al., 2003). Thirty parent-child free play videos from when the children were 13-16 months old will be coded for transactions using the Transactional Engagement Coding-Extended (TEC-E), adapted from Yoder et al., 2010. Videos will be coded on ProcoderDV™ (Tapp, 2003) software using continuous timed event coding. Reliability will be determined by using point-by-point agreement with a criteria level of .75 for ICC. Measures from when the children were 13-16 months old (TEC-E) and preschool age (ADOS classification and severity) will be used in ANOVA and regression analyses.

Results: Previous preliminary ordered probit regression analyses using data from 30 parent-child videos indicated that a high occurrence of miscues within transactions were associated with a later ASD diagnosis on the ADOS at preschool age (p=0.041). For this study, additional planned ANOVA and regression analyses will examine the association of mean length of transactions and proportion of miscues with the classification and severity of ASD at preschool age. The length of transactions and proportion of miscues are theorized to predict later ASD symptomatology.

Conclusions: Preliminary analyses show promising evidence that measuring transactions can aid in identifying ASD risk, and that miscues specifically may be an early indicator of ASD. Full results of the study will further add to evidence supporting the practice of assessing ASD risk in the context of parent-child engagement.

106 **139.106** Movidea: An Innovative Semi-Automatic Software to Detect Early Motor Signatures in Autism Spectrum Disorder

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Background: Motor abnormalities have been reported as one of the earliest markers of autism spectrum disorder (ASD). The Italian network for early detection of ASD (NIDA) has been established in 2012 with the aim to define a surveillance protocol of High-Risk (HR, siblings of children

with a diagnosis of ASD) and Low-Risk infants (LR, siblings of typically developing children) from birth to 36 months of age. The NIDA clinical/biological protocol includes also video recordings of spontaneous motor behaviors in the first 6 months of life. Based on the Pretchl's method, the NIDA network has recently detected abnormalities in general movements of HR infants during the first two weeks of age.
Objectives: To identify early motor signatures of ASD through an innovative, semi-automatic and advanced tool.

Methods: MOVIDEA is a software aimed to analyze bi-dimensional video-recordings of infant's movements by implementing a semi-automatic tracking of limbs. MOVIDEA has been developed by Ab.Acus, an Italian company with high expertise in the field of biomedical science and in developing advanced technologies for studying human kinematic. The measures extracted by the software have been validated by a child psychiatrist and two researchers of the Istituto Superiore di Sanità (ISS) with high expertise in infant's motor assessment and analysis. The NIDA network enrolled 113 LR and 276 HR infants. For each infant, five structured video-recordings have been collected [at 10 days, 6-12-18-24 weeks]consisting of approximately 1900 video recordings. The median length of each scored video is 3 minutes and the median length of time to analyze it is 30 minutes. Infants were subdivided in three groups based on their clinical outcome: typical development (TD), neurodevelopmental disorders (NDDs) and autism spectrum disorder (ASD). Statistical analysis was performed with STATA 13.1.

Results: Between-group differences emerged in the standard deviation of y-directions of the centroid of motion (spatial center of the positive pixels in the motion image) at 10 days [NDD>TD], in the Cerebral Palsy Predictor [NDD>TD at 10 days and 6 weeks], in the cross-correlation indexes between right and left foot [NDD>TD at 24 weeks], in the area differing from moving average of foots [NDD>TD at 10 days] and of right foot both in x- and y-direction [NDD>TD at 10 days]. No differences emerged in the quantity of motion and in other values such as the centroid of motion, the area from moving average and cross-correlation indexes.

Conclusions: The NIDA Network is a longitudinal prospective study aimed to identify early signs of ASD. Preliminary data suggest that infants later diagnosed with NDD presented early motor abnormalities. MOVIDEA is a useful innovative tool to describe early motor development, but further research should be performed to increase sample's size.

107 **139.107** Neuro-Electrophysiological Repetition Effects Are Associated with Age and Adaptative Skills in Infants

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Background:
Intellectual disability is highly comorbid with autism. An important focus of neurodevelopmental research aims at identifying such disorders as early as possible in order to act favourably on development within the time window of highest brain plasticity. Habituation, the simplest form of learning, can be measured very early on behavioral paradigms. It has been shown to be moderately correlated with cognitive development (Bornstein & Sigman, 1986; Kavsek, 2013). The electrophysiological correlate of habituation, described as the repetition effect, has been shown to be associated with intellectual disability (Knoth et al., 2018) and sensorial hypersensitivity (Ethridge et al., 2016), traits that can be found in autism spectrum disorders. The repetition effect's evolution with maturation and link with early behavioural development still need to be determined.

Objectives:

The purpose of our study is to investigate the relationship between EEG repetition effect and adaptive skills, an early surrogate of intellectual functioning, during the first year of life.

Methods:

We recorded high density EEG in 49 healthy infants (19 females) age between 3 and 8 months at the CHU Sainte Justine hospital. The experimental design consisted of a sequence of three times the vowel A (AAA) presented 64 times. Auditory presentations were supported by visual images (faces pronouncing the syllables) in order to attract infant's attention (Basirat, 2014). Adaptive skills were measured using the GAC score obtained through the parent form of the Adaptive Behavior Assessment System Second Edition (ABAS-II).

A time-frequency analysis was performed to investigate repetition effects associated with the three stimulus (A) repetitions. Statistical analysis was performed using a linear mixed model (LMM) approach. Changes in spectral power with regards to stimulus repetition were analysed in six frequency windows (FW) [3-5Hz; 5-10Hz; 10-20Hz; 20-30Hz; 40-61Hz; 80-120Hz] in the time window from 2 to 202ms post-stimulus and four regions of interest (ROI) [central, frontocentral, left frontal and right frontal]. Age, GAC score and sex were tested as potential predictors for the model.

Results:

Spectral power changes across repetitions were explained by age in the 40-60Hz FW [$\chi 2(6, N=49) = 19.285$, $p<0.01$] across all ROI. Specifically, older infants showed repetition enhancement in response to the third repetition. Furthermore, GAC score explained spectral power changes across repetitions in the 80-120Hz FW in the frontocentral region [$\chi 2(2, N=49) = 8.07$, $p=0.017$]. Higher GAC scores were associated with repetition enhancement at the second presentation of the stimulus.

Conclusions:

Our results show modulation of the EEG repetition effect with maturation and adaptative skills. As expected, maturation and adaptive skills modulate higher frequency brain responses. Whereas brain signal is enhanced at the third repetition towards the end of the first year, increased brain signal is found at the second repetition in babies with higher GAC scores. A longitudinal follow-up of our sample will allow us to determine the predictive value of these markers in the early diagnostic of neurodevelopmental disorders.

108 **139.108** New-Born Infants at Risk for Autism Spectrum Disorders Exhibit Altered Grey Matter Maturation

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Background:

Autism spectrum disorders (ASD) alter the trajectory of brain maturation. This is based, not only on evidence that there are structural differences in brain regional grey matter (GM) in children and adults with ASD, but also differences in inter-regional GM correlations, suggesting that how brain regions connect and grow together is also distinct. However, it is not known to what extent the maturational profile observed even in children with ASD is primary to the condition, and/or a secondary or compensatory consequence of living with ASD. To understand what makes a brain vulnerable to dysmaturation we need to look as early as possible in development.

Objectives:

Therefore, in this exploratory study we tested the hypothesis that infants vulnerable to developing ASD traits have differences in inter-regional GM correlations already around birth.

Methods:

Brain MRI scans of term-born neonates were acquired during sleep, on a 3T Phillips scanner. GM volumes for 44 cortical and subcortical regions were extracted using a neonatal dedicated atlas (22 regions per hemisphere). An exploratory analysis compared inter-regional GM volume correlations (using Pearson's *r*) in 15 ASD high-risk (HR) neonates (i.e., with a parent or sibling diagnosed with ASD) and 15 low-risk (LR) neonates matched for sex and gestational age at birth (±0.3), with no significant differences in age at scan between the two groups (postmenstrual age mean=42.4±1.6). To examine if group differences were significantly different from the null hypothesis using non-parametric methods, permutation testing of 1000 random group assignments were performed. Significance level for group differences was set at $p<0.01$.

Results:

The HR group had an altered pattern of GM inter-regional correlations concentrated in temporal and limbic regions, especially involving the anterior cingulate. Specifically, 5 inter-regional GM correlations between the anterior cingulate, hippocampus, anterior temporal and superior temporal regions were significantly higher in the HR group. However, 7 inter-correlations between a wider network of regions were significantly lower in the HR group, including between temporal-occipital-parietal cortices, the insula and basal ganglia regions.

Conclusions:

Our preliminary analysis suggests that the inter-relationship between brain regions within networks which contribute to primary sensory and multimodal processes is already altered in neonates at HR of ASD. Moreover, there appears to be an anterior/posterior gradient in that anterior cingulate correlations with temporal lobe targets are higher in the HR group whereas correlations between temporal regions, the subcortex and posterior cortical targets are lower. Whether this pattern has behavioural or developmental correlates remains to be determined. In addition, how the inter-relationship between brain regions changes as the infants grow and whether there are even earlier (fetal) maturation differences in GM-based structural connectivity will be examined in a larger cohort.

109 **139.109** Overall Attention to a Dynamic Social Scene in Preschoolers with Autism Spectrum Disorder and Fragile X Syndrome

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Background:

Fragile X Syndrome (FXS) is the leading heritable cause of intellectual disability (ID) and the most common known monogenetic cause of autism spectrum disorder (ASD). Fifty to 75% of males with FXS meet diagnostic criteria for ASD (Harris et al, 2008). Further, 77-86% of individuals with FXS have an anxiety disorder (Cordeiro et al., 2011). Both FXS (Crawford et al. 2017) and ASD (Falck-Ytter et al., 2013) are associated with impaired social attention and decreased eye contact, and atypical looking patterns to static social information are associated with ASD and anxiety symptoms in FXS. Despite the overlapping symptoms in FXS and non-syndromic (i.e., non-FXS) ASD, it is unknown whether and how overall attention to dynamic social information compares in these two groups.

Objectives:

To evaluate group differences in attention to dynamic social information in children with FXS, non-syndromic ASD, and typically developing (TD) controls; and to take a preliminary, dimensional approach to evaluating how attention to dynamic social information relates to developmental ability, ASD, and social anxiety symptoms across groups.

Methods:

Participants included 15 participants with FXS (n_{males}=10; M_{age}=69.35 months), 11 with non-syndromic ASD (n_{males}=10; M_{age}=44.06 months), and 18 TD participants (n_{males}=15; M_{age}=70.84 months). Groups differed in age ($p<.001$), so age was included as a covariate. Intellectual ability was measured by the Mullen Scales of Early Learning (MSEL) or Differential Ability Scale (DAS) [Primary outcome: NVDQ]. Severity of autism symptoms was measured using the Autism Diagnostic Observation Schedule (ADOS-2) Calibrated Severity Scale (CSS). Anxiety was measured with the Spence Children's Anxiety Scale (SCAS-P) Social Anxiety t-score. Eye-tracking stimuli included a 3-minute video depicting an adult female seated at a table and engaging in activities designed to elicit different looking behaviors (Chawarska et al., 2012). Percent of time looking at the screen (%Valid) was computed, and group differences on this measure were evaluated. In order to take a dimensional approach to understanding how attention to dynamic social information relates to symptomology, correlations between %Valid and NVDQ, ADOS-2, and SCAS-P scores were investigated.

Results:

ANCOVA indicated a marginally significant main effect of group ($F(2,36)=2.90$, $p=.068$). Post hoc analyses indicated that the ASD group ($M=85.2\%$) significantly differed from both the FXS ($M=96.1\%$, $p=.044$) and TD ($M=97.6\%$, $p=.025$) groups. %Valid was correlated for all children across groups with NVDQ ($r= .394$, $p = .012$) and ADOS-2 scores ($r=-.40$, $p=.010$) but not SCAS-P scores.

Conclusions:

Young children with ASD show reduced task adherence or reduced interest in social scenes relative to their peers with FXS and TD. This could suggest a primary social motivation deficit in ASD that is not seen in the FXS group despite comorbid intellectual disability and the high prevalence of ASD associated with FXS. In addition, FXS is also associated with high rates of anxiety, which is often characterized by hypervigilance to threatening stimuli. It is possible that overall looking time is not sensitive to attention patterns associated with anxiety in FXS. Across all groups, more nonverbal and social impairments were associated with less attention to the social scene overall.

Poster Session
140 - Family Issues and Stakeholder Experiences
5:30 PM - 7:00 PM - Room: 710

110 **140.110** Capturing the Autistic Experience: Self-Advocates Develop Self-Assessment Tools to Inform Autism Diagnosis and Validate Neuroimaging Findings across the Gender Spectrum

ABSTRACT WITHDRAWN

Background: Current gold standard tools for identifying and studying autism have been critiqued for their lack of specificity and sensitivity, especially in older, higher IQ, and non-male individuals (e.g. Lai et al, 2015). For example, evidence from an epidemiological study indicates that females are diagnosed later than males, and females without intellectual disability (ID) are diagnosed significantly later than both females with ID and males without ID (Shattuck et al., 2009).Information from autistic people about their own experience of autism represents an undertapped resource for enhancing diagnostic and phenotyping tools. To fully capture the inner experience of autism, however, autistic people need to define the questions asked, as well as the answers given.
Objectives: Leverage a collaborative team of autistic self-advocates, clinicians and researchers to develop: an ADOS-2, Module 4 participant feedback questionnaire; a self-report autism trait questionnaire and a self-report questionnaire to validate neuroimaging findings with the inner experience of the imaging participants themselves.

Methods: As part of a multi-site NIMH Autism Center of Excellence Network study of gender in autism, and using participatory research techniques, autistic self-advocates have partnered with autism researchers and clinicians to develop and collect self-report measures on a suite of autism evaluation tools for diagnostic and research purposes. These are:

- A participant feedback questionnaire to capture the inner experience of people receiving the ADOS-2, Module 4, in order to inform its findings. Feedback will also be collected after the research appointment about the experience of participants in the study overall.
- A self-report autism trait questionnaire constructed with items identified by an iterative process consisting of: conducting an environmental scan of internet postings of autistic peoples' descriptions of their autism; condensing those descriptions into an item list; and revising the item list through a modified Delphi procedure conducted with a diverse panel of autistic experts (e.g. speaking and non-speaking, full gender spectrum).
- A self-report questionnaire to validate and inform resting-state neuroimaging findings from the Autism Center of Excellence network study with the self-concept of the imaging participants themselves.

Results: The development of the ADOS feedback questionnaire has identified important issues such as the level of effort expended to participate in the ADOS interview and whether any of the participants' comments had been previously rehearsed or practiced. The self-report autism trait questionnaire, based on a review of the on-line self-advocacy literature, addresses aspects of the autistic experience that are not captured with current assessment tools, such as "autistic inertia", pleasure in word play/scripting, and variability in skills/abilities related to overwhelm and burnout. The neuroimaging validation questionnaire includes 20 items developed through iterative discussion between self-advocates and neuroimagers regarding the functional correlates of previously collected resting-state findings. It translates specific brain functions into plain English (items include: "I find it is easy to pick the right word when I talk."; "Watching things move interests me.").

Conclusions: Participatory research techniques with autistic partners as co-investigators leading researchers and clinicians in the development of new assessment tools yields measures which introduce previously unrecognized aspects of the autistic experience.

111 **140.111** Roadblocks to Earlier Identification of Autism in Girls and Women from the Perspectives of Autistic Girls and Women and Parents

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Background: Earlier recognition of autism in girls and women offers opportunities to provide support and care that are tailored to their health, education and social care needs. Research suggests that autism is often overlooked, misdiagnosed or diagnosed later for girls and women by health and education professionals. Many are not considered or referred for autism assessments, even when they have approached health or education services for help. Earlier recognition can open opportunities for referrals to diagnostic services and to health, education and social services that can promote mental health and wellbeing and participation in daily life activities.
Objectives: Our objectives were: 1) to engage directly with autistic girls and women, and parents to guide our research questions, methods and analytic interpretations; 2) to identify the service experiences that led to girls and women being identified or diagnosed with autism; and, 3) to examine the 'roadblocks' in these service experiences that prevented earlier recognition and diagnosis from the perspectives of autistic girls and women, and parents.

Methods: We partnered with a local autism association to create a project advisory of autistic women and parents that provided: 1) guidance on

autism-friendly data collection strategies; 2) interpretations of key themes; and, 3) recommendations for applying and mobilizing the results. A qualitative design was used to map and generate data about the service pathways experienced by girls and women that led to recognition and diagnosis of autism. Data collection methods included individual and focus group interviews with three groups of participants: autistic girls (age 12 to 18 years) and women (age 19 years and older), and parents of an autistic girl or woman. Thematic analysis methods proposed by Braun and Clarke (2006) were used to identify patterns in the data related to service pathways and factors associated with missed opportunities for recognition of autism on these pathways.

Results: Six focus groups and 20 individual interviews were conducted, involving 23 girls and women diagnosed clinically with autism and four self-diagnosed women (age range 12 to 71 years), and 21 parents. The age of diagnosis ranged from 2 to 63 years. Participants experienced a range of service pathways leading to diagnosis, including early referrals for autism assessments by service providers, referrals related to mental health and/or stressful life events, and self-referrals after gaining information about autism from online resources. Several 'roadblocks' that prevented earlier recognition were identified, including lack of service provider training on 'female presentations' of autism, masking of autistic characteristics by girls and women, and autism not being considered when participants experienced challenges with social roles and demands at different life stages.

Conclusions: We identified a number of service pathways and roadblocks to recognition of autism in girls and women. This effort provides new opportunities to improve access to autism assessment services and supports at an earlier stage on the service pathway. Recommendations for interventions (e.g., training of front line service providers, refining screening and diagnostic practices) were identified.

112 **140.112** From Autism and Aging Articles to Knowledge Implementation: The Development of 'Older & Wiser' Psychoeducation for 55+ Autistic Adults

***H. M. Geurts**, B. F. van Heijst and E. Groenendijk, University of Amsterdam, Amsterdam, Netherlands*

Background: Autistic adults diagnosed in childhood or young adulthood are now approaching old age, but also older adults (55+) do receive an autism diagnosis. After a diagnosis psycho-education is the first (obliged) step in providing care, but existing psyco-education programs do not target older individuals.

Objectives: This study had two objectives. First to develop a psycho-education program for 55+ autistic adults in close collaboration with a group of autistic adults, clinicians and behavioral scientistis. Second, to investigate whether this co-created psychoeducation program "Older and Wiser" (van Heijst & Geurts, 2016) regarding autism and aging is beneficial for older autistic adults. We hypothesized that the psycho-education program will primarily lead to an improved insight in autism and the corresponding cognitive challenges, for participants and their proxy. Furthermore, we hypothesized that the program can secondarily improve mastery, self-efficacy, self-esteem, quality of life and hope and future perspectives, along with a decrease in self-stigmatization. Please note that these outcome measures were co-determined upon with the group of people that co-created the actual psycho-education program.

Methods: The psychoeducation program consists of six weekly meetings of approximately two hours. In meeting five, which focuses on the social network of the participants, a proxy of their choice was also present. On two different clinical sites a psycho-ducation group was run. Across these two sites, N=9 autistic adults (55-73 years) and N=9 proxies (33-70 years) participated. Both the baseline phase and an intervention phase lasted six weeks. Three times questionnaires were adminstered in the autisic adults and their proxies measuring the primary outcome measures. Furthermore, throughout both phases, participants fill out questionnaires for the secondary outcome measures, at the end of every single week.

Results: Quantitiate and qualitative data collection is complete, but is not analysed yet.

Conclusions: The process of the development of the program was fruitful, but whether the program it self indeed results in positive findings is not yet known. Qualitative information suggest that participants were positive about the content and set-up of the program, althought given the amount of information having a meeting every single week might be a bit too dense.

113 **140.113** Parental Stress and Experienced Family Quality of Life in the Postdiagnostic Period

***C. Mello**[1] and M. Rivard[2], (1)Applied Psychology, The Pennsylvania State University, Reading, PA, (2)Psychology, Universite du Quebec a Montreal, Montréal, QC, Canada*

Background: The preschool years are rife with challenges for families of children with autism spectrum disorder (ASD). Indeed, the family unit must adjust to the child's diagnosis and its practical implications, while also taking steps to access information and ASD services. The effectiveness of early intensive behavioral intervention (EIBI) programs on children's functioning is well documented. However, EIBI can be time- and resource-consuming for parents and, when provided as a universal public service as in Québec, may incur excessive waiting periods. Some lower-intensity parent-mediated intervention programs present good social validity but may not directly impact children's outcomes. Thus, it is unclear how the psychosocial difficulties reported by parents of children with ASD evolve as families enroll in these services.

Objectives: To track the experienced family quality of life (FQOL) and parenting stress in parents following their child's formal ASD diagnosis, specifically over the course of EIBI and, for some families, a parent coaching and training program (PTCP) intended as waiting list intervention delivered in the year preceding EIBI.

Methods: Participants were 91 families of preschool-aged children (M = 46 months) with ASD deemed eligible to receive 10 to 20 hours of free EIBI services per week. Some families (n = 45) immediately received 1 year EIBI; the remaining families received PTCP (1 hour/week) for 1 year prior to EIBI. Every 12 months, parents completed the Beach Center FQOL scale and the Parenting Stress Index.

Results: Families in the PTCP+EIBI and EIBI-only groups presented comparable FQOL at intake. The group who participated in the PTCP initially experienced increases (d = .35) across all five dimensions of FQOL, $F(1,46) = 6.645$, $p = .013$, $\eta^2_{partial} = .13$. These families then presented higher overall FQOL immediately before and after EIBI compared to the EIBI-only group (d = 0.50), $F(1,85) = 5.451$, $p = .022$, $\eta^2_{partial} = .06$. Over the course of EIBI, FQOL levels remained relatively constant across both groups, with the exception of an increase in their satisfaction with Disability-related Support in the EIBI-only group (d = 0.49). Parenting stress increased during the PTCP, $F(1,42) = 9.487$, $p = .004$, $\eta^2_{partial} = .18$, specifically for Parental Distress and Parent-Child Dysfunctional Interaction (d = 0.86, 0.84); at the same time, stress on the Difficult Child subscale decreased (d = -0.67). The reverse pattern was observed when this group received EIBI (d = -0.51, -0.40, and 0.47, respectively). In contrast, during this period the EIBI-only group experienced large increases in Parental Distress and Parent-Child Dysfunctional Interaction (d = 0.81, 1.31) while Difficult Child levels

remained stable (*d* = -0.17).

Conclusions: Parent-mediated interventions intended to support families on a waiting list for EIBI appear helpful in alleviating some impacts of a child's recent ASD diagnosis on FQOL; these benefits may persist as families access EIBI. While instrumental in improving children's functioning, EIBI by itself may instead present an added source of stress during an already challenging period. Thus, postdiagnostic interventions that provide direct psychosocial support to parents should be considered.

114 **140.114** An Overview of the Experience of Immigrant Families of Children with an Autism Spectrum Disorder : From the Diagnosis to Early Intervention

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Background: Studies report that immigrant families of children with Autism Spectrum Disorder (ASD) have greater difficulty accessing, using and adhering to intervention services offered to their child. Although it is important to document the experience of immigrant families in order to better support them, there are currently few research analyzing their experience and ways to improve adapted services.

Objectives: This presentation will present the results of two studies conducted with immigrant families of children with ASD living in Montreal (Canada).

Study 1 : The aim of the first study is to describe the quality of the service trajectory of immigrant families living with a child with ASD, from the first suspicions to the moment they accessed services.

Study 2: The second study focussed on parental stress and family quality of life among immigrant parents of children with ASD during the waiting period, between the diagnosis and intervention services.

Methods: Study 1: Twenty-four families completed a questionnaire evaluating their trajectory and participated in a semi-structured interview during which they described how they experienced public health services. Qualitative and quantitative analyses were done in order to describe their satisfaction and trajectory of services, as well as to identify the facilitators and the barriers to accessing services.

Study 2: Twenty-four mothers and seventeen fathers completed the Parental Stress Index (PSI) and twenty-nine mothers and twenty-three fathers completed the Beach Center Family Quality of Life scale.

Results: Study 1: Preliminary results indicate that families have a neutral overall satisfaction of their trajectory. The barriers most often mentioned by families were the waiting period for diagnostic and early intervention as well as social isolation. Parental advocacy and education as well as competency and expertise of professionals were identified as facilitators.

Study 2: The results highlight a high parental stress level (75% exceeded the clinical cut-off) and a poor or neutral family quality of life as well as a lack of social support.

Conclusions: The results of these two study show the importance of developing appropriate services in order to meet the needs of immigrants families of children with ASD. Thus, in addition to these results clinical recommendations regarding the organization and enhancement of a culturally sensitive and relevant offer of services will be presented.

115 **140.115** The Evaluation of a Parent-Coaching Program Based on the Early Start Denver Model

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Background: In Quebec (Canada), it is common for families to wait over a year for a diagnostic evaluation. Once a child is diagnosed with Autism Spectrum Disorder (ASD), families can then wait up to 3 years for Early Intensive Behavioural Intervention (EIBI), a critical service to avoid crystallization of symptoms and increase in problem behaviours. However, due to long waitlist families are often dealing with these challenges alone during the waiting period, not to mention those who will not access EIBI as some children will age out before accessing services. Interim measures such as parent-mediated interventions have been developed to support families while they are waiting for specialized and intensive services. The See Things my Way Parent coaching services has launched, in 2017, a pilot project to provide parent-coaching services based on the Early Start Denver Model (ESDM™) for families with children diagnosed with ASD within one month of diagnosis to support transition to more intensive services. The program aims to provide parents with tools and strategies to help them support their child on early developmental stages.

Objectives: The pilot study aims to investigate the efficacy of a parent-coaching program based on the Early Start Denver Model. More specifically, the satisfaction of the program as well as the effects on parental stress, perceived family's quality of life and Parenting Sense of Competence will be evaluated.

Methods: 41 families of children aged between 28 and 44 months who were diagnosed with ASD/provisional ASD (with or without GDD) participated in a 14 week parent-mediated intervention which consisted of 1 parent group training, 2 assessments (pre & post), 1 Intervention Plan meeting and 8 Individual parental coaching sessions.

5 Instruments were used. Objective 1: parent satisfaction questionnaire (University of California at Davis, M.I.N.D. Institute), Therapeutic Alliance Scale (Davis & Carter, 2003). Objective 2: Parent measures: Parental Stress (PSI), Family Quality of Life (BEACH-FQOL), Parenting Sense of Competence (PSOC)

Analysis : Qualitative and quantitative (parametric: ANOVA and t-test)

Results: Preliminary results indicate that all children showed improvement on all developmental domains between the start and end of the program. Results on self-reported measures of parental self-efficacy reveal improvement. Based on parents' responses, an increase in their quality of life was also experienced. These findings will support the effects and value of early parent-delivered interventions, based on ESDM.

Conclusions: Providing parent coaching services increased children learning opportunities and reduced the impact of the child's deficits and challenges on the parents' stress level and family's quality of life while also improving the perceived parental self-efficacy. It is expected that these positive outcomes will persist and support children and their family when making the transition to EIBI. Conducting further research on this proposed model will provide additional empirical evidence in order to diversify the current array of services, replicate parent-coaching services and bridge the gaps in the broader community, in and beyond Quebec.

116 **140.116** Children with ASD Transitioning into Primary School: Parents and Teachers' Activities and Perceptions

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Background: Although research related to children with ASD entering school has described, on the one hand, parents' dissatisfaction with school systems and, on the other hand, teachers struggling in working with those children in class, links between both perspectives on the same child have been less examined. Moreover, while many studies describe variables related to support for families during the early years, there is a gap regarding conditions of support during school years.
Objectives: Regarding the transition process of children with ASD from kindergarten to first grade, the objective is to present in depth the mutual experience:

- of parents related to their perceptions of support from formal services, partnership with teachers, empowerment process and family quality of life.
- of teachers related to their sense of self-efficacy and efforts to support children and families.

Methods: From March 2016 to May 2017, a multi-perspective case study approach was used to explore the transition of eight students with ASD from Kindergarten (K) to grade 1 in the Montreal area. Participants were identified through purposive sampling to ensure diversity of school placements: 4 were in a special class and 4 in a mainstream class setting. Using a photovoice approach, 50 interviews were conducted with 8 parents and 16 teachers (maternal and first grade) to describe the change over time. Participants recorded, with the use of an iPod, activities carried out to support children's education during the transition. These activities were then discussed in keeping with Clot's (2015) definition of activity through his ergonomic model of work, to obtain information regarding what participants do to support the child but also what they do not, what they cannot, what they should, will, won't, have left to do. Data was analyzed using a thematic and emergent coding approach (Patton, 2002).

Results: Results illustrate similarities across cases. Parents all demonstrated a very high level of involvement in their child's education through a large continuum of activities: stimulation at home to facilitate learning, reading and writing, routines and daily schedules to avoid problem behaviors, seeking information from school as well as formal and informal support, etc. Teachers all showed a willingness to support the child and his family. K teachers played a crucial role to meet the child's educational needs but also the families' ones, as for some of the latter school represents their first contact with formal support. Core differences were found when comparing across contexts: some parents of children attending a mainstream setting were advocating more than the others for their child's educational needs or placement. Special education teachers were more largely using behavioral approaches and struggling with academic learning whereas those in ordinary contexts were more bothered by the students' lack of social skills.

Conclusions: Benefits of pairing parents with teachers in research will be discussed as well as results that can be studied more in depth or in a larger sample in future research. Implications for practice will also be discussed, including challenges and facilitators for children with ASD transitioning from K to primary school.

117 **140.117** The Voices of Children: Being Friends with Classmates Who Are Minimally Verbal or Nonverbal

ABSTRACT WITHDRAWN

Background: Friendships are central to development and overall quality of life. Yet, many children with autism—particularly those who are minimally verbal or nonverbal—have social networks dominated by professionals rather than peers. Despite the critical importance of positive peer relationships, little is known about the nature of friendships of children with autism who are minimally verbal, particularly from the perspectives of the peers with whom they are friends.
Objectives: We will present research focused on an exploratory understanding of the "stuff of friendship" (Bukowski & Sippola, 2005) from the perspectives of children without disabilities who are friends with classmates who are minimally verbal. We specifically addressed the question: How do children think about and experience friendship across different relationships (i.e., with any friend and specifically with a friend who is minimally verbal)?

Methods: We conducted a qualitative study using in-depth interviews and based on the grounded theory approach (Strauss & Corbin, 2008). Data collection consisted of individual, semi-structured interviews with 16 children (i.e., ages 8-10) who were friends with a classmate with autism or a related developmental disability who was nonverbal or minimally verbal. Participants responded to questions about any self-selected friend, and then about the identified friend with a disability. Data were analyzed using an inductive approach guided by grounded theory and the constant comparative method. We used repeated systematic coding, collaborative dialogue, diagramming, and memoing to generate a theory of friendship development across children's relationships. Credibility and trustworthiness were enhanced through multiple avenues: conducting repeated, systematic searching of the data; developing an audit trail; using a collaborative approach to analysis; searching for negative cases; and triangulating sources of data through sustained presence in the schools before and during the period of data collection.

Results: The developed theory of friendship involved four intertwined major categories: *proximity* as the entry point to friendship, varying *depths of friendship, key agents* influencing friendship development, and a continuum of *help-care* (see Figure 1). In friendships with classmates who were minimally verbal, these major categories also interacted with *the impact of and language around disability.*

Conclusions: We will share these major categories—and their intersections—from the ways children talked about their friendships generally and specifically with classmates who were minimally verbal. We will also discuss implications for using qualitative methods to understand the lived experiences of a variety of key stakeholders, including peers who are friends with children with autism.

Figure 1. *Conceptual model of a grounded theory of friendship development across different types of relationships*

118 **140.118** Insights into Family Meals from the Perspective of Children on the Spectrum

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Background: Although mealtimes and children's eating patterns are often the focus of autism research, there have been few efforts to understand mealtimes from the child's perspective. In general, the voices of children with autism remain largely absent from research regarding autism (Milton & Bracher, 2013).

Objectives: The first goal of this study was to have a better understanding of family meals by analyzing the perspectives of children on the autism spectrum. The second goal was to evaluate the qualitative interview procedures.

Methods: This study is part of a larger study of family meals and autism. Interviews were conducted with 16 children whose parents had identified as having autism. Parents were recruited for the larger study using opportunistic sampling (Miles & Huberman, 1994). Children ranged in age from 5 to 14. The interview consisted of four components: reaction to video recording from their family meal (recorded in the larger study); interview based on semi-structured questions; interview based on using art supplies and figurines; and child-directed interviewing. The data were analyzed using thematic (Braun, Clarke, & Terry, 2014). Although the analysis primarily relied on the child interviews, parent interviews and mealtime observations were used from the larger study to provide context for their statements.

Results: Three themes were identified: special relationships, the importance of conversation, and being challenged by new food. Children often identified a specific person in the family to whom they had a special connection or relied on for support. Although these special relationships were not mentioned as such during the interviews with mothers from the larger study, they could be observed (especially in terms of help-seeking behavior from the mealtime observations). Important conversations were described by the children as something that made them feel closer to their families and part of the family unit. This was regardless of the degree of participation in the conversation, for example, a child explained what he enjoyed about family meals as "Just talking to her [his mother]. I don't do much but just talking to her." The third theme, being challenged by new food, was the topic that elicited the most emotional language from the children. Words like nervous and anxious were used to describe how they felt about being exposed to new foods.

Conclusions: This research highlights the difficulty of qualitatively interpreting the interviews of children on the autism spectrum, but suggests that they can provide valuable insights into their experience of family life. Further research can explore how to incorporate their perspectives into research on families and autism. By in large, the interview techniques we used were successful in eliciting some mealtime oriented conversation; however, it would have been difficult to establish the trustworthiness of the findings based solely on the child interviews. This research can inform mealtime based interventions for children with autism as well as education programs for parents of children on the spectrum.

119 **140.119** Exploring the Work Life Experiences of UK Autistic Women

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Background: Statistics quoted by the National Autistic Society point to a low participation rate in employment by autistic people. However, these statistics only record autistic people with a diagnosis, and we know that there are many undiagnosed adults who missed being identified as children. Little is known about the employment experiences of autistic people, with even less known about autistic women who have been underdiagnosed compared to men.

Objectives: The research sets out to explore the work life experiences of autistic women in the UK.

Methods: The research has followed a qualitative research strategy, adopting an inductive approach. The epistemological orientation is interpretivist and the ontological orientation constructionist. Identity has been extracted from the interviews as a major theme and provides the conceptual framework for the research.

Semi structured interviews were conducted with 35 autistic women of varying ages and occupations in the UK with experience of seeking or obtaining work. Participants were recruited via the research pages of the National Autistic Society, Research Autism, and through social media outlets such as Facebook, Twitter and online autistic communities such as 'Wrong Planet' where autistic women could be found. Participants were able to select from a range of interview options including a face to face interview, telephone interview or to answer questions via email.

Results: Working, and having a defined work identity was very important to many women. However, participants typically described their work identity as a performed act, in line with Goffman's concept of dramaturgy. Participants felt they needed to perform in the workplace to fit in, and to do this they spent years 'learning the rules' in order to perform. This performance not only involves behaviours but may also involve their physical appearance, which may be at odds with the autistic woman's home persona. Although a daily struggle, participants were often clearly successful in their performances, however the autistic women highlight the physical and mental exertion of their work combined with the need to 'act out' an additional performed identity to fit in. Autistic women are also often stigmatised in the workplace and many had mixed experiences about disclosing their diagnosis at work, with strong evidence of participants' perception of being 'othered'.

Conclusions: The research demonstrates the overwhelmingly positive effect of receiving a diagnosis, enabling the women to enter a process of reframing and reinterpreting past experiences. The autistic women studied were able to see both positive and negative patterns within their employment and were able to consider the impact of their autism identity. Autistic women are working in a wide range of occupations, some not previously associated with autistic people and their strengths, which may help widen the career choices of autistic women. The prevalence of stigma in the workplace also has implications for human resources professionals, policy makers, legislators and legal professionals, trades unions and employment support organisations.

120 **140.120** Understanding the Evolution of Employment and Financial Situations of Mothers and Fathers of Children with Autism

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Background:

When a child is diagnosed with autism, the lives of his or her parents change significantly. Up until now, scientific research has mainly focused on the psychological difficulties of these parents, particularly the stress and distress they experience (Yorke et al., 2018). Available research has also shown that parents of children with autism often lack social support and face major work-family balance challenges (Karst & Van Hecke, 2012). That being said, very little research has been done in a sociological perspective that address the specific socio-economic challenges and gender issues these parents face.

Objectives:

The present study aims to better understand the dynamics that lead to changes in the socio-economic situation of mothers and fathers of children with autism. Carried out in a feminist perspective (Hesse-Biber, 2012), it focuses on two central aspects of these dynamics: employment and financial situations.

Methods:

Semi-structured interviews were conducted with twenty Quebec families. The sample was composed of families with varying socio-economic backgrounds and a range of different household situations. Each family included at least one child with autism who was between 8 and 17 years old. Each parent was asked about the particular socio-economic challenges they faced from the moment their child was diagnosed to his or her adolescence. A thematic content analysis (Paillé & Mucchielli, 2003) was used to organize the participants' discourses into different themes, which allowed for a thorough understanding of each family's situation concerning employment and financial situation. The data was then analyzed more broadly, leading to an in-depth understanding of the various socio-economic and gender issues parents of children with autism face.

Results:

The results obtained in this study highlight important social and gender inequalities and reveal that the employment and financial situations of mothers and fathers of children with autism evolve in dramatically different ways. Specifically, the employment situations of mothers follow four distinct trajectories over time, three of which lead to financial insecurity. The results from this study also show that high-income mothers are able to maintain employment because they can afford specialized intervention, childcare and support. Indeed, many mothers in this study found themselves in a precarious financial situation, particularly in the event of a divorce or separation. The results also revealed that fathers often increase their working hours, mostly to compensate for their spouse's loss of income. Nonetheless, most families experienced a significant loss of financial resources over time. Although some mothers were able to return to work once their child became a teenager, the financial situation of most families remained grim.

Conclusions:

The health of parents of children with autism is a major public health issue. These parents, who are expected to take care of their child over a long period of time, are likely to experience psychological distress and financial instability. In order to adequately support these families, it is crucial to develop programs and legislative frameworks that will protect them from financial precariousness, as it is known to have detrimental effects on health and wellbeing.

121 **140.121** Adults with Autism's Narratives about Their Social Support Network

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Background: Research on the narratives of adults with autism highlights the importance of taking into account their subjective experiences for a better understanding of how they manage daily challenges and develop strategies to address them (Hurlbutt & Chalmers, 2002; Milton & Sims, 2016). Support networks (formal and informal) play a key role for the fulfillment of their life choices and the development of their full potential (Tobin, Drager, & Richardson, 2013). Several researches have focused on support networks for parents of children with autism. However, little is known about social support networks as described and perceived by adults living with autism. The network trajectory approach highlights the interactive nature of the social environments in which individuals evolve as well as their agency and capabilities (Carpentier & White 2013). This approach views the individual as already engaged in a social network, despite the fact that modalities in which they enter and maintain social interactions can derogate from what is generally expected in a given social situation.

Objectives: This paper presents the results of an original research based on the network trajectory approach. This exploratory research aimed to explore how adults with autism describe their social support network, describe the resources and the social supports they use to face challenges, and analyze their appreciation of the social support they received and/or hoped for.

Methods: Qualitative interviews were conducted with 12 participants (4 women and 8 men, French Quebecer - Canada, aged from 21 to 64 years old, and diagnosed with Asperger Syndrome or Autism Spectrum Disorder –ASD). A relational analysis of social networks combined with a constant comparative method (Denzin & Lincoln, 2011, Glaser, 1965) was used to analyze the content of the social supports (ex. informative, recreational, approbative) as well as the meaning participants gave to their social relations with their significant ones.

Results: The results show the difficulties and challenges faced by participants, the support they received (or not) from their social support networks, and many situations where they provided support to others. The participants shared some critiques about the support provided by many professionals.

Conclusions: The results of this research and the contribution of the networks trajectory approach will be discussed to better understand the importance of the social support for people with autism by putting forward their capabilities from a self-determination perspective. Proposals will be made to improve the interventions and formal supports offered to them.

122 **140.122** Development of a Digital Platform Offering Social Support for Parents of Children with Autism

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Background: More than half of parents with children with autism experience mental health or physical health problems. Protective factors for the health and well-being of these parents include social support, accessibility to care, and personal resources such as resilience (Ruiz-Robledillo N, et al. 2014). Currently, interventions are most often provided immediately after the announcement of the child's diagnosis. Regardless of the level of support required, these interventions focus more on the child by providing assistance through parents. Fewer interventions target the health and well-being of parents in medium and long term.

Objectives: This study aimed to define the parameters of an online support intervention based on the needs of parents of young children with autism.

Methods: Qualitative research with focus groups was done. Eighteen parents were recruited for the focus groups. The interview guide was proposed based on a systematic review of the literature on the winning conditions of online interventions (Cherba M, et al. 2018) and two theoretical models: Parent Empowerment Program (Jensen PH, Hoagwood K2008, Rodriguez J, et al. 2011) and the Montreal Model of Parent Care Partners (Pomey P, et al. 2015). The Parent Empowerment Program proposes the development of personal effectiveness with information, social support, training, coaching, a directory of accessible services in the community and advocacy. The Montreal Model of Parent Care Partners proposes to understand in a complementary way the experiential knowledge of the person concerned and the scientific knowledge of health professionals.

Results: The need for social support has been strongly expressed. An online platform seemed very relevant for them to get support from other parents. The most important conditions were confidentiality, accessibility, complementarity with existing services, needs-based content and the relevance of a moderator, which one can be a peer worker.

Conclusions: This research raises the need to develop population interventions in a comprehensive approach including in the form of online social support. Such a platform could help parents develop a sense of social support and improve their coping skills and sense of self-efficacy. This innovative platform could help meet the informational and emotional support needs of parents based on peer support.

123 **140.123** Setting Families up for Success: Parent Perspectives on a Toolkit to Enhance the Autism Spectrum Disorder Diagnostic Evaluation Process

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Background: Serving children with Autism Spectrum Disorder (ASD) is a significant public health concern (CDC, 2014). The first step in accessing services is often the ASD diagnostic evaluation. Unfortunately, receiving a diagnosis alone does not guarantee that services will be initiated. Parents report challenges with the evaluation process, such as providers recommending services not consistent with what is available and communication gaps between families and providers (Rous et al., 2008). Each parent brings a unique set of characteristics to the evaluation that may influence the evaluation's impact on a child's service use trajectory. For example, studies have documented that parental beliefs about the causes and chronicity of ASD can impact treatment choices (Dardennes et al., 2011; Mire et al., 2017), and parent perceptions of ASD symptom severity can impact follow-through with evaluation recommendations (Moore & Symons, 2009).

Objectives: To: 1) describe the development of a toolkit to enhance psychologists' communication and tailoring skills during the ASD diagnostic evaluation process; and 2) preliminarily evaluate the impact of the toolkit on parents' perceptions of the evaluation and recommendation follow-through efforts.

Methods: The ASD evaluation enhancement toolkit was developed with input from psychologists providing ASD diagnostic evaluations at a regional children's hospital and the parents they serve. More specifically, parents (n=10) whose children were diagnosed with ASD by participating psychologists (n=7) were interviewed one month post-evaluation about the diagnostic report, recommendations, and feedback portion of the evaluation. The interview protocol included both close-ended and open-ended questions. Another group of parents (n=6) whose children received an ASD diagnosis from participating psychologists were interviewed after the toolkit training had taken place, and responses between the two groups of parents were compared. The majority of children with ASD of these participating parents were male (87.5%), Hispanic (50%), and Medicaid-insured (43.8%) with a mean age of 3.4 years. Close-ended responses were analyzed using SPSS; open-ended responses were coded using an open-coding process (Haine-Schlagel et al., 2013).

Results: Effect size estimates from t-tests indicated that parents who received their evaluation after the toolkit training reported higher satisfaction with feedback. Across the two groups, there were no differences in understanding the evaluation results and confidence in next steps after the evaluation. There were also no differences in the likelihood of obtaining the report or percentage of recommendations initiated by the time of the interview. Qualitative data indicate that barriers to following through with recommendations differed for those who received their evaluation before versus after toolkit training. For example, some parents interviewed before the training discussed the need for more support after the evaluation to help obtain recommended services. Parents interviewed after the training did not articulate any need for additional support to obtain recommended services from their evaluator.

Conclusions: Results indicate some promising signals that this toolkit may address some barriers that facilitate parents' follow-through with recommendations following an ASD diagnostic evaluation. A larger-scale test of the toolkit's effectiveness with a much larger sample of parents across a more heterogeneous group of psychologists is a critical next step.

124 **140.124** The Impact of Community-Implemented Esdm on Parents' Ratings of Parenting Reward and Providers' Sense of Competence

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Background: Infants and toddlers at-risk for ASD frequently receive early intervention through federally regulated Part C services, which typically address family needs and general developmental and heath needs of children via transdisciplinary assessment and parent guidance, rather than disability-specific interventions. While research studies have demonstrated positive effects for parent-implemented ASD-specific interventions, none of these empirically supported approaches have been adapted and tested in existing community Part C service systems. A randomized controlled trial analyzing the efficacy of one such model, Community-Early Start Denver Model (C-ESDM), is currently underway to fill this gap. Here, we examine the effects of this model on the providers receiving training and on the families being served.

Objectives: To evaluate the effects of C-ESDM on 1) parents' ratings of parenting reward and child developmental progress, and 2) community-based early intervention providers' sense of competence.

Methods: Agencies and providers serving toddlers at-risk for ASD in low resource communities were recruited across 4 states: Alabama, California,

Colorado, and Pennsylvania. Participating providers assisted with recruitment of families on their caseload. Agencies were randomly assigned to receive training in C-ESDM or a general developmental education program. The research team used telehealth to disseminate intervention materials to providers in both groups. Training consisted of: (1) provider webinars (general review of child development for the control group and training in C-ESDM strategies and autism for the experimental group); and (2) access to web-based materials for families (videos describing strategies to encourage general child development across domain areas for control group or a smartphone app, called Help is in Your Hands with multimodal materials to help parents implement key features of the C-ESDM at home). At intake and exit (6 months), providers completed a Sense of Competence Scale (PSOC) and parents completed Ratings of Parenting Reward (RPR) and Parent Rating of Child Progress (PRCP).

Results: To date, 32 providers (19 C-ESDM) and 33 parents (19 C-ESDM) have completed data for at least one time point (Provider: T1 *n* = 31; T2 *n* = 9; Parent: T1 *n* = 31; T2 *n* = 9). Preliminary findings suggest no differences between the randomization groups at baseline on any measure (PSOC, RPR, PRCP, all *p's* >.4). There are no significant main effects of time for any measure (all *p's* >.1), but non-significant differences between the groups over time in the expected direction (more positive improvements for C-ESDM group) are observed for the PSOC and PRCP measures. Time 2 data are expected to be available for all 32 providers and 33 families prior to the meeting.

Conclusions: These preliminary findings highlight the need to consider the effects on practitioners and parents when adapting laboratory-based empirically-validated interventions for use in existing early intervention service systems. Positive effects of an adapted intervention on providers and parents will support implementation and sustainment of evidence-based strategies in the community.

125 **140.125** A New Way to Help Parents? Exploring the Impact of School-Based Interventions on Parenting Outcomes

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Background: Increased levels of parenting stress are well documented in parents of children with neurodevelopmental disorders in comparison to parents of typically developing children, with parents of children with Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD) reporting the highest scores (Craig et al., 2016a). Parenting stress impacts individual beliefs and behaviors (e.g., parent self-efficacy) as well as the family system and can lead to diminished outcomes on child-focused therapy. In turn, child behavior has been shown to influence parenting stress and practices. Executive dysfunction, or difficulties with behavioral, emotional or cognitive regulation, has been suggested to serve as an endophenotype in neurodevelopmental disorders (Craig et al., 2016b), and may play an important underlying role in parenting stress and self-efficacy. Although not the primary target of treatment, analyzing the secondary impact of a school-based intervention on parents can help examine family impact, which in turn can lead to greater maintenance of child skills.
Objectives: Determine the impact of a school-based intervention on parenting strain and self-efficacy and explore moderators of change.

Methods: Participants included 148 parents (79.1% mothers) of children diagnosed with ASD (*n* = 50) or ADHD (*n* = 98) from Title 1 eligible schools in Washington, D.C. and northern Virginia. Children were randomly assigned to either Unstuck and On-Target or Parents and Teachers Supporting Students. Parent strain (Caregiver Strain Questionnaire-Short Form 7 (CSQ-7; Brannan et al., 2012)), parenting self-efficacy (subscale from Family Empowerment Scale (FES; Singh et al., 1995)), and child executive dysfunction (two subscales from the Behavior Rating Inventory for Executive Function (BRIEF; Gioia et al., 2000) were measured at pre, post, and follow-up.

Results: There was a significant decrease in subjective parenting strain from pre to post-treatment ($t(91) = 3.08$, $p = .003$) and maintained to follow-up ($t(73) = 2.10$, $p = .039$). A significant decrease in objective parenting strain was noted from pre- to post-treatment ($t(90) = 3.15$, $p = .002$), but effects did not extend to follow-up ($t(72) = 2.10$, $p = .265$). Although parent self-efficacy increased from pre- to post-treatment, it was not a significant change ($t(85) = -.80$, $p = .425$). After controlling for baseline levels of parenting strain and child executive dysfunction, only change in metacognition significantly predicted change in subjective parenting strain ($\beta = .413$, $p = .002$). Changes in metacognition ($\beta = .276$, $p = .027$) and not behavioral regulation ($\beta = .189$, $p = .094$) significantly predicted change in objective parenting strain.

Conclusions: The current study builds on the encouraging findings in relation to both treatments demonstrating positive changes in child executive functioning and behavioral flexibility. Results demonstrate significant changes in parenting strain and not parenting self-efficacy as a consequence of participating in these school-based treatments. Interestingly, only change in metacognition, or increases in child's ability to plan, organize, and initiate tasks) significantly predicted change in both subjective and objective strain. Neither changes in classroom observation nor number of parent training sessions attended impacted change in parenting strain or self-efficacy.

126 **140.126** Predictors and Moderators of Parenting Stress in Youth with Autism Spectrum Disorder and Their Typically-Developing Siblings

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Background: Mothers of children with autism spectrum disorder (ASD) experience a particularly elevated level of stress (Schieve et al., 2007) and depression than mothers of children with other developmental disabilities or typically-developing (TD) children (Abedduto et al., 2004; Davis & Carter, 2008). Increased rates of problem behaviors in children with ASD contribute to parenting stress more than ASD symptoms (Peters-Schefferet al. 2012). A less studied component of parenting stress is the clinical functioning of TD siblings in the context of ASD. Mothers may also respond differently to child characteristics, including sex-based differences (Sameroff, 2009). A better understanding of factors contributing to parenting stress, including clinical functioning in children with and without ASD and across genders, is crucial for developing interventions that enhance well-being of families affected by ASD.
Objectives: Examine whether the relationships between clinical functioning in children and parenting stress are moderated by maternal depression or child's gender, in children with ASD and in TD siblings.

Methods: Mothers (*N*=256) with one child with ASD (M_{age}=11.82, SD_{age}=3.02; 84% male) and a TD child (M_{age}=11.24, SD_{age}=3.18; 47% male) completed a measure of clinical functioning in their children (BASC-2; Reynolds & Kamphaus, 2004), as well as a measure of parenting stress (PSI-4SF; Abidin, 2012) and their own depressive symptoms (BDI-II; Beck, Steer, & Brown, 1996).

Results: PSI total score positively correlated with externalizing, internalizing, behavioral symptoms (r>.30, p<.001), and negatively with adaptive skills (r=-.52, p<.001) in children with ASD. BDI moderated the relationship between the child with ASD's internalizing behaviors and PSI (B=-.02,

p=.012), such that the relation was present only when BDI was low or average (Fig 1A). The gender of children with ASD moderated the relationship between child externalizing behavior and PSI (*B*=-.85, *p*=.006), such that these relationships were only present for with boys (Fig 1B). TD children's behavioral symptoms (*r*=.17, *p*=.016) and adaptive skills (*r*=-.14, *p*=.025) related to PSI. These relationships were not moderated by BDI, but the relationship between adaptive skills and PSI was moderated by gender (*B*=-0.35, *p*=.041), such that the relation was only in TD girls (*B*=-0.25, *p*=.015).

Conclusions: Results suggest that both children with ASD and their TD siblings' clinical functioning contribute to parenting stress, supporting bidirectional relations along with parenting stress predicting child psychopathology (Anthony et al., 2005; Bauminger et al., 2010). Surprisingly, these relations were not seen in highly depressed mothers. Given that parenting stress predicts depressive symptoms above and beyond child characteristics (Weitlauf et al., 2014), it is possible that depressed mothers may experience elevated parenting stress regardless of child behaviors. Moderation by gender suggests that mothers' differential expectations of behavior, such as perceiving externalizing behaviors in boys with ASD and low adaptive skills in TD girls as more stressful, may affect mothers' sense of parenting efficacy. As parental stress has a negative impact on treatment outcome (Osborne et al., 2008), these findings highlight the importance of addressing emotional and behavioral problems in both children with ASD and TD siblings, and considering maternal (depression) and child-specific (gender) factors to reduce parental stress.

127 **140.127** Autistic Adults' Views and Experiences of Stimming

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Background:

'Stereotyped or repetitive motor movements' are characterised as core symptoms in the diagnosis of autism and treatments to control them remain popular (Jaswal & Ahktar, 2018). Diverse therapeutic perspectives have regarded these behaviours as self-stimulatory acts that shut out external stimuli and interfere with the person's (and others') focus (Lilley, 2018). In contrast, many autistic adults (and the neurodiversity movement) have reclaimed them as 'stimming', arguing they may serve as useful coping mechanisms and decrying practices such as "quiet hands" (e.g. Bascom, 2012). Yet only one empirical study has directly elicited autistic adults' views about stimming, a pilot online survey presented by Steward at IMFAR (2015) that found most participants viewed stimming as a coping mechanism to reduce distress or overstimulation. Furthermore, most reported they generally or sometimes enjoyed stimming, yet had been told not to do it.

Objectives:

We sought to extend the study by Steward (2015) through more in-depth data collection and purposive sampling for a diverse range of support needs among autistic adult participants. We aimed to examine autistic adults' perceptions and experiences of stimming, including: (1) the reasons they stim, (2) any value doing so may hold for them, and (3) their perceptions of others' reactions to their stimming.

Methods:

We conducted semi-structured interviews and focus groups with a participatory team of autistic and non-autistic researchers. Thirty-two autistic adults (20 male, 11 female, one non-binary), between the ages of 21 to 56 years (μ = 36.4) participated in the study (20 in one-to-one interviews and six each in two facilitated focus groups). Recruitment took place through the existing networks of research teams in the Southwest of England and London, including residential homes and a training centre for autistic adults, producing a sample with a diverse range of support needs. Interviews and focus groups had a similar topic guide and prompts to encourage active participation.

Results:

Using thematic analysis (Braun & Clarke, 2006), we identified two themes, including stimming as: 1) a self-regulatory mechanism, and 2) lacking in social acceptance, but can become accepted through understanding. For the first theme, participants reported external causation of stimming through overwhelming environments that cause sensory overload, as well as internal causation through noisy thoughts. Stimming always involved uncontainable emotion, but it could be a positive emotion such as joy or a negative one such as anxiety. For the second theme, we observed a dynamic of (de)stigmatisation in which others usually devalued participants' stims, especially when they were harmful and as participants got older, but stims could become socially accepted through others' understanding.

Conclusions:

Autistic adults highlighted the importance of stimming as an adaptive mechanism that helps them to soothe or communicate intense emotions or thoughts and thus objected to treatment that aims to eliminate the behaviour. The point of intervention could therefore be shifted to dysfunctional causes of stimming, such as the overwhelming environment and possibly distressing thoughts and emotions. Future research might investigate the possibility that everyone stims by comparing stimming to the fidgeting ubiquitous among non-autistic people.

128 **140.128** Should Heritage Languages be Incorporated into Interventions for Bilingual Individuals with Neurodevelopmental Disorders?

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Background: Bilingualism is becoming increasingly prevalent in today's rapidly globalizing world, and this increase is also seen among children with disabilities. A core characteristic of individuals with neurodevelopmental disorders like intellectual disability (ID), global developmental delay (GDD), communication disorders (CDs), and autism spectrum disorder (ASD) is a deficit in language. Concerns that dual language exposure may hinder language development often lead to many language-minority parents being advised against speaking in their heritage languages. According to special education policies, the heritage languages of individuals with disabilities should be developed and preserved. However, practice does not seem to align with these policies. Does research support incorporating the heritage languages of bilingual individuals with neurodevelopmental disorders into interventions?

Objectives: Research syntheses are key when determining evidence-based practices. Previous reviews on this topic were unregistered narrative reviews with methodological weaknesses. Consequently, the purpose of this review was to evaluate the effects of incorporating heritage languages into interventions for bilingual individuals with neurodevelopmental disorders using more systematic methodology and meta-analytic

procedures. The quality of research designs was also evaluated.

Methods: This systematic review was registered with the PROSPERO international prospective register of systematic reviews. Procedures used followed PRISMA guidelines. A total of 18 studies met predetermined inclusion criteria (i.e., used an experimental design, implemented an intervention, included individuals with ID, GDD, CDs, and/or ASD who were bilingual, and investigated the effects of languages of instruction). Participant characteristics, interventions delivered, languages of instruction used, and study outcomes were summarized. Study quality was evaluated using the What Works Clearinghouse (WWC) Standards Rating. Effect sizes for studies that met WWC standards were also calculated.

Results: Nine out of 18 studies were conducted with participants with CDs. The other nine studies were conducted with participants with diagnoses of ID, GDD and/or ASD. Findings indicate a small effect favoring interventions that incorporated participants' heritage languages versus interventions that were delivered solely in the majority language. Additionally, most studies met WWC standards and were found of be of high quality.

Conclusions: Overall, findings support the incorporation of heritage languages of bilingual individuals with neurodevelopmental disorders into interventions. More than half of the studies conducted with participants with CDs favored interventions delivered in participants' heritage languages, but the same was only found for a third of studies conducted with participants with ID, GDD, and/or ASD. This may be due to a discrepancy in heritage language supports provided to participants. Specifically, 80% of participants with CDs were reported to be receiving some amount of heritage language instruction in school. However, this was only the case for less than 10% of participants with ID, GDD, and/or ASD. Thus, due to previous exposure, participants with CDs may have developed preferences for heritage language instruction and/or been more familiar with receiving formal instruction in heritage languages. Suggestions for future research include assessing social validity, involving stakeholders when designing and implementing interventions, and investigating strategies for overcoming language barriers between therapists and clients.

129 **140.129** Bringing School Home: Understanding the Interactional Resources of a Bilingual Child with ASD

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Background: Children with autism spectrum disorder (ASD) engage in social interactions differently from their typically developing peers. The ways in which bilingual children with ASD socially engage with others is not well understood. Bilingual language practices may be shaped by families' contexts and childrearing practices (Yu, 2016). We utilized Bakhtin's notion of heteroglossia - varied speech voices in context -- to examine the interactional implications of code-switching within an immigrant, bilingual family that includes a child with ASD.
Objectives: The purpose of this study was to examine how code switching is used as an interactional resource during parent-child interactions among immigrant parents and their child with ASD.

Methods: To understand certain features of code-switching -- the alternation between two languages -- we examined transcripts to answer the following questions: (1) Who initiated code-switching; (2) What was the activity context during code-switching; (3) How was code-switching used in conversation; and (4) What did code-switching appear to do for the interaction? Over three hours of video data were collected from an immigrant, predominantly Spanish-speaking family who lives in a rural border town. The primary caregiver was Beatriz (names are pseudonyms), a 32 year-old unemployed mother working on her bachelor's degree. The child, Herman, was a 5 year-old boy with autism. The father, David, was a 31 year old merchant.

Results: Beatriz initiated code-switching 21 times; David, 4 times; and Herman, 46 times. The alternation primarily occurred from Spanish to English during structured interactional activities like book reading, homework, or in conversations about animals and colors. Code-switching also occurred during pretend play like play-doh, car play, and preparing pretend meals.

The form of code-switching included single word insertions -- a second language word inserted into a primary language sentence (Moyer, 2013). Herman inserted a single English word (e.g., red, dinosaur, pirate) into a Spanish conversation. Alternations -- secondary language sentences or clauses utilized within a speaker's turn -- were also utilized. Herman asked his mother a question in English and the mother responded in Spanish.

To understand interactional implications, code-switching was used as a contextualization cue (Gumperz, 1982). After playing with play-doh, Beatriz asked the children to clean up. Herman sang the "clean up song" in English as he cleaned up the play doh. Herman enacted a song that he learned outside of home (likely at school) within a similar interactional context at home. Code-switching brought school interactional contexts into the home. Code-switching was also used as a metalinguistic pedagogical tool to encourage Herman to learn new words and practice the second language (Waring, 2009). During a book reading activity, David and Herman communicated in English to describe the pictures. When Herman did not know an English translation for a word (i.e.,"disfraz") he asked David to translate it to English ("costume").

Conclusions: This case study exemplifies how Herman and his parents used code-switching as an interactional resource within family interactions. These findings indicate the need for interventionists to capitalize on the linguistic strengths of bilingual families to support language and communication.

130 **140.130** Question-Response-Evaluation Sequences in the Home Interactions of a Bilingual Child with Autism Spectrum Disorder

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Background: Early interventions for children with autism spectrum disorder (ASD) rely on caregivers as interventionists, and leverage family routines as intervention contexts (e.g., Kasari, 2015). However, families in most intervention research are monolingual. There is little research on the interactional routines of bilingual families that could be drawn upon to aid in the implementation of family-centered intervention practices. To fill this gap, we examined naturally occurring interactions in a Spanish-English bilingual, immigrant bilingual family with a 4-year old child with ASD.
We focused on interactions involving parent questions directed toward their child. Child-directed questions are often *pedagogical*, ostensibly designed to teach the child about the world, social interaction, and language itself (Snow, 1972; Yu, Bonawitz, & Shafto, 2017). When answers to questions are known to the adults who pose them (i.e., *known-answer* questions; Grosse & Tomasello, 2012; Schegloff, 2007), they culminate in

question-response-evaluation (QRE) sequences. These sequences have been examined classroom contexts (e.g., Waring, 2009), but few studies have examined these sequences in family interactions that involve children with ASD.

Objectives: to determine (a) the question formats that were used to launch QRE sequences, (b) the types of third-turn evaluations used to close these sequences, and (c) the larger action trajectories in which the QRE sequences were embedded.

Methods: We used Conversation Analysis, a micro-analytic approach to examining interaction that focuses on the sequence organization of talk. Parents were given a video camera, and instructed to turn it on during times of the day that family members engaged in routine interactions. We focused on one family in our data corpus, comprised of ~4 hours of recordings. Recordings were transcribed in Spanish, and then translated into English. After an initial pass through the dataset, we developed a code book to identify segments of transcript that included the provision of known-answer questions. These segments were then coded to determine the question format, the evaluation format, and the action trajectory within which the QRE sequence was embedded.

Results: Known-answer questions were posed using several question formats, with q-word (who, what, why, etc.) questions being the most prevalent. We also found that parents formatted evaluations in a variety of ways; by initiating repair, repeating the child's utterance to confirm the acceptability of the response, moving to the next question is a series of topically organized questions, and by offering affirmative tokens (e.g., yes) or evaluative phrases (e.g., wow, that's great). In terms of action trajectories, our analyses showed that QRE sequences were *not* designed solely to test child knowledge. Instead, they worked to: (a) repair prior responses, (b) move play routines forward, and (c) launch an extended, topically connected series of questions. See Table 1 for descriptions and examples.

Conclusions: This study offers a characterization of QRE routines in a Spanish-English, immigrant family with a child with autism. Our findings suggest that QRE sequences were a rich interactional resource for the child and his parents, and could potentially be a space for maximizing high level engagement to encourage social-communication development.

131 **140.131** Using Community Advisory Boards to Inform Interventions for Latinx Children with ASD.

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Background: Data from the Arizona Developmental Disabilities Surveillance Program 1 in 71 8-year children have autism spectrum disorder (ASD) in Arizona. When considering race and ethnicity, White or black non-Latinx children are more likely to be identified with ASD than Latinx children in Arizona. For those Latinx children who are diagnosed, they are more likely to receive a later diagnosis and receive fewer services compared to non-Latinx white children. A plethora of socio-cultural individual, family, healthcare systems, educational systems, community systems factors impact access to diagnosis and services for Latinx children. Thus, to reduce ASD disparities among Latinx children it is critical to engage in interprofessional collaborations to engage relevant stakeholders and promote social justice through collaborative work. Community advisory boards provide a platform for interprofessional and community engagement to enhance the inclusiveness of the target community perspectives and advisement. The purpose of this presentation is to discuss the development and utility of a community advisory board to inform the scope of the problem, outreach, and participant recruitment for the pilot of a culturally informed intervention combined with pivotal response training for Latinx families of children with ASD.

Objectives:

1) increase awareness of ASD disparities for Latinx children in AZ.

2) identify effective collaborations among service providers and Latinx families in the autism community

3) highlight opportunities to engage Latinx families raising children with autism in intervention programs

Methods: A geographic area within Maricopa County was identified to be the targeted area for the pilot intervention project. An engagement and relationship-building phase followed. After which, key stakeholders within the community were invited to serve on a community advisory board to guide the pilot intervention project. The community advisory board responsibilities included 1) identify barriers Latinx families experience in the diagnostic process and challenges after diagnosis; 2) collaborate with the program by incorporating their knowledge of resources in the community; 3) describe strategies within the community that have been successful for outreach and recruitment of Latinx families.

Results: Six community members (three Latina mothers of children with ASD, three providers) served on the community advisory board. The community advisory board provided information and advisement about the problem, outreach strategies, retention considerations, appropriate and reliable community resources, and offered space for assessments. This information contributed to the successful recruitment of 10 parent-child dyads for the intervention program.

Conclusions: The community advisory board supported the implementation of a culturally informed intervention for Latinx families raising children with ASD. Through this inclusive practice the community perspective of challenges Latinx children and families face in access to ASD diagnoses, treatment services in the targeted region. The community advisory board assisted the researcher in identifying inclusive strategies in outreach, modifications of the intervention delivery, and culturally appropriate resources. This presentation is particularly relevant, given the variety of providers and disciplines involved in the lives of individuals diagnosed with ASD. Implications for outreach, recruitment, inclusion, and retention of Latinx children and families in ASD research will be discussed.

132 **140.132** "Had a Good Cry, then Went Online": Factors Associated with Parent Reactions to Diagnostic Disclosure Sessions

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Background:

Receiving a diagnosis of an autism spectrum disorder (ASD) is often an important event in the life of a family. The diagnostic disclosure session can produce strong emotions and stress, but also can help families learn about autism and access helpful resources. To date, most of the research literature focuses on the broader diagnostic process or on qualitative data from a small number of families. Little is known about how providers can improve their diagnostic disclosure sessions to better serve families.

Objectives:

This study aims to better understand positive and negative parent experiences with diagnostic disclosure sessions, with the goal of understanding how providers can improve client outcomes by maximizing the benefit of these sessions.

Methods:

Information was gathered through a mixed-methods study including interviews with diagnosing professionals of various disciplines (n=6), a focus group of parents (n=11), and surveys from U.S. parents with children diagnosed with ASD in the past 3 years (n=160). The survey was developed for this study using currently available research and asked parents about their attitudes and knowledge coming into the disclosure session, their experiences during the disclosure session (e.g., provider characteristics, information received), and their experiences following the session (e.g., knowledge and confidence, emotional responses, actions taken). The survey also included open response questions about their experiences receiving the diagnosis and how the session could be improved.

Results:

Parent satisfaction with the diagnostic disclosure session was best predicted by having a provider who parents felt was warm and empathetic, really "got" their child, and was competent. They also felt more satisfied if providers adequately explained why their child had ASD, described treatment options, and gave strategies they could use at home. In qualitative responses, parents emphasized that recommendations for at-home strategies were extremely helpful, and that they would like more step-by-step recommendations that were rank-ordered in terms of priority. Parents who entered the session feeling more nervous about receiving an autism diagnosis were more likely to leave the session feeling shocked, worried, upset, and sad about the loss of the future they imagined for their child. Parents felt most hopeful after the session if they had a provider who addressed their child's prognosis, explained the diagnosis, and was warm and empathetic. Immediately following the session, parents report crying, and then accessing services right away, with most parents seeking informal social support and provider-recommended treatments first.

Conclusions:

Providers who diagnose ASD can help support parents by making sure that parent expectations are adequately addressed during the disclosure session. Attending to parents' emotional states at the time of the session may improve outcomes afterward. Parents especially value step-by-step information on how the diagnosis was decided and instructions on how to access specific resources. Empathic and warm diagnosticians are valued and trusted most.

133 **140.133** "We Are Mama and Papa Bears": A Mixed Methods Study of the Outcomes of Parents of Transition-Age Youths with ASD

***V. Hang**, University of Kentucky, Lexington, KY*

Background:

The negative transition outcomes and transition experiences do not only impact students with ASD, but also their families because many individuals with ASD continuously rely on their caregivers' intensive support, even through adulthood (Smith et al., 2010). A successful transition should be based on how well the family is doing and how parents perceive the transition process (i.e., family-centered approach; Neece et al., 2009). However, the transition process often fails to empower caregivers or measure family-level outcomes (Cameto & colleagues ,2004).

Objectives:

To provide a detailed account of the experiences associated with the transition process from a family-centered approach and answer three questions: (1) What are the stressors, external and internal support, coping strategies, and parent transition outcomes from a parent's perspective?; (2) What are the predictors of parent transition outcomes?; and (3) Does resources and coping strategies mediate the relationship between stressors and outcomes as proposed by the ABCX model?

Methods:

An exploratory sequential mixed methods study was conducted:

Part 1–Qualitative study

Participants. 13 parents of transition-age youths with ASD were interviewed. The analysis of the qualitative data was guided by the thematic analysis approach (Daly, Kellehear, & Gliksman, 1997).

Part 2–Quantitative study

Participants. 252 parents of transition-age youths with ASD was recruited. According to the qualitative results generated by phase 1, four regressions and a structural equation model were developed to identify predictors that influence parent transition outcomes at indicator and structural levels.

Results:

Qualitatively, parents identified four stressors at three levels (family, parent, child), seven resources, five perception/coping strategies used, and five current/desirable outcomes. These themes were categorized using the ABCS model (see figure 1). These parents were angry, fearful, and worry, but were hopeful at the same time. They shared thoughts about the meaning of being a parent, aging, and their own dream. A father shared, "I am a prisoner." Another mother said, "I just want to read a book on a beach." These parents' powerful sharing sheds light on their areas of need and gives us a deeper understanding of the intersection of aging and parenting an adult with ASD.

The quantitative study added information about the factors that impact parents' transition outcomes to the literature. At the indicator level, two child-related factors (i.e., autism severity; mental health crisis/challenging behaviors), two parent-related factors (i.e., filial obligation; efficacy), two school related factors (e.g., transition planning quality; parent-teacher alliance), coping strategies (problem-focused coping; avoidance-focused coping; optimism) predicted at least one of the parents' transition outcomes. At the structural level, optimism, emotion-coping strategies, and resources mediated the relationships between stressors and parental outcomes (see Figure 2).

Conclusions:

The current project provided insights into the complexity of the transition process experienced by parents of adolescents and young adults with ASD. The results also shed light on variables for further development and study of family-centered transition interventions. Parents are crying for help and support is far from sufficient. Clinical and research implications will be discussed.

134 **140.134** "What We Need from the U.K Healthcare System for Our Children with Autism": Voices of Parents / Carers Captured through Qualitative Interviewing.

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Background: Children with Autistic Spectrum Conditions (ASCs) often require access to multiple areas of healthcare provision through the course of their development, due to increased presentation of both physiological and psychiatric co-morbidities. It is hoped that this medical support is delivered in a timely, fully integrated, and appropriately individualised way to adequately support autistic individuals and their families.
Objectives: No published data are available in the U.K. reporting how satisfied parents / carers are with the level of health-related support that their dependents with ASC receive. This qualitative interview study aimed to collect those views in addition to parental suggestions for possible improvement of future health care provision, with a focus on the use of hospital passports (dossiers of integrated patient information).
Methods: Data were obtained from 24 voice-recorded, semi-structured interviews (mean duration 60 minutes) with parents / carers of children with ASC, aged between 0-18 years. Interviews took place predominantly in participants own homes (3 took place in a quiet interview room in the Medway School of Pharmacy). Parents were asked to describe specific past experiences of healthcare provision for their children with autism and to define factors which led to overall level of satisfaction. The services surveyed were General practitioners (GP's), Paediatric services, Child & Adolescent Mental Health services (CAMHS), Accident & Emergency and inpatient hospital admissions. Parents were asked to offer suggestions to improve future practice. Finally parents were asked if they were aware of hospital passports, and if they could improve provision. Interviews were anonymised and transcribed, and thematic analysis was used to identify, analyse and report thematic frequency within the data.
Results: Parents gave examples of both positive and negative experiences with healthcare provision in all sectors. The dominant theme to emerge which appeared to discriminate positive & negative experiences was the amount of autism-related knowledge parents felt that healthcare professionals (HCPs) demonstrated in their practice, along with the depth of their understanding of the range of possible individual presentations of ASC. A secondary theme highlighted a need for the appropriate level of communication and interaction between the health care professional and the child, and for the HCP to actively listen to the parents and to treat them as "experts" regarding their child. Parental suggestions for improvement aimed at optimising the holistic health outcome for the child, and overall family satisfaction will be discussed.
Conclusions: The suggestion of use of the hospital passport for children with autism was met with overwhelmingly positive reviews as parents felt it could be used in an integrated way across a variety of healthcare settings to improve information dissemination and communication between health care professionals and families.

135 **140.135** "and Yet, I Still Hope": Parenting Self-Efficacy in ASD

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Background: Children with ASD are often involved in multidisciplinary, complex therapy programs, requiring significant caregiver management, participation, and strain (Ruble & McGrew, 2007; Kandolkar & Kenchappanavar, 2014). Parenting self-efficacy, i.e. the expectations caregivers have about their abilities to successfully parent their children, has previously been shown to predict a parent's ability to cope with the unique challenges of raising a child with ASD (Pastor-Cerezuela et al., 2016; Kuhn & Carter, 2006). High parental self-efficacy has been shown to mediate parental stress (Bayat, 2007). Despite a recent focus on family-centered care and parental involvement in therapy for children with ASD, little research has investigated the impact of various components of a child's therapy programming on parental ratings of confidence and self-efficacy.
Objectives: We aim to assess the effects of intervention intensity, parental therapy involvement, and parent training on ratings of parenting self-efficacy. This study seeks to answer two questions: (1) To what extent do intervention-level factors (e.g. degree of parental involvement in intervention, training from professionals, intervention frequency, number of different interventions) modulate autism-specific parenting self-efficacy?; (2) Does perceived level of caregiving burden mediate the predictive power of these intervention-level factors on parental self-efficacy ratings?

Methods: Parents of children with ASD (N=439) across 47 states completed an online questionnaire on parenting self-efficacy for autism (PSEa). The survey was designed to capture parental confidence in advocating for their child with ASD, confidence in navigating the complexities of autism intervention, and perceived level of social and financial strain associated with raising their child. It also captured basic demographic information and details of intervention frequency, modality, and number and type of clinical interventions.

Results: We used linear regression with PSEa as the outcomes measure. Result show that time since diagnosis, parental rating of involvement across all therapies, and parental rating of satisfaction with training significantly predict PSEa. We also grouped participants by high vs. low parental strain and found that for individuals who rated the strain of raising their child as low, parental involvement in therapy significantly predicted 32.3% of the variance in PSEa and parental satisfaction with intervention training significantly predicted 30.3% of the variance in PSEa. Conversely, among parents with a high rating of strain, parental involvement predicted only 18.7% of PSEa ratings and training satisfaction did not significantly predict PSEa. PSEa was not significantly predicted by number of therapies, total number of therapy hours per week, severity of child's ASD symptoms, or child language level.

Conclusions: Data collected from 439 caregivers of children with ASD indicate that parental self-efficacy can be improved through parental involvement and positive training experiences, as long as perceived burden is low. However, when parents indicate high perceived burden, practitioners may need to prioritize working with families to counsel, refer to other professionals, and engage community resources in order to decrease burden and enable parents to derive maximal benefit from training and involvement. Interestingly, these effects seem to be independent of intensity of intervention, severity of child's ASD symptoms, or child language level.

136 **140.136** ASD Support Networks and the Services Cliff: Mappings Social Capital Inequalities for Young Adults with ASD Post-Transition

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Background: Over 66% of young adults with Autism Spectrum Disorder (ASD) are disconnected from opportunities for work or schooling in the first few years after high school. [1] Unequal access to social capital (resources and connections) from work, community and school contexts could adversely impact their transition to employment and other lifecourse outcomes. [2-4] Our study represents the first attempt to use modern social network methods to investigate the social networks of transition-age youth with autism to investigate social capital inequalities during transition.
Objectives: To conduct a preliminary investigation of the social capital of youth with ASD post transition by using pilot data from self-report egocentric social network surveys to identify resources and connections and investigate variation across gender.

Methods: A purposeful sample of 17 young adults between the age of 19-28 were asked to identify up to five important people and the supports they provided to the young adult. The young adults also identified network connections among identified supporters. Using ORA [5], we computed the density of the team of identified supporters, the percent for each role type and the percent for each support type of supporter. Descriptive statistics suggest that participants represented a racially homogenous (88% white), relatively advantaged group of 17 young adults, with a mean age 23.25. Overall, 82% had ever attended college and 35% were living independently. 59% were male (n=10), 29% female (n=5), and 12% were gender non-conforming (n=2) (Table 1).

Results: Pilot data suggest that youth were not isolated, with mean networks size = 4.88. Few support networks included professionals (n=2). Types of supports provided by network members varied. Friendship (75%), emotional support (74%) and advice (73%) were more frequent while employment support was less frequent (24%). Median network density for males was 100%, while female or gender non-conforming persons median density was 60% (Mann–Whitney U = 13, p = .03, two-tailed). (Figure 1) Role types of supporters varied by gender. Family members were marginally more present in males' support networks (median 68%) than female and gender non-conforming persons' (median 40%; Mann–Whitney U = 17.5, p = .09, two-tailed). In contrast, community members were more present in the support networks of females and gender non-conforming persons (median 40%) than in the support networks of males (median 12.5%) (Mann–Whitney U = 53, p = .08, two-tailed). Family friendship also varied by gender, where males had on average a marginally greater percentage of family members who provided friendship (median 60%) than females and gender non-conforming persons (median 40%) (Mann–Whitney U = 15.5, p = .06, two-tailed).

Conclusions: Pilot data suggests that youth were not isolated and that gender is salient for diverse sources of social capital acquisition, as male young adults with ASD in this study relied primarily on family network members, while females and gender non-conforming persons had more diverse networks that included family and community members. The lack of professionals present in support networks illustrates the adverse impact of the service cliff, as identified in previous studies.[1]

137 **140.137** Adjustment in Typically Developing Siblings of Children with ASD: The Impact of Sex, Age, and Birth Order

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Background: The current literature investigating adjustment and behavior challenges in typically developing siblings of children with ASD (TD-Sibs) reports inconsistent findings. Some studies report TD-Sibs demonstrate adjustment problems compared to normative samples, while others report no significant differences. However, the inconsistent literature may reflect the influence of modulating factors that impact sibling adjustment. While some modulating factors, such as maternal stress and affected sibling's ASD severity, have been investigated with mixed results, other potential modulators (e.g. birth order) have yet to be fully explored. Recent literature suggests TD-Sibs younger than their affected sibling may exhibit problem behaviors because of increased stress from birth due to the presence of a sibling with ASD or modeling sibling behavior.
Objectives: To investigate the impact of modulating factors such as sex, age, and birth order on TD-Sib adjustment. We hypothesized that TD-Sibs younger than their sibling with ASD will exhibit more adjustment challenges compared to older TD-Sibs and age-based norms.

Methods: Thirty-four families with at least one TD-Sib (N=34, 6-12 years, mean age=8.9 years) and one child with ASD were recruited through a larger study investigating the effectiveness of a sibling support group. Prior to support group participation, one parent completed the *Child Symptom Inventory-4* (*CSI-4*) and *Behavior Assessment System for Children, Second Edition* (*BASC-2*) to measure the TD-Sib's emotional and behavioral adjustment. To investigate the difference in clinical/subclinical occurrences in adjustment difficulties between TD-Sibs and normative samples, binomial *t*-tests were conducted for each *CSI-4* and *BASC-2* subscale. Within the TD-Sib sample, independent sample *t*-tests were used to compare subscale scores between males and females, TD-Sibs younger or older than the affected sibling, and TD-Sibs younger than eight (<8) or eight and older (8+; cutoff selected to correspond to *BASC-2* normative age groupings).

Results: On the *CSI-4,* male and female TD-Sibs showed no significant differences in adjustment and scored in the normative range on all subscales. However, the proportion of female TD-Sibs with subclinical Depression subscale scores was lower than population norms ($p<0.05$). TD-Sibs younger than their affected sibling had greater challenges than older TD-Sibs on *BASC-2* Daily Living Skills subscale ($t(29)=-2.06$, $p<0.05$). Compared to TD-Sibs 8+, TD-Sibs <8 exhibited worse adjustment on *BASC-2* Functional Communication ($t(32)=2.55$, $p<0.05$) and marginally more impairment on *BASC-2* Attention ($t(32)=2.01$, $p=0.053$) and Conduct ($t(32)=1.10$, $p=0.054$) subscales. Likewise, the proportions of TD-Sibs <8 with subclinical adjustment difficulties on the *BASC-2* Depression subscale was higher than population norms ($p<0.05$). The proportions of TD-Sibs 8+ with adjustment challenges on all *CSI-4* and *BASC-2* subscales were comparable to or less than population norms (*BASC-2* Somatization, Withdrawal, Leadership, Functional Communication, *p*-values<0.05).

Conclusions: TD-Sibs did not exhibit difficulties in their parent-reported adjustment and scored in the normative range on both adjustment measures. However, our findings suggest an effect of birth order and developmental age, such that TD-Sibs younger than their affected sibling or younger than eight showed more adjustment challenges. Understanding the psychological well-being of TD-Sibs may help inform family and sibling support groups as well as sibling-mediated interventions for children with ASD.

138 **140.138** An Autism Friendly Hospital Initiative: Measuring Distress in Children with ASD during Vital Signs

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Background: On average, children with autism spectrum disorder (ASD) have more medical visits than those without this diagnosis (Liptak et al., 2006; Shimabukuro et al., 2008) and have more difficulty tolerating procedures due to rigid behaviors, sensory seeking behaviors, and difficulty coping with change (Davignon et al., 2014). Vital signs (e.g., height, weight, HR, BP) are routinely collected across healthcare settings to provide essential information for care. When vitals are missed, there may be significant implications for the timeliness, quality, and safety of care provided. Little is known about how children with ASD tolerate these exams and to what extent vital signs are missed or delayed.
Objectives: We aimed to determine (1) the likelihood that patients with ASD are unable to complete vital signs exams and (2) the frequency and severity of distress behaviors in those who are able to complete the procedure. To explore if distress behaviors were specific to ASD we utilized a comparison group of patients with other developmental/neurological diagnoses.

Methods: Participants included 56 patients with ASD and 45 without ASD (ages 4-17) who presented for routine care in the neurology and developmental medicine outpatient clinics. We included equal numbers of children with and without intellectual disabilities in each group. An adapted version of the Brief Behavioral Distress Scale (BBDS; Tucker et al., 2001) was administered to measure the frequency and severity of distress behaviors during vital signs collection. Interrater reliability on the BBDS was established utilizing a separate cohort of patients recruited from the neurology outpatient clinic. BBDS scores for each procedural step were calculated and total BBDS score was computed. Total time to completion was recorded and it was also noted when patients could not complete the procedure.

Results: There were no significant differences in baseline characteristics when comparing the two groups (Table 1). Total BBDS scores were significantly higher for patients with ASD than for patients without ASD, after controlling for baseline characteristics ($F(8,91)=6.63$, $p<0.001$). Additionally, age and intellectual disability were unique predictors of higher total BBDS scores in the ASD group ($p<0.001$). The average time required to complete vital signs was significantly longer for the ASD group compared to the non-ASD group (4.9 vs. 3.5 minutes; $p<0.001$). Children with ASD were also found to be twice as likely to be unable to complete vital signs compared to children without ASD.

Conclusions: Patients with ASD exhibited significantly more behavioral distress during the vital signs exam compared to patients without ASD. Additionally, children with ASD had significantly longer exams and were more likely to miss the exam altogether. To our knowledge, this is the first study to demonstrate that children with ASD have difficulty tolerating one of the most routine and important procedures in healthcare, the vital signs exam. These findings highlight the need for additional behavioral supports to improve patient experience as well as the quality and efficiency of patient care for children with ASD.

139 **140.139** An Examination of Life Satisfaction of Caregivers and Typically Developing Siblings of Children with Autism Spectrum Disorder

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Background:
Having a child with ASD can present unique challenges for other family members. Research on parents of children with ASD has found increased risk of negative outcomes associated with parenting a child with ASD, including heightened parental stress (e.g., Dabrowska & Pisula, 2010) and depression and anxiety (e.g., Sharpley et al. 1997). With respect to outcomes for typically-developing (TD) siblings of children with ASD, results are mixed (e.g., Meaden et al., 2010). Recently, research has begun to also focus on more positive outcomes for parents of children with ASD, such as life satisfaction (e.g., Ekas & Whitman, 2010). Given that life satisfaction and subjective well-being have been shown to be positively related to better health outcomes (Diener et al., 2017), further examining correlates of these positive outcomes is particularly important for family members of children with ASD.

Objectives:

The present study sought to 1) explore life satisfaction in caregivers and TD siblings of children with ASD, 2) examine relations between symptom severity of the child with ASD and life satisfaction of caregivers and TD siblings, and 3) examine relations between parental distress and life satisfaction of TD siblings.

Methods:

Participants included 106 families of children with ASD ages 3 to 17 years (M = 11.47, SD = 4.00), with at least a primary caregiver (M = 41.40, SD = 5.12) and a TD sibling (ages 11 to 17 years; M = 13.76, SD = 1.91) serving as respondents. Of these 106 families, 68 families had a secondary caregiver (M = 42.87, SD = 6.91) who also participated. Caregivers completed measures to assess ASD symptom severity in their children with ASD, a self-report measure of overall distress, and a self-report measure of overall life satisfaction. TD siblings completed a self-report measure of their emotional/behavioral difficulties and a self-report measure of life satisfaction.

Results:

Regarding life satisfaction, for both primary and secondary caregivers rated their average life satisfaction rating fell in the “slightly satisfied” range. Results indicated no significant relation between autism symptom severity in children with ASD and life satisfaction for primary caregivers (r = -.12, p = .230) or secondary caregivers (r = -.09, p = .468). TD siblings’ average life satisfaction rating fell in the “mostly satisfied” range, almost reaching the “pleased” range. Again, results revealed no significant correlation between autism symptoms severity in children with ASD and life satisfaction for TD siblings (r = -.14, p = .144). Results also indicated no significant association between primary caregivers’ distress and TD siblings’ life satisfaction (r = -.16, p = .106).

Conclusions:

In general, caregivers and TD siblings in the current sample reported relatively high levels of life satisfaction. Moreover, their overall life satisfaction was unrelated to autism symptom severity of their family member with ASD. This study highlights that family members seem to be displaying resiliency regardless of the level of autism symptom severity. Additionally, the present study emphasizes the importance of researchers continuing to explore positive outcomes for family members of children with ASD.

140 **140.140** Aspirations and Needs for Successful Post-Secondary Transitions: Stakeholder Voices

ABSTRACT WITHDRAWN

Background:
ASD is a lifelong disorder requiring continual services and supports to ensure success. Despite the best efforts of special education, the outcomes for individuals with ASD after high school are bleak. Of particular concern is a sub-group of adolescents with high-functioning autism (HFA). Although these individuals have the potential to fully participate in mainstream community activities, outcomes for many adults with HFA are surprisingly poor in the areas of secondary education, employment, independent living, and social participation. These individuals are three times more likely to have no daytime activity compared to adults with an intellectual disability (Taylor & Seltzer, 2011). The transition process is a time of great opportunity and risk for these adolescents and their families. Without adequate supports, families lack awareness of and access to services *and* adolescents often do not achieve their full potential.

Objectives:

Adolescents' and parents': (a) goals and aspirations for adult life; (b) views of transition areas they feel most and least prepared for; and (c) views of needed services and supports to support the transition to adult life will be identified.

Methods:

Parents and adolescents (ages 13-18) participated in separate focus groups. Parents completed the Social Responsiveness Scale Version 2 (Constantino & Gruber, 2012) to document their child's functioning level. In the focus groups, 36 parents and 26 adolescents (ages 13-17) from both rural and urban areas were asked about their goals after high school, and the services and supports they have used *and* need to facilitate a successful transition to adulthood. Using a card sort activity, participants provided information about transition areas for which they felt most and least prepared. Focus groups were audio taped and transcribed verbatim. A constant comparative method and consensus coding process were used to validate the major themes highlighted by parents and adolescents.

Results:

The parents were generally positive about their youth, highlighting strengths while acknowledging their individual challenges. While the adolescents had aspirations for independence, they expressed concerns regarding future employment, education, and relationships. Interestingly, parents and adolescents' views were often similar but different in subtle ways. The similarities and differences will be described in terms of goals for adult life, concerns regarding independence, and perceived needs for services and supports. Parents' goals focused on successful employment and independent living whereas adolescent goals related to employment focused on their specific interests such as computers or fantasy novels. While parents' major concerns related to social interaction (e.g., having friends to do things with), getting a job, and living independently, adolescents' major concerns related to being financially secure, and having a safe place to live and the social skills needed to maintain employment. Both parents and adolescents identified needs for continued supports.

Conclusions:

The adolescent and family perspectives indicated a need for capacity building supports tailored to *what really matters* to stakeholders for achieving successful adult outcomes. Those supports include social support for the adolescent and family, accessible and useble information about the adult service system, and continued professional supports according to adolescent's individualized needs.

141 **140.141** Autistic Traits in Transgender Youth: Dysphoria, Stigma, and Barriers to Care

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Background: There is an apparent over-occurrence of Autism Spectrum Disorder (ASD) and Gender Dysphoria (GD; e.g., de Vries et al., 2010; Strang et al., 2018[a]). In qualitative interview, youth with the co-occurrence describe challenges related to being both autistic and transgender, as well as experiences of having their gender dysphoria questioned (e.g., providers and family members dismissing their experience as a symptom of ASD; Strang et al., 2018[b]).

Objectives: Examine the relationship between ASD traits (as reported by parent and self) and: self-reported intensity of gender dysphoria, LGBTQ-related stigma, and specific perceived barriers to obtaining gender care.

Methods: Thirty-nine transgender youth, age 13-21 years, were recruited across the neurodiversity spectrum: transgender youth with confirmed ASD diagnoses (N=16); transgender youth with suspected, but unconfirmed ASD or autistic traits (N=10); and transgender allistic (i.e., non-autistic) youth (N=13). Measures of autistic traits were given: parent-reported Social Responsiveness Scale-2 (SRS-2; Constantino et al., 2012) and self-reported Broader Autism Phenotype Questionnaire (Hurley et al., 2007). Youth participants completed the Utrecht Gender Dysphoria Scale (UGDS; Cohen-Kettenis & van Goozen, 1997) and the LGBT Stigma Scale (Weinhardt et al., 2017, Logie & Earnshaw, 2015). Youth also answered questions regarding gender affirmation barriers including barriers related to executive function, and barriers related to social anxiety/reactions of others. Spearman correlation analyses were conducted to examine the relationship between ASD traits and GD intensity, barriers and stigma. FDR corrections for multiple comparisons were applied.

Results: Positive correlations were observed between gender goal barriers related to executive function and both SRS-2 and self-reported BAPQ scores (r=.463(p=.012) and r=.434(p=0.012) respectively). No significant correlations were found between ASD trait measures and the UGDS (intensity of gender dysphoria), the LGBT stigma scale, or other barriers.

Conclusions: Results suggest transgender people with increased autistic traits may require additional levels of executive function support to help them meet their gender related needs and goals. The lack of relationships between level of autistic traits and experienced gender dysphoria provides further evidence that gender diversity experiences of transgender autistic individuals are similar to those of transgender people in general.

142 **140.142** Barriers to Healthcare in an Insured Latino Population with ASD

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Background:
In the United States, ethnic minorities are more likely to receive inferior mental health care than Whites. The disparity extends to autism spectrum disorders (ASD) where Latino children experience critical delays in diagnosis and treatment. These health care disparities are partially

explained by structural barriers, such as lack of insurance, or limited availability of services. However, even when controlling for structural factors, ethnic minorities underutilize available health care services. This exploratory study will identify barriers to accessing resources and recommended assessment, diagnostic, and treatment services for ASD among Latino children receiving healthcare at Kaiser Permanente Northern California (KPNC).

Objectives:

To describe how socioeconomic and language factors affect access to healthcare resources and utilization of behavioral and mental health services among Latino children with ASD across target subgroups defined by insurance type (Commercial vs. Medicaid) and primary language (English vs. Spanish).

Methods:

We identified all Latino children with ASD among the membership of KPNC (N=3263). English and Spanish survey materials were mailed to 1164 parents in the 4 target subgroups with the goal of obtaining 100 completed surveys per subgroup. Three weeks after the initial mailing, we called non-responders to invite them to complete the survey by phone. The survey covered parental access to information about ASD services and resources, barriers to use of ASD services (e.g., cost, lack of awareness, logistics, language barriers), parent literacy and health literacy, and social determinants of health and healthcare access (e.g., food insecurity, trouble paying for different basic necessities, transportation difficulties, social support). Data collection began in 2018 and is ongoing. Differences by language and insurance type were examined for the first 50 completed surveys in each subgroup (total N=200).

Results:

Significant differences by language were seen regarding low educational attainment (76% of Spanish vs, 19% of English speakers had no education beyond high school and 36% vs. 3%, respectively, had not completed high school), health literacy (34% of Spanish vs. 3% of English speakers lacked confidence filling out health related forms by themselves), receiving unpaid help with their child from friends/family (71% of Spanish vs. 44% of English speakers), never or rarely getting enough social and emotional support (52% of Spanish vs. 38% of English speakers), and use of the patient portal to communicate with their child's clinical care team (18% of Spanish vs. 75% of English speakers). Significant differences by insurance type were seen for household income < $35,000 (48% of Medicaid vs. 11% of Commercial), trouble paying for housing (18% of Medicaid vs. 8% of Commercial), and trouble paying for ASD services (7% of Medicaid vs. 35% of Commercial). Approximately 1/3 of the sample was food insecure, with notable differences in prevalence between English-speaking Commercial (16%) and English-speaking Medicaid (50%).

Conclusions:

Preliminary results indicate that in this population of insured Latino children with ASD, family social and economic risk factors such as low income, low health literacy, and lack of social support may limit parents' ability to utilize developmental evaluations and specialty ASD care for their children.

143 **140.143** Caregiver Perspectives on Treatment for Challenging Behaviors in School-Age Children with Autism Spectrum Disorder

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Background: Children with autism spectrum disorder (ASD) are at risk for challenging behaviors, including aggression, oppositional behaviors, and tantrums or meltdowns. Despite the effectiveness of pharmacological and behavioral interventions for challenging behaviors in a considerable number of children with ASD, there is little information on stakeholder perspectives about the available treatments. Increasing knowledge about stakeholder perspectives may help providers better understand preferred approaches within the ASD community and support greater treatment acceptability and compliance.

Objectives: To characterize caregiver perspectives on challenging behavior treatment for school-age children with ASD.

Methods: A survey about challenging behavior treatment use was sent to an autism research center mailing list of ~10,000 individuals. 346 caregivers of children with ASD aged 7 to 17 years who had undergone treatment to address challenging behaviors completed the survey. Kruskal-Wallis rank-sum tests and subsequent pairwise comparisons using a Wilcoxon rank-sum test with False-Discovery Rate-adjusted p-values ($q<0.05$) were conducted for caregiver ratings of treatment satisfaction, helpfulness, and amount of improvement maintained over time. Analyses were completed separately for children with a caregiver reported IQ≥70 and children with a caregiver reported IQ<70.

Results: Caregivers reported attempting distraction (n=214), identifying triggers and using reward systems not as part of an ABA program (hereinafter, "triggers/rewards") (n=211), medications (n=208), Applied Behavior Analysis (ABA) (n=187), Collaborative Problem Solving (CPS) (n=101), Zones of Regulation (ZOR) (n=67), Parent-Child Interaction Therapy (PCIT) (n=42), and Unstuck and On Target (UOT) (n=19). For children with an IQ≥70, the omnibus test was significant for caregiver ratings of treatment satisfaction ($\chi^2(8)=16.147$, $q=0.040$); pairwise tests revealed no significant differences among treatments. The omnibus test was also significant for caregiver ratings of treatment helpfulness ($\chi^2(8)=38.065$, $q<0.001$) with medications rated significantly more helpful than PCIT, ABA, distraction, triggers/rewards, and ZOR; and CPS more than triggers/rewards. The omnibus test was significant for caregiver ratings of amount of improvement maintained over time ($\chi^2(8)=45.56$, $q<0.001$) with medications rated significantly higher than PCIT, ABA, distraction, triggers/rewards, and ZOR; CPS higher than PCIT, distraction, triggers/rewards, and ZOR; and ABA higher than triggers/rewards. For children with an IQ<70, the omnibus test was significant for caregiver ratings of treatment helpfulness ($\chi^2(8)=19.845$, $q=0.011$); pairwise tests revealed no significant differences between treatments. The omnibus test was not significant for caregiver ratings of treatment satisfaction ($\chi^2(8)=13.811$, $q=0.087$), or amount of improvement maintained over time ($\chi^2(8)=5.709$, $q=0.680$).

Conclusions: This is one of the first studies to examine caregiver perspectives on treatments for challenging behaviors in school-age children with ASD. For children with an IQ<70, there were no significant differences among caregiver ratings of treatment types. However, for children with an IQ≥70, medications, Applied Behavior Analysis (ABA), and Collaborative Problem Solving (CPS) received significantly higher caregiver ratings than other treatments. While medications and ABA treatments are standard-of-care interventions, CPS is an evidence-based treatment for targeting challenging behaviors in Oppositional Defiant Disorder that relatively few caregivers in our study have tried with their children. CPS may be a preferred and efficacious treatment option that is underutilized for a subgroup of children with ASD and challenging behaviors.

144 **140.144** Caregiver-Reported Use of Autism-Related Services in the Dallas-Fort Worth Metroplex and Associated Satisfaction

Ratings

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Background:

The prevalence of Autism Spectrum Disorder (ASD) has risen rapidly to 1 in every 59 children. Being one of the fastest growing developmental disorders, the need for services outpaces availability for individuals with ASD. Texas is ranked 50th (out of the 51 states included) in providing community-based services for people with developmental disabilities. In order to make community- and state-level policy recommendations to address this issue, it is important to understand the specific landscape of met and unmet needs of individuals with ASD. By identifying gaps in service availability and use of services, policymakers, healthcare providers, and community advocates will be better equipped to design programs that facilitate access to appropriate and timely interventions.

Objectives:

We aimed to identify patterns of service utilization among individuals with ASD and their families in the Dallas/Fort Worth (DFW) area, a large population center in northeast Texas. We predicted that service navigation and financial burden would be among the most difficult challenges caregivers faced.

Methods:

We conducted a cross-sectional study to assess the services used by individuals with ASD in the DFW area, and satisfaction with these services. We created the Autism Service Utilization and Satisfaction survey by combining new items with adaptations of two existing instruments, the Pathways in ASD and the Community Services Outcomes for Families and Children with ASD. The survey was delivered to caregivers of individuals with ASD and adult self-advocates with ASD using REDCap, an online secure project management service. The survey captured family demographics, services utilized (e.g., type, setting), and associated satisfaction. Preliminary analysis included 26 caregiver respondents; demographics are presented in Table 1.

Results:

Preliminary qualitative analysis revealed several notable trends in caregivers' self-reports of the most challenging issues they faced after a diagnosis was made. Caregivers reported difficulty navigating services: 47% struggled to find the appropriate services for their child, 29% did not know where to start, and 24% had difficulty scheduling and maintaining appointments with providers. Overall, 29% reported that affording services and qualifying for help was one of their three most challenging issues. Additionally, 82% of caregivers affirmed that they identified a resource but could not pay for it, 67% were satisfied with the diagnostic services provided by their school district, and 71% were satisfied with education programs meeting the recipient's behavioral and emotional needs. Finally, 88% either disagreed or were neutral about overall satisfaction with available services and providers.

Conclusions:

Preliminary examination of responses suggests that caregivers in the DFW area have difficulty navigating their child's diagnosis and case management. Participants confirmed our hypothesis that they were satisfied with the diagnostic and educational services the school provided; however, they had trouble paying for the services and qualifying for help through insurance and other means. This further emphasizes the importance of identifying resources that families are using, and where the gaps lie in their access to these resources. Data collection is ongoing through partnership with clinics, schools, and community organizations in Dallas-Fort Worth.

145 **140.145** Change in the Use of Request Strategies over Time in Parents of Toddlers with ASD

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Background:

Compliance to parental requests is considered a developmental hallmark in early childhood, and is related to a range of positive outcomes for children with and without developmental disabilities (Kuczynski & Kochanska, 1990). The way parents communicate with their children plays an important role in eliciting their compliance (Radley & Dart, (2016). Various child factors may contribute to how parents communicate with their children, namely children's maladaptive behavior (Ostfeld-Etzion et al., 2016). It is important to understand how these factors may change how parents communicate with their children over time.

Objectives:

This study aims to explore predictors of change in parental request strategies over time.

Methods:

Participants were part of a randomized efficacy trial of a parent-mediated social communication intervention (JASPER; Kasari et al., 2015). 86 toddlers with ASD (CA = 24 - 36 months) and their primary caregivers completed a video-taped clean-up task at entry and, 10 weeks later, at exit. Parents were also asked to complete the Infant Toddler Social Emotional Assessment (ITSEA; Briggs-Gowan & Carter, 2000), a measure of children's maladaptive behavior. Parent's use of request strategies during the task was coded in 10-second intervals to include 6 types of requests: Unclear command, direct command, indirect command, reprimand, positive incentive and reasoning. Proportions of each request strategy used during the task was calculated for parents at both time points. Change scores between entry and exit were calculated for the three subdomains of ITSEA - internalization, externalization and dysregulation - and the proportion of each request strategy. Paired sample t-tests were conducted to determine that there were no differences between the treatment groups on any of the outcome variables. Separate linear regressions were conducted to predict the 4 most used request strategies: Unclear commands, direct commands, indirect commands and reprimands. Change scores for each ITSEA subdomain were entered as predictors, and the regression model controlled for treatment group assignment.

Results:

At entry parents used, on average, 0.05 unclear commands, 0.45 direct commands, 0.26 indirect commands, and 0.05 reprimands per interval. At exit, parents used, on average, 0.07 unclear commands, 0.32 direct commands, 0.32 indirect commands, and 0.10 reprimands per interval. Linear regressions predicting the change in the proportion of each strategy used, controlling for treatment group, revealed that change in ITSEA

dysregulation (b = -0.243, p < 0.01), ITSEA internalizing (b = 0.181, p < 0.05) and ITSEA externalizing (b = 0.172, p < 0.05) scores predicted change in the proportion of unclear commands used by parents. Only change in ITSEA dysregulation scores (b = 0.420, p < 0.05) predicted change in the proportion of indirect commands. The regressions predicting change in direct commands and reprimands did not emerge as significant.

Conclusions:

Children's internalizing, externalizing and dysregulation, as reported by parents, emerged as a significant predictor of change in parental request strategy use over time. This emphasizes the transactional nature of parent-child interactions, and indicates the need for parent education curriculums that teach parents how to address maladaptive behaviors and optimize communication with their children with ASD.

146 **140.146** Changes in Autism Nosology: Stigma, Knowledge, Contact, and the Removal of Asperger's Syndrome from the DSM-5.

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder diagnosed in one in every 59 eight-year-olds (CDC, 2014). Further insights into the heterogeneous nature of ASD have contributed to the revised diagnostic criteria. Research has documented evidence to classify the disorder as a spectrum with severity ranges (Lord & Jones, 2012; *DSM-5,* American Psychiatric Association, 2013) instead of a categorical system comprising Pervasive Developmental Disorder—Not Otherwise Specified, Asperger's Syndrome, and Autistic Disorder (*DSM-IV-TR*, American Psychiatric Association, 2000). However, classification under an umbrella diagnostic label represents individuals with a wide range of symptoms and may assume homogeneity (Lord & Jones, 2012). This conceptualization can promote stigma and pessimistic attitudes (Corrigan, 2007). Indeed, individuals previously diagnosed with Asperger's Syndrome have raised concerns regarding stigma that may be associated with ASD (Linton et al., 2014).

Objectives: This study examined undergraduate students' perceptions of a label of ASD compared to Asperger's syndrome or no diagnosis. It was hypothesized that participants would associate increased stigma with ASD compared to Asperger's syndrome. Additionally, no diagnostic label would promote greater stigma than assigned diagnostic labels.

Methods: Raters included 71 undergraduate students from Roosevelt University. Participants were randomly assigned to read a vignette adapted from prior research (Ohan et al., 2016) about a student with one of three labels (i.e., ASD, Asperger's Syndrome, No Diagnosis). Participants also completed questionnaires, including an adapted Social Distance Scale (SDS) (Bogardus, 1925), which assessed their comfort level with the individual, the ASK-Q (Harrison et al., 2017), which assessed participants' knowledge of ASD in general, and additional questions regarding level of contact with ASD.

Results: Differences in comfort level ratings between the three conditions were assessed using one-way ANOVAs. Post-hoc comparisons were conducted following significant multivariate differences. Results revealed more positive ratings for the Asperger's compared to the ASD condition on a number of SDS items. Participants rated being more comfortable residing in the same hall as an individual with Asperger's than an individual with ASD (p=.01). When asked about comfort as a child's caretaker, group differences revealed higher ratings for the Asperger's condition compared to the ASD condition (p<.05). No group differences emerged between the Asperger's and ASD groups when asked about going to dinner or a sporting event (ps>.72). Significantly higher positive ratings were associated with both ASD and Asperger's conditions compared to No Diagnosis (ps<.05). All results remained significant when covarying for ASK-Q and contact scores.

Conclusions: Results demonstrate the impact of diagnostic labels in different social contexts, and support the need for education surrounding the change in diagnostic criteria. Having greater responsibility and more prolonged exposure increased stigma in the ASD condition compared to the Asperger's condition. Short-term interactions did not raise the same concerns and were rated similarly between the ASD and Asperger's conditions. Diagnostic ambiguity may result in greater discomfort than concrete diagnostic labels, suggesting the benefit of obtaining a diagnosis. Additional research on the perception of the ASD label should be conducted to better understand stigma associated with ASD.

147 **140.147** Characterizing Challenging Behaviors in Preschoolers with ASD: Home and School Contexts

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Background:

94% of children with ASD exhibit challenging behaviors (CBs; Jang et al., 2010). CBs impact the wellbeing of parents (Davis & Carter, 2008; Hayes & Watson, 2012) and burnout rates in teachers (Hastings & Brown, 2002). A greater understanding of situations in which CBs commonly occur would allow for the development of tailored, situation-specific interventions, helping to reduce parent stress and teacher burnout. However, there is little information on contexts where CBs are most prevalent and most severe from the perspectives of parents and teachers. Additionally, many studies that examine CBs are cross-sectional (Lecavalier et al., 2006), with few examining CBs longitudinally.

Objectives:

1) Determine in which situations parents and teachers: a) most commonly report child CBs and b) report high severity CBs. 2) Examine change in parent-reported CBs over 12 months.

Methods:

This study used data from a social communication RCT collected across three timepoints (entry, exit, 6-month follow-up). Preschoolers (n=145) using <30 spontaneous words at entry received 6 months of behavioral intervention (JASPER or DTT). At each timepoint parents completed the Home Situations Questionnaire-PDD (HSQ), which assesses behavioral noncompliance in everyday contexts. Parents were asked to report whether their child exhibits CBs across a variety of settings, and if so, how severe they perceive those behaviors to be (1=mild to 9=severe). Teachers completed the School Situations Questionnaire (SSQ), which assesses child noncompliance within the school context.

Results:

Across all three timepoints, parents reported that children most frequently displayed CBs while attending group events, playing with other children, transitioning between activities, and being out in public places (Table 1). They reported that the most severe CBs occurred when children

were taken to appointments, attended group events, when repetitive behavior was interrupted, and when out in public places (Table 1).

Across all timepoints, teachers most commonly endorsed that students displayed CBs during small group activities, individual desk work, and during lessons (Table 2). Teachers reported most severe CBs across timepoints were while on field trips, during small group activities, and during lessons (Table 2).

Linear mixed models were used to investigate change in parent-reported CBs over time (entry, exit, follow-up). Analyses controlled for treatment group, ADOS total score, chronological age, and Mullen visual reception scores. The treatment x time interaction was not significant and was removed from subsequent analyses. HSQ severity differed significantly from entry to exit (B=-.32, p=.014), but not from entry to follow-up.

Conclusions:

These results provide rationale for targeting of CBs in behavioral interventions for preschoolers with ASD, illustrating in which situations parents and teachers may benefit from supports. Parents most commonly endorsed severe CBs during routine changes and in social situations, while teachers reported that CBs occurred during lesson times. Parents and teachers may benefit from training in managing CBs around these specific situations.

Results also indicate that CBs reduce over time with intervention, but the reduction is not maintained. This finding suggests that parents may benefit from intervention booster sessions once social communication interventions have ended to help maintain the reduction in CB severity.

148 **140.148** Community Engagement in Deafness and Autism Research: Organizer Experiences

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Background: Research with marginalized groups increasingly aims to include representatives from the groups studied not just as data-generators, but as key contributors in developing and executing the research. The scientific community is shifting in kind: 1) with improvements in access to education, researchers who study neurodiverse populations are more often themselves members of those communities; 2) an understanding that research should respect the needs of stakeholders; 3) a recognition that research requires extensive community collaboration. Certainly, the process of scientific inquiry requires training and expertise; but what is the role of researchers who are *not* members of the community they research? Community engagement is particularly complex when the very nature of human interaction is under investigation, with studies involving consent and the emergence and use of conventional communication skills.

Scientific research with deaf people and autistic people (and people who are both deaf and autistic) exemplifies the challenge of navigating community, culture, and marginalization. Over the past sixty years, research on Deafness has led to watershed advances in our understanding of the fundamental building blocks of human language. Deaf researchers have made strides in persuading the scientific community to jettison the "medical model" in which deafness was construed as something that needed to be *fixed* rather than accepted as part of the diverse spectrum of humanity. These changes came about primarily because non-researcher and researcher members of the Deaf community were engaged as partners in the research enterprise.

Objectives: To present lessons learned from a 2018 workshop.

Methods: Drawing on our collective expertise (personal and scientific), and on the experiences of autism community organizations (e.g., ASAN), a team of scientist and non-scientist Deaf, Autistic, and neurotypical (i.e., individuals who are not autistic) people gathered in October, 2018 to discuss the challenges of engaging non-scientist Deaf and autistic communities in research. Steve Silberman, author of *Neurotribes*, was an invited speaker. Facilitated discussions and shared meals created spaces for exchanging ideas. The planning process was itself challenging, as Organizing Committee members struggled with difficulties in communication, differing expectations about how to accommodate individual needs, and with shifting and differing goals.

Results: Important similarities and differences characterize the Deaf and Autistic communities, including questions about who speaks for the community, the importance of labels, and the utility of community members raising their voices to affect public policy. We also learned firsthand that Deaf individuals *with autism* are grossly underserved; the rapidly growing number of Deaf autistic individuals in the US have very limited access to services, research, and a community.

Conclusions: Given that many others may wish to include non-scientist community members in a group enterprise, we share the collective wisdom that our group takes away from this meeting. While many others have engaged in a similar process, the historical and experiential parallels between the Deaf and Autistic communities provide a unique foundation for improving on the process; with others, we will build on this momentum in planning future meetings.

149 **140.149** Community-Partnered Participatory Research in Autism: Engaging Underresourced African American, Korean and Latino Communities

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Background: Despite the advancement in ASD research, engaging underresourced minorities remains a challenge. In addition to financial barriers, cultural factors contribute to these families' low research participation. For example, many African Americans (AA) who have experienced history of research abuse distrust research; Korean Americans, the majority of whom are first-generation immigrants, are excluded from most ASD studies due to language barriers. Community members who understand cultural barriers can help motivate families to participate in research. In community-partnered participatory research (CPPR), community members share power equally with academic partners in all research phases and ensure research prioritizes community needs. CPPR utilizes community engagement conferences to educate the community and build research-community trust. CPPR conferences have shown success in engaging underresourced communities in other disciplines, but have not been examined in ASD.

Objectives: The goal of the study was to examine whether a CPPR conference can engage underresourced AA, Korean, and Latino communities and

increase attendees' perceived ASD knowledge and trust toward research.

Methods: The conference, held in a Los Angeles church for four consecutive years, was part of the AIR-B III Network's larger CPPR study. Academic and community partners met monthly to plan the conference and multicultural staff reached out to diverse communities. Conference attendees were verbally consented to participate in demographic, perceived ASD knowledge and research trust, and conference evaluation surveys. English, Korean, and Spanish materials and simultaneous interpretation were provided. Community and academic partners co-led conference sessions, directed attendees and collected data together.

Results: Excluding staff (>50), 153 participants attended. More than half (51%) were caregivers of individuals with ASD, with 21% earning $9,999 or less annually. Races included Latino (49%), Asian (24%), AA (18%) and others (8%); 39% reported their primary language as non-English (Table 1). Bonferroni-adjusted repeated measures t-tests were conducted to examine score changes on the 15-item perceived ASD knowledge and research trust survey pre- and post-conference. Attendees showed increases in perceived knowledge in core deficits of ASD ($t(94)=3.04$, $p=.003$)), finding effective therapies ($t(94)=5.19$, $p<.001$)), and trust in community agencies ($t(94)=3.50$, $p=.001$)) and ASD research ($t(93)=5.21$, $p<.001$)) (Table 2). Analyses by race also revealed Latinos' increased understanding of research participants' rights. However, AA showed no change in any items, in part due to their higher baseline scores; Asians showed an increase in perceived knowledge in core deficits of ASD only. No decreases in scores were found. Attendees agreed that the conference increased their knowledge about autism and services (99%), advocating for individuals with autism (98%), transitions (100%), and that the conference helped them make new connections (99%). AA and Latinos rated the conference higher than Asians.

Conclusions: The CPPR conference successfully engaged diverse underresourced communities, increased attendees' perceived ASD knowledge and research trust, and was highly rated. Findings highlighted the need for culturally-tailored information; the conference's impact and ratings differed by race. Each group's baseline knowledge, culture-specific attitudes, and native language likely contributed to differential results. Future research should consider incorporating culturally-adapted contents in CPPR conferences and examine research-community partnerships' long-term impact on the autism community.

150 **140.150** Comparison of Parental Stress, Parental Efficacy, and Child Problem Behavior between ASD and Non-ASD Youth: A Multi-Group Confirmatory Factor Analysis

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Background: Several studies have examined the role of parental stress and child outcomes in autism spectrum disorder (ASD). However there is little research examining positive parental characteristics, such as self-efficacy, that may reduce the impact of stress in families with a child with ASD. Whether the relationships between parental stress, parental self-efficacy, and child problem behavior outcomes have the same measurement characteristics across groups (ASD/non-ASD), known as measurement invariance, is also unclear.
Objectives: To examine the relationships between parental stress, parental self-efficacy, and child problem behavior using confirmatory factor analysis (CFA). To examine differences in the measurement of these latent variables between ASD and non-ASD samples.

Methods: Participants were 1035 hospitalized children and adolescents, 937 with an Autism Diagnostic Observation Schedule-2 (ADOS-2) confirmed ASD diagnosis, and 98 participants with non-ASD developmental delay, admitted to one of six specialized inpatient psychiatry units and prospectively enrolled in the Autism Inpatient Collection (AIC) study. Parents completed the Aberrant Behavior Checklist Irritability (ABC-I) subscale, Parent Stress Index Short Form (PSI-SF-4) and Difficult Behavior Self-efficacy Scale (DBSS) at admission. The measurement model contained three latent variables – parental stress, parental self-efficacy, and child problem behavior – which were measured using observed variables of each as indicators (see Figure 1). A multi-group CFA was conducted using AMOS version 25.

Results: Individual model results indicated the three latent variables were significantly correlated with each other in a manner that supported the validity of each for the ASD sample only: parental efficacy was negatively correlated with both parental stress and child problem behavior and parental stress was positively correlated with child problem behavior (all p-values ≤ .001). In the non-ASD sample, only parental stress and child problem behavior were positively correlated with each other (p ≤ .001). Group differences were also found among the observed variables used as indicators to measure the child problem behavior latent variable. Specifically, self-injurious behavior items did not contribute to the measurement of child problem behaviors in the non-ASD sample, β= 0.104, p=0.25. Multi-group CFA results indicated differences between group correlations ($\chi^2 = 57.5$, $df = 13$, $p = 0.001$) and means of the observed variables ($\chi^2 = 44.5$, $df = 7$, $p = 0.001$) between ASD/non-ASD groups, however we did not find differences between group factor loadings, that is, how well the observed variables measured the underlying latent variable.

Conclusions: Relationships between parental stress, parental self-efficacy, and child problem behaviors differed between parents of children with ASD compared to those without. Measurement invariance was not found across groups. By applying CFA we're able to obtain more reliable measures of the underlying constructs of parental stress, parental self-efficacy, and child problem behaviors and the correlations between them. Of clinical importance, while parental stress is correlated with child problem behaviors in both samples, self-efficacy in parents of children with ASD may be a positive characteristic for reducing both parental stress and child problem behavior. Interventions targeting parental self-efficacy could be a novel treatment target with downstream effects on both members of the parent-child dyad.

151 **140.151** Comparison of Parenting Stress, Efficacy, and the Home Environment Among Families of Youth with ASD, ADHD, and ASD with ADHD Features

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Background: Given the persistent and pervasive nature of Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD), difficulties often extend beyond the child resulting in challenges regarding parental and family functioning. Parents of youth with ASD or ADHD commonly report heightened parenting stress, decreased parental efficacy, and disruption in the home environment (e.g., Hayes & Watson, 2013;

Theule, Wiener, Tannock, & Jenkins, 2013).

Objectives: While many studies have compared experiences of parents of youth with ASD or ADHD to parents of typically developing children, a paucity of research has explored differences in parenting and household experiences between families of youth with ASD, ADHD, and those presenting with symptoms of both disorders. Therefore, the present study aimed to begin to address this gap in the literature.

Methods: 124 youth were included in the current analyses; subgroups reflect ASD alone (ASD- n= 76), ADHD alone (ADHD- n= 29) and ASD with clinical levels of ADHD via the Child Behavior Checklist (ASD+ n= 19). Adolescents presented for participation in the PEERS® intervention; data collected prior to the intervention is used here. Presence of ASD was confirmed with the ADOS-G (Lord et al., 2000), and a composite IQ greater than or equal to 70 was required for the ASD participants (KBIT-2; Kaufman & Kaufman, 2004). Youth presenting for ADHD provided documentation of an established diagnosis and demonstrated clinically-significant ADHD symptoms on the Disruptive Behavior Disorder scale (DBD; Pelham, Gnagy, Greenslade, & Millich, 1992). Parental and family functioning was assessed using the Stress Index for Parents of Adolescents (Sheras, Abidin, & Konold, 1998), Parent Sense of Competency Scale, Efficacy Subscale (Johnston & Mash, 1989), and the Confusion Hubbub and Order Scale (Matheny, Wachs, Ludwig, & Phillips, 1995).

Results: Results of ANOVA and MANOVA analyses indicated that total parenting stress and subscales of parent-domain stress (restrictions on life and social alienation) were significantly greater in the ASD+ group compared to the ASD- and ADHD- groups (Table 1). Subscales of the adolescent-domain parenting stress (adolescent moodiness, delinquency, and failure to achieve), as well as overall home disruption were significantly greater in the ADHD and ASD+ groups compared to the ASD- group (Table 1). Parental efficacy was marginally greater in the ASD- group compared to the ADHD group (Table 1).

Conclusions: Findings from the present study revealed significant differences in parenting stress and home disruption, but less robust differences in parental efficacy among parents of youth with ASD, ADHD, and ASD with ADHD features. The pattern of differences appears to be driven by either a compounding effect of ADHD and ASD or the presence of ADHD symptoms. The results highlight the importance of screening for comorbidity among these populations as varying neurodevelopmental presentations appear to be associated unique parental and family functioning and, in turn, likely impact treatment recommendations. While a strength of this study is the comparison between multiple clinical groups, lack of a typically developing control sample, small sample sizes, and reliance on parent-report limit the interpretation and generalizability of these findings.

152 **140.152** Cultural Adaptation of an Evidence-Based Social Skills Intervention for Latino Families in the Inland Empire: A Feasibility Study

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Background:

Obtaining stakeholder feedback when adapting interventions for autism is integral to assure culturally sensitive practices (Hwang, 2009). The Program for the Education and Enrichment of Relational Skills (PEERS), a parent-assisted social skills intervention for adolescents with autism spectrum disorder (ASD), has been found to be effective in eight randomized controlled trials conducted across multiple sites (Laugeson et al., 2009; Laugeson et al., 2012; Schohl et al., 2013; Yoo et al., 2014; Matthews et al., 2018; Jagersma et al., 2018; Shum et al., 2018; Rabin et al., 2018). While PEERS has been adapted for Asian and European populations, most studies on the effectiveness of PEERS in North America have been conducted with primarily Caucasian families of middle to high socioeconomic status. The effectiveness of PEERS for low-income Latino families has yet to be examined. The Inland Empire (I.E.) area of Southern California is an ideal place to expand the PEERS intervention to families who have been historically left out of intervention research. As a first step in the cultural adaptation of PEERS for underrepresented families in the I.E., we obtained parent perspectives on the practicality of the intervention.

Objectives:

The current study examines stakeholder perspectives on the feasibility of the PEERS intervention with primarily low-income Latino families in the I.E.

Methods:

Three 90-minute focus groups were conducted with 19 parents of youth with ASD in the I.E. (Latino=16, Caucasian=3, Spanish-speaking=9, English-speaking=10). Parents were recruited from local school districts, community organizations, parent groups, and flyers posted in the community. Parents completed questionnaires and engaged in a group discussion regarding the feasibility of the PEERS intervention. Our main questions were: 1) Is the original format of the program (weekly 90-minute sessions for 16 weeks) feasible? 2) What is the preferred timing of the program? 3) What are the barriers to participation? Data were analyzed through quantitative (i.e., responses on questionnaires) and qualitative (i.e., group discussion themes) methods.

Results:

The majority of parents reported that the original 16-week format of the program is feasible (*n*=13), while some parents reported that a shorter length of the program would be preferable (*n*=5). Most parents preferred sessions to be on weekdays from 6-8 pm (*n*=15) or on weekends (*n*=10), and fewer parents preferred weekdays from 4-6 pm (*n*=6). The greatest barriers to participation were childcare issues (*n*=7) and work schedules (*n*=5). Other barriers included getting to the groups (*n*=4) and the length of the program (*n*=4). The main theme that emerged from the group discussion was that parents perceive a lack of services and a need for evidence-based interventions for adolescents with ASD in the I.E.

Conclusions:

This preliminary study aimed to increase the accessibility of an evidence-based social skills intervention for underresourced Latino families in the I.E. Overall, results suggest that parents endorse the feasibility of the PEERS intervention and have a desire to participate in it. Implications for decreasing disparity in autism intervention research are discussed.

153 **140.153** Depression, Self-Efficacy, and Family Functioning Reported By Mothers of Children with Autism Spectrum Disorder

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Background: Clinically significant depressive symptoms are reported in 30-50% of mothers of children with autism spectrum disorder (ASD), compared to 10% of mothers of typically-developing (TD) children. Improving our understanding of the prevalence and relationship of depressive symptoms to family functioning and child outcomes is needed to support professional practices as well as national and state policy decisions. Understanding the burden of depression requires rigorous study involving validated instruments, large heterogeneous samples, and comparison groups. In other populations, maternal depression is associated with lower family functioning and lower maternal self-efficacy. Evidence exists that maternal self-efficacy mediates the relationship between maternal depression and child behavior. The nuances of the relationships among these variables, however, have not been studied in ASD. Understanding these relationships will help researchers design tailored interventions to improve outcomes in families with a child on the autism spectrum.

Objectives: (1) Compare mean depression score and prevalence of depressive symptoms in mothers of children with ASD to mothers of Down syndrome (DS) children and TD children. (2) Describe the mediating role of maternal self-efficacy in the relationship between depressive symptoms and child behavior, controlling for family functioning.

Methods: Convenience sample of mothers 18 and older living with a biological child under 18, diagnosed with ASD, DS, or TD, completed an online survey with SCQ, ABC, PHQ-9, Family Assessment Device General Functioning Scale, Maternal Self-Efficacy Scale, Demographics.

Results: 245 mothers : 101 ASD, 101 DS, and 43 TD (power=0.8). Mean PHQ-9 score was higher in ASD group compared to DS and TD groups (6.6 vs 4.0 vs 2.0, respectively, $p<0.001$).

Significantly more mothers in ASD group screened positive for depression than the DS and TD groups (23.8% vs. 11.9% vs. 0% respectively, $p<0.001$).

A higher proportion of mothers of children with ASD met cutoff for poor family functioning compared to DS and TD groups (42.6% vs. 19.8% vs. 18.6%, respectively, $p<0.001$). Better family functioning is significantly associated with fewer maternal depressive symptoms ($r=0.408$, $p<0.0001$), better maternal self-efficacy ($r = -0.410$, $p<.0001$), and fewer child problem behaviors of irritability ($r=0.255$, $p<0.0001$), social withdrawal ($r=0.310$, $p<0.0001$), stereotypy ($r=0.236$, $p=0.0002$), hyperactivity ($r=0.217$, $p=0.0006$), and inappropriate speech ($r=0.350$, $p<0.0001$).

Controlling for family functioning, maternal self-efficacy statistically significantly mediated the relationship between maternal depressive symptoms and child behavior. The Sobel test revealed the percent of total effect mediated as follows: irritability (43%, $t=5.72$, $p<0.0001$), social withdrawal (29%, $t= 4.61$, $p<0.0001$), stereotypy (30%, $t= 4.12$, $p<0.0001$), hyperactivity (41%, $t= 5.13$, $p< 0.0001$), and inappropriate speech (43%, $t= 5.72$, $p< 0.0001$).

Conclusions: Significantly higher proportion of mothers of children with ASD screen positive for depression, compared to mothers of children with DS and TD. Associations among depressive symptoms, maternal self-efficacy, and family functioning were found. Parenting self-efficacy partially mediates the relationship between maternal depressive symptoms and child problem behaviors, controlling for family functioning. Interventions that (a) increase parenting self-efficacy and (b) improve how the family unit functions to support the needs of all family members may be helpful in addressing depression in mothers of children with ASD.

154 **140.154** Understanding the Oral Health Beliefs and Experiences in Latino Families of Children with ASD and Typically Developing Children

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Background:

Oral care is related to overall health and quality of life. Oral health of children is of particular importance because those with early childhood caries are at higher risk for developing gingivitis, periodontal disease, and other adverse health problems as they age. Culturally influenced factors that affect dental care utilization may include behaviors, beliefs, attitudes, and values, such as diet, infant feeding practices, care of primary teeth, concern for oral health, and dental knowledge. Research has shown that Latinos are less likely to believe in the need for regular professional dental care, more likely to have misperceptions about oral health, and less likely to have access to dental care than the general population. Similarly, children with Autism Spectrum Disorder (ASD) have also experienced oral care related disparities regarding access to trained dentists and receiving sub-standard care. To date, minimal research has explored oral health beliefs in Latino families with ASD and typically developing children, and little is known about how these families experience oral care.

Objectives:

Using a qualitative description methodology, this study examined oral health attitudes, beliefs, and practices in Latino families with and without children with Autism Spectrum Disorder (ASD).

Methods:

Participants were 18 English or Spanish-speaking Latino families with children aged between 6 and 12 years. Of the total, eight families had typically developing (TD) children, and 10 families had a child with ASD. The qualitative description approach consisted of conducting one-on-one, semi-structured interviews. Each family participated in three interviews: two caregiver interviews (36 total parent/caregiver interviews), and one child interview (18 total child interviews) for a total of 54 interviews. One of two bilingual study team members, both with extensive interview experience, conducted interviews in either English or Spanish. Parent/caregiver interviews lasted 30-180 minutes, and child interviews lasted 2-20 minutes. All interviews were audio-recorded, transcribed verbatim by a professional service, and translated if necessary. Transcripts were iteratively coded using thematic analysis by two coders, with the research team providing input on the coding scheme in order to reach a final consensus regarding findings.

Results:

Three themes arose from the interviews including *Vulnerability and Mistrust*, *Putting Children First,* and *Acculturation and Cultural Practices*. The Latino families described dissatisfaction with dental treatments and costs. They highlighted fear of the dentist and health care providers, due to their ethnic minority status, as key factors inhibiting receipt of dental care. Additionally, families discussed prioritizing other occupations of daily

living over oral care routines. Finally, they shared cultural influences on oral care habits that were passed on from their varied upbringing.

Conclusions:

These findings contribute to the literature discussing barriers to oral care among underserved Latino families. Understanding the importance of social and cultural influences on patients' health beliefs and behaviors, and considering how these factors interact at multiple levels of the health care delivery system, will assist in devising future interventions. Future programs need to take these issues into account to assure quality health care delivery to diverse patient populations

155 **140.155** Provider Feedback on the Integration of Parent Engagement Strategies into an Evidence-Based Parent Coaching Intervention for Toddlers at-Risk for ASD

ABSTRACT WITHDRAWN

Background: State-of-the-art evidence-based treatments for children with autism spectrum disorder (ASD) include parent coaching interventions (e.g., Schreibman et al., 2015) that require active parent participation. One implementation challenge with parent coaching interventions is community providers' level of training and comfort working directly with parents (Bailey et al., 1992). Little is known about how providers perceive training specific to parent engagement, in particular as part of an intervention for children with ASD.

Objectives: To use mixed-methods to characterize both agency trainer and therapist perspectives on parent engagement strategies integrated into a parent coaching intervention, Project ImPACT for Toddlers (PI^T; Stahmer et al., 2016), within a community-based train-the-trainer pilot study. The engagement strategies, referred to as Alliance, Collaboration, and Empowerment (ACEs), were adapted from a toolkit designed for child mental health services (Haine-Schlagel et al., 2016).

Methods: Fifteen community agencies serving toddlers with ASD each identified an agency leader to learn PI^T and become an agency trainer (n=14), who subsequently trained interventionists (n=24) within their agencies. Trainers were 21% Hispanic/Latinx; interventionists were 29% Hispanic/Latinx. 29% of trainers and 33% of interventionists had a special education credential. Training was delivered over 12 weeks and included two sessions focused on ACEs. After an additional three months utilizing PI^T independently, trainers and interventionists received an intervention feedback survey (1=strongly disagree to 5=strongly agree) and were invited to participate in an interview. The survey and interview guide questions specifically about ACEs are the focus of this study. Quantitative data were analyzed using SPSS; qualitative data were coded using an iterative grounded theory approach (Glaser & Strauss, 1967).

Results: The four ACEs survey items were combined into one attitudes score (Cronbach's alpha=.82; higher scores more positive). Overall, attitudes were positive (M=4.06; SD=.66). Demographic and background characteristics of trainers and interventionists were examined as predictors of ACEs attitudes. Provider age and ethnicity were not associated with attitudes. Experience working with children with ASD had a modest positive association (r=.34) and caseload had a modest negative association (r=-.39), but neither were statistically significant. ACEs attitudes did not vary for trainers versus interventionists, but providers with a general background (child development, early intervention) had significantly more positive ACEs attitudes (p=.041) compared to providers with a specialist background (SLP, PT, OT). Interview results indicated both trainers and interventionists agreed on the usefulness of the ACEs, their appropriateness for providers, and reported some sustainment in current practice. Trainers indicated high acceptability of ACEs and appropriateness for parents, and suggested placement of ACEs information earlier in training.

Conclusions: Results indicate that across service roles, providers consider training on parent engagement strategies to be useful and generalizable. Providers in supervisory positions had more positive attitudes about engagement strategies in their interviews but not in the survey data. Survey results preliminarily suggest that background (generalist versus specialist) may play a role in readiness to receive training on parent engagement strategies. Future research should examine whether provider use of parent engagement strategies improve both parent engagement and child outcomes.

156 **140.156** Supporting Autistic Children to Successfully Transition to Primary School: Perspectives from Parents and Early Intervention Professionals

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Background:

The transition to primary school is an important social and developmental milestone which may evoke significant anxiety and uncertainty for both children and families, as it is coupled with changes to existing supports. This transition can be particularly difficult for children diagnosed with Autism Spectrum Disorder (ASD) who face significant barriers to developing school readiness and experiencing a positive transition to school. There is a need to better understand how to support families and children diagnosed with ASD during this crucial time.

Objectives:

This study aimed to explore the perceptions of parents and early intervention staff on the factors contributing to school readiness and a successful school transition for children diagnosed with ASD.

Methods:

Focus groups and interviews exploring school readiness and transition for children diagnosed with ASD were conducted with 58 early intervention staff and 15 parents of children diagnosed with ASD who transitioned to school from autism specific early learning and care centres (ASELCC) at the beginning of 2018. Thematic analysis was undertaken to explore factors influencing school readiness and transition at both system and individual levels.

Results:

At the system level both early intervention staff and parents discussed the need for better communication and collaboration between early intervention staff, receiving teachers and parents. Both groups also noted that teachers receiving children must build a relationship with the child and have an adequate understanding and knowledge of ASD. Early intervention staff and parents also emphasised the need to utilise a strengths-based approach, incorporating a child's interests and skills to facilitate a successful transition to school. Early intervention staff noted that support provided by early intervention staff and parents advocating for the child was important for success. At the individual level, key issues highlighted were assisting children to develop independence, beginning the transition early to provide time to adjust, developing routines and structure, providing tools to facilitate transition, developing strategies to manage anxiety and individualizing the transition process.

Conclusions:

Findings indicate a number of factors which must be considered to facilitate the transition to school for children diagnosed with ASD. This study highlights the need for clear, collaborative and ongoing communication between parents, teachers and early intervention staff to support children diagnosed with ASD during the transition to school. Early intervention staff must provide support to families and work with receiving teachers to develop knowledge and understanding of ASD to facilitate better school outcomes for children diagnosed with ASD. Using a strengths-based approach, collaboration between all stakeholders and individualizing the transition process are essential for success.

Poster Session
141 - Interventions - Non-pharmacologic - Infant, Toddler, and Preschool
5:30 PM - 7:00 PM - Room: 710

157 **141.157** Effectiveness of Parent Training for Disruptive Behavior of Children with Autism Spectrum Disorder in a Clinic Setting

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Background: The Research Units on Pediatric Psychopharmacology (RUPP) Autism Network developed a parent training (PT) manual for children with autism spectrum disorder (ASD) and disruptive behavior. Randomized clinical trials suggest that manualized PT is an efficacious treatment for disruptive behavior in children with ASD (Johnson et al., 2007; Aman et al., 2009; Handen et al., 2015; Bearss et al., 2015). However, little is known about the effectiveness of this intervention when conducted in clinical settings, and in general results of studies evaluating the external validity of manualized psychotherapy treatments in community settings are inconclusive (Weisz, Donenberg, Han, and Weiss, 1995; Shadish, Matt, Navarro, and Phillips, 2000). We implemented an adaptation of the RUPP manual in a clinic setting. Administration differed from previous RCTs in that clinicians were encouraged to administer the treatment manual flexibly, with the primary goal of the clinic being to meet the unique needs of each patient.

Objectives: (1) Evaluate differences between implementation of the PT manual in a clinic setting to implementation in a previous RCT (Bearss et al., 2015); and (2) Compare the effects of the intervention conducted in a clinic setting to the previous RCT.

Methods: Participants included were children whose caregivers completed the parent training program and pre- and post- treatment questionnaires in the current outpatient behavioral health clinic (N=50). We analyzed data on child characteristics (age, gender, race, ethnicity, and diagnoses) and intervention characteristics (length of treatment, number of sessions attended, session content covered). We also conducted paired sample T-tests and calculated effect sizes for pre- and post-treatment questionnaires: the Home Situations Questionnaire, Autism Spectrum Disorder (HSQ-ASD; Chowdhury et al., 2015), Brief Assessment of Mealtime Behavior in Children (BAMBI; Lukens and Linscheid, 2008), and Children's Sleep Habits Questionnaire (CHSQ; Owens, Spirito and McGuinn, 2000). Data from the current clinical sample was compared to data reported in Bearss et al. (2015).

Results: Child Characteristics: Children in the current sample tended to be older (M=6.3) and less likely to have a diagnosis of ASD (48 percent) compared to the prior RCT. Intervention Characteristics: On average, caregivers attended treatment for 12.48 sessions over 15.33 weeks. Session topics covered in treatment differed some from the previous RCT. Outcome Measures: We saw a 40 percent reduction in HSQ-ASD Total Mean Severity Scores from pre- to post- treatment, yielding a large effect size, comparable to reductions exhibited on pre-treatment and 12-week follow up in the prior RCT. Small effects were observed on the BAMBI and CSHQ.

Conclusions: Overall, we found some differences in the children who were served and the sessions that were administered in our current clinical sample. Despite differences, decreases in disruptive behavior (assessed by the HSQ-ASD) were comparable to the previous RCT.Many individuals who participated in our parent training program were not included in the current analysis, due to missing/incomplete questionnaires. Therefore, the current sample may be biased. However, the current investigation provides preliminary support for PT for children with developmental disabilities and disruptive behavior in a clinical setting.

158 **141.158** Parent Training for Medicaid-Enrolled Families of Children with ASD

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Background: Parent training, in which providers teach parents to address their child's maladaptive behavior or skill development, is considered best practice in the treatment of autism spectrum disorder (ASD). However, it is underutilized in community settings, particularly for traditionally underserved families of children with ASD.

Objectives: Little is known about the use of parent training with families from lower-resourced backgrounds. The present study utilized Medicaid claims data and a survey of applied behavior analysis (ABA) providers to describe the parent training service use landscape for children receiving ABA services through the Michigan Medicaid Autism Benefit.

Methods: Six months of Medicaid claims for 879 youth receiving the Autism Benefit in a 12-county region were examined to determine the number of encounters of ABA parent training received per child. Child characteristics (age, gender, race, and ethnicity) were examined as potential predictors of number of parent training encounters. ABA providers who service Medicaid-enrolled children with ASD (n = 97) were asked to provide

a written description of parent training, and then asked to report how frequently they provide parent training for an average client per month and the content of their parent training sessions. Content analysis was used to code provider descriptions of parent training.

Results: Youth received an average of 1.5 parent training sessions (range 0-19 encounters), which was less than 2% of the total number of ABA encounters that they received. Only 1.6% of children received at least 8 encounters (consistent with lower intensity evidence-based models), and 44.9% received no encounters. Gender and racial minority status were not associated with number of parent training encounters, but Hispanic/Latino ethnic status and age were; thus, these two predictors were entered into a multiple regression model. The model was significant (R^2 = .01, F (2,876) = 4.49, p = .012), with Hispanic/Latino status predicting fewer parent training encounters (β = -.069, p = .043) and younger age predicting more (β = .077, p = .023).

The majority of providers reported delivering 1-2 encounters of parent training per month (74.2%). Providers reported that the content of their parent training sessions primarily included principles of ABA (90.8%), communication skills (87.8%), self-care skills (85.7%), and play skills (70.4%). When defining parent training, most providers described it as an opportunity to discuss the child's progress with caregivers or to provide psychoeducation. Providers infrequently mentioned the use of evidence-based strategies like modeling an intervention strategy or providing time for caregiver practice with feedback.

Conclusions: Parent training is infrequently provided to this population, with younger children receiving significantly more sessions. Hispanic/Latino individuals received significantly less parent training sessions, possibly due to language and cultural barriers. Providers reported a substantially higher rate of parent training than what was reflected in the claims data, with session content targeting a range of relevant skills. Yet providers appear to be largely unaware of evidence-based parent training components and use critical components infrequently; thus, additional pre-service and in-service training is needed to increase community use.

159 **141.159** Community Interventionists' Perspectives Toward Using Parent Coaching

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Background: University-based randomized trials demonstrate that parent-mediated early intervention for children with autism spectrum disorder (ASD) results in improved child outcomes across a range of developmental domains, as well as improved parental self-efficacy and treatment engagement (Green et al., 2010; Kasari et al., 2014; Rogers et al., 2012; Wetherby & Woods, 2006). The manner through which interventionists coach parents is a critical component of all parent-mediated interventions. Effective parent coaching requires the therapist to actively teach the parent techniques to improve their child's development. However, preliminary evidence shows that community therapists infrequently implement parent coaching strategies (Aranbarri, Miller, Stahmer, & Rogers, 2017; Salisbury, Woods, & Copeland, 2009); especially in under-resourced settings. An in-depth understanding of the barriers and facilitators to using parent coaching in community-based treatment settings is a necessary first step towards improving the implementation of this approach in the community.

Objectives: The objective of this community-partnered study is to learn directly from community interventionists working with families of young children with ASD about their experiences with, and perspectives toward, using parent coaching during usual practice. We identified barriers and facilitators to using parent coaching within community-based early intervention (EI), the primary service setting for young children with ASD, in order to inform the development of an implementation strategy toolkit designed to improve the use of parent coaching in EI.

Methods: Semi-structured interviews were conducted with 15 interventionists employed within a publicly-funded EI system, which encourages the use of family-based interventions such as parent coaching. Interview questions asked about the interventionists' experiences using a specific set of evidence-based parent coaching strategies, barriers and facilitators to using each strategy, as well as attitudes, self-efficacy, and intentions to implement parent coaching. All interviews were audio recorded and professionally transcribed for analyses. Transcripts were analyzed in an iterative process based upon an integrated approach that incorporates both inductive and deductive features, which provides a rigorous and systematic approach to analyzing qualitative data.

Results: Analyses are ongoing. Preliminary results provide important insights into community-based interventionists' perspectives toward the acceptability and appropriateness of parent coaching. Common themes are consistent with constructs described in the Consolidated Framework for Implementation Research (CFIR: Damschroder et al., 2009) and include barriers related to the outer setting (parental expectations for a direct service model; busy, chaotic, and challenging home environment) and inner setting (inconsistencies in treatment approach across interventionists), as well as facilitators related to the outer setting (parental buy-in; flexible approach to implementing strategies within home settings), and individual characteristics (interventionist self-confidence). Distinct barriers and facilitators for different coaching strategies were described by interventionists.

Conclusions: This study is one of the first to provide first-hand perspectives regarding community interventionists' use of parent coaching. The findings highlight the unique challenges to implementing parent coaching within publicly-funded service systems and point to the need to develop strategies to support the widespread implementation of parent coaching within these systems.

160 **141.160** Comprehensive Meta-Analysis of Early Intervention Research for Young Children with ASD

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Background: Early-intervention research for young children with ASD has been rapidly proliferating, partly owing to the assumption that intervention provided before school entry will have the largest impacts on later outcomes. However, there are marked differences between early intervention approaches, and there is currently no consensus on the 'best' strategies for supporting developmentally important outcomes for this group of children. Meta-analysis is a useful tool for sorting and synthesizing extant research, to gain a holistic understanding of research evidence.

Objectives: The purpose of this project is to generate summary effect sizes and tally quality indicators from all available studies that investigated the effect of early interventions on any outcome for young children (ages 0-8) with ASD.

Methods: To gather peer-reviewed literature and dissertations/theses, we searched nine online databases. The initial search yielded 12,933 records. In an effort to gather "grey literature", or studies not published in a peer-reviewed journal, investigators who received federal grants to

study autism were emailed and asked to provide unpublished data that would fit our inclusion criteria. A preliminary screen of abstracts was first completed using Abstrackr software. Studies that met the following inclusion criteria: (a) published in English, (b) published from 1970 - present, (c) group design that includes both an intervention and control group, (d) participants received a confirmed ASD diagnosis, and (e) participants were within the 0-8 year old range, went on for a full-text reading. Following screening, two coders extracted relevant information and effect sizes from each study. Discrepancies were resolved by consensus. We used robust variance estimation (RVE; Hedges, Tipton, & Johnson, 2010) to synthesize Hedge's g effect sizes within each intervention and outcome type. The RVE approach accounts for the nesting of multiple effect sizes within a single study sample, allowing us to take all available effect sizes from each study without violating independence assumptions.

Results: The search and screening process yielded 1,615 effect sizes gathered from 347 studies/databases. The RVE approach requires that at least five studies contribute to the generation of effect sizes. This criteria was met for six intervention categories; traditional behavioral (8 outcomes), naturalistic developmental behavioral (7 outcomes), developmental (2 outcomes), computer-based (1 outcome), sensory (1 outcomes), and TEACCH (2 outcomes). Significant summary effects ranged from 0.25 to 0.44. Coefficients, standard errors, and confidence intervals for each summary effect is listed in Table 1. However, a high percentage of behavioral studies were quasi-experimental in design, and all of the intervention types had high risk of bias for at least one study quality indicator.

Conclusions: In this comprehensive meta-analysis, we computed 21 summary effects across 6 intervention types. Results indicate at least some support for behavioral, NDBI, developmental, and computer-based interventions across several outcome types, and no support for any outcomes for sensory and TEACCH interventions. Future intervention research should include studies with randomized controlled designs, and low risk of bias across the full set of quality indicators. These findings have implications for best practices within the early intervention period.

161 **141.161** Impact Reduces Social Hyporesponsiveness and Translates to More Optimal Spoken Language Outcomes Infants at Heightened Risk for Autism

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Background: Infant siblings of children affected by autism spectrum disorder (Sibs-ASD) are at high risk of receiving a future diagnosis of ASD or language delay and may show hyporesponsiveness (i.e., reduced or absent responding to sensory stimuli), in particular to social stimuli, such as a name call, tap on the shoulder, or wave. It has been proposed that such social hyporesponsiveness, especially early in life, may produce cascading effects on the development of higher-level skills, such as spoken language. In an early intervention called ImPACT, parents are taught to use a number of strategies that might reduce social hyporesponsivity (e.g., well-timed animation, face to face positioning, behavioral responsivity) and support language acquisition (e.g., language responsivity, communication temptations, direct communication teaching) in Sibs-ASD.
Objectives: The present study sought to evaluate whether an early intervention called ImPACT may reduce social hyporesponsiveness and translate to more optimal spoken language outcomes in Sibs-ASD.

Methods: At entry to the study (T1), 39 infants (17 male, 22 female; chronological ages 12-18 months) were randomly assigned to receive ImPACT vs a business as usual (BAU) control at Vanderbilt University. Families assigned to ImPACT received 24 sessions of parent training over 3 months by an ImPACT-certified speech-language pathologist (SLP) or someone trained and supervised by the certified SLP in the home setting. Social hyporesponsiveness was measured at immediate post-treatment (3 months post study entry; T2) with the Sensory Experiences Questionnaire. Infants' spoken language was measured at the final follow-up period (9 months post study entry; T3) using the average of z-scores for the (a) raw number of words infants were reported to say on the MacArthur-Bates Communicative Development Inventories (MBCDI), (b) Mullen Scales of Early Learning expressive language age equivalency, and (c) number of different words spoken in the context of Communication and Symbolic Behavior Scales: Developmental Profile and Brief Observation of Social Communication Change samples. Assessors and coders were blind to treatment assignment. T2 social hyporesponsiveness and T3 MBCDI expressive raw scores were log 10 and square root transformed, respectively, to correct for positive skew.

Results: ImPACT was superior to BAU for effects on T2 social hyporesponsiveness for infants with parents who entered treatment with more formal education (*p* value for parent formal education * treatment group parameter in regression model testing moderated effect = .0015). The effect of ImPACT on social hyporesponsiveness translated to more optimal T3 spoken language outcomes for this subgroup of infants, 95% CI for conditional indirect effect of treatment on spoken language outcomes via midpoint social hyporesponsiveness according to parent formal education [.0001, .7774].

Conclusions: This study is the first to our knowledge to demonstrate that an early "preventative" intervention may impact social hyporesponsiveness in infants who are at heightened risk for autism. Results suggest ImPACT has the greatest potential to reduce social hyporesponsiveness and translate to more optimal language outcomes when parents have a relatively high level of formal education and perhaps are best positioned to learn strategies to be applied in the course of everyday interactions with their infant.

Background:
Infant siblings of children affected by autism spectrum disorder (Sibs-ASD) are at high risk of receiving a future diagnosis of ASD or language delay and may show hyporesponsiveness (i.e., reduced or absent responding to sensory stimuli), in particular to social stimuli, such as a name call, tap on the shoulder, or wave. It has been proposed that such social hyporesponsiveness, especially early in life, may produce cascading effects on the development of higher-level skills, such as spoken language. In an early intervention called ImPACT, parents are taught to use a number of strategies that might reduce social hyporesponsiveness (e.g., well-timed animation, face to face positioning, behavioral responsivity) and support language acquisition (e.g., language responsivity, communication temptations, direct communication teaching) in Sibs-ASD.

Objectives:

The present study sought to evaluate whether ImPACT may reduce social hyporesponsiveness and translate to more optimal spoken language outcomes in Sibs-ASD.

Methods:

At entry to the study (T1), 39 infants (17 male, 22 female; chronological ages 12-18 months) were randomly assigned to receive ImPACT vs a business as usual (BAU) control at Vanderbilt University. Families assigned to ImPACT received 24 sessions of parent training over 3 months by an ImPACT-certified speech-language pathologist (SLP) or someone trained and supervised by the certified SLP in the home setting. Social

hyporesponsiveness was measured at immediate post-treatment (3 months post study entry; T2) with the Sensory Experiences Questionnaire. Infants' spoken language was measured at the final follow-up period (9 months post study entry; T3) using the average of z-scores for the (a) raw number of words infants were reported to say on the MacArthur-Bates Communicative Development Inventories (MBCDI), (b) Mullen Scales of Early Learning expressive language age equivalency, and (c) number of different words spoken in the context of Communication and Symbolic Behavior Scales: Developmental Profile and Brief Observation of Social Communication Change samples. Assessors and coders were blind to treatment assignment. T2 social hyporesponsiveness and T3 MBCDI expressive raw scores were log 10 and square root transformed, respectively, to correct for positive skew.

Results:

ImPACT was superior to BAU for effects on T2 social hyporesponsiveness for infants with parents who entered treatment with more formal education (*p* value for parent formal education * treatment group parameter in regression model testing moderated effect = .0015). The effect of ImPACT on social hyporesponsiveness translated to more optimal T3 spoken language outcomes for this subgroup of infants, 95% CI for conditional indirect effect of treatment on spoken language outcomes via midpoint social hyporesponsiveness according to parent formal education [.0001, .7774].

Conclusions:

This study is the first to our knowledge to demonstrate that an early "preventative" intervention may impact social hyporesponsiveness in infants who are at heightened risk for autism. Results suggest ImPACT has the greatest potential to reduce social hyporesponsiveness and translate to more optimal language outcomes when parents have a relatively high level of formal education and perhaps are best positioned to learn strategies to be applied in the course of everyday interactions with their infant.

162 **141.162** Longitudinal Indirect Effect of Parent Responsiveness and Vocal Complexity on Expressive Language Outcome in Toddlers at Risk for ASD

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Background: Up to 40% of later-born siblings of children with ASD are diagnosed with ASD (7-19%) or other language and/or cognitive delays (14-20%) by age three. Vocal complexity, a measure of the quality and maturity of vocal communication, is a strong predictor of later expressive language in typically developing children and children with ASD, but no studies have examined this relation for toddlers at high familial risk (HR) for ASD.

Parent responsivity to toddlers' vocalizations may facilitate children's complex vocal communication, which in turn may provide the basis for expressive language. ImPACT is a parent-implemented, naturalistic developmental behavioral intervention (NDBI) that teaches parents to respond contingently to toddlers' vocalizations, which could facilitate complex vocal communication and expressive language.

Objectives: (1) To examine whether parents' verbal responsiveness (PVR) indirectly predicted expressive language through vocal complexity in an ongoing longitudinal RCT of the ImPACT intervention; and (2) To explore longitudinal indirect effects of ImPACT on expressive language through PVR or HR toddlers' vocal complexity.

Methods: Participants were 54 HR toddlers and parents randomly assigned to receive 3 months of ImPACT (*n*=28) or to business-as-usual (*n*=26). Toddlers were 12-18 months old at study entry (*M*=14.32 months; *SD*=2.03 months). PVR was measured at Time 2 (immediately post-ImPACT). Vocal complexity was measured at Time 3 (3 months post-ImPACT). Expressive language was measured at Time 4 (6 months post-ImPACT).

Parents' verbal responsiveness (PVR) to children's vocally complex communication acts was coded from a parent-child free play and snack time task using observational coding definitions from previous research. Vocal complexity, an aggregate of canonical syllable frequency and consonant inventory in communication acts, was coded from the Communication and Symbolic Behavior Scales (CSBS-DP) and the Brief Observation of Social Communication Change (BOSCC). Expressive language was an aggregate of T4 MCDI expressive vocabulary, number of word roots used during the CSBS-DP, and MSEL expressive language subscale. Indirect effects were assessed using bias-corrected bootstrapping.

Results: For toddlers in both treatment conditions, there was a significant indirect effect: Time 2 PVR significantly predicted T4 expressive language, in part, through Time 3 vocal complexity, *ab*=1.74, 95%CI [0.64, 3.19] (Table 1; Figure 1). This indirect association did not vary by treatment group. Participation in the ImPACT intervention did not significantly affect Time 4 expressive language indirectly through Time 2 PVR or Time 3 vocal complexity.

Conclusions: To our knowledge, this was the first study to assess whether the relation between parental verbal responsiveness and children's later expressive language is partly due to intermediate increases in the maturity of children's vocalizations. Although this preliminary analysis did not find a significant effect of the ImPACT intervention on PVR or vocal complexity, it *did* find that regardless of treatment condition, PVR predicted an increase in the proportion of HR toddlers' communication acts that were vocally complex, which in turn predicted later expressive language ability. Parents' verbal responsiveness and children's vocal production clearly influence each other in a transactional manner over time, a phenomenon that could have cascading implications for HR children.

163 **141.163** A Pilot Study on the Impact of Group-Delivered Parent Training on Parental Self-Efficacy and Stress

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Background: Parent-implemented, naturalistic behavioral intervention using a group-based parent training format represents a unique and efficient service-delivery model. Research suggests these interventions positively impact the social, communication, and language skills of young children with autism spectrum disorder (ASD; Hardan et al., 2015; Laugeson et al., 2016; Minjarez et al., 2010). Given their primary role, parent factors may influence child changes in parent-mediated approaches. Though researchers have studied family empowerment and parental stress outcomes in group parent-implemented models (Minjarez et al., 2013), parental stress has been considered more prominently in the broader parent training literature and with inconclusive results. Another parent factor warranting investigation is parental self-efficacy (Steiner et al., 2012), an underrepresented construct in the ASD parent training literature. Changes in parental self-efficacy following group-delivered parent

training programs may be integral to understanding variability in proximal and maintained treatment outcomes and may be linked to parental stress. As such, it is valuable to study the impact of group parent training on parental self-efficacy.
Objectives: This study highlights the understudied construct of self-efficacy in the context of group-delivered, parent-mediated interventions for young children with ASD by examining changes in parental self-efficacy and whether such changes are related to changes in parent stress.

Methods: As part of an ongoing clinical study, we are enrolling 30 total parents of children with ASD under the age of 5, with 15 parent-child dyads in each intervention group: (1) Pivotal Response Treatment (PRT) and (2) Preschool PEERS, two empirically supported, group-delivered parent training programs targeting social communication skills. Parents are asked to report on their levels of parenting self-efficacy (Early Intervention Parenting Self-Efficacy Scale, EIPSES) and stress (PSI-Short Form 4 or Caregiver Strain Questionnaire) before and after their participation in their respective intervention. At present, we have collected completed preliminary pre- and post-treatment self-efficacy and stress data on seven participants. Table 1 displays the data for our preliminary descriptive analysis.

Results: Based on our pilot sample, families both increased and decreased in self-efficacy and stress. Three of seven parents reported increases in self-efficacy (average increase of 0.33 points on the EIPSES), with two of those parents also reporting concomitant decreases in stress levels, and one of them reporting little change. The remaining four parents reported decreases in parental self-efficacy (average decrease of 0.58 points on the EIPSES), with three of those parents reporting increases in stress levels and one reporting a decrease.

Conclusions: Despitethe overall mixed results suggested by these preliminary findings, there may be an emerging pattern of negative relationships between changes in parental self-efficacy and changes in parental stress, whereby increases in self-efficacy are accompanied by decreases in stress and vice versa. Importantly, variability in our small dataset is prominent, with some families reporting less self-efficacy and more stress at post. As we continue to enroll families in our ongoing study, a larger sample will allow us to inferentially examine the mechanism of intervention changes in parental self-efficacy and stress across and between the two intervention groups.

164 **141.164** Changes in Adaptive Behaviour in 3-5-Year-Old Children with Autism Spectrum Disorder Following a Motor Skill Intervention: Preliminary Results

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Background: Children with Autism Spectrum Disorder (ASD) experience significant challenges in socialization and communication in addition to repetitive and restricted behaviors. In addition to these core characteristics, delays in the development of fundamental motor skills (FMS) are often observed from a young age. These challenges can lead to reduced opportunities to engage in active play which is an important venue for the development of social and behavioral skills. Adaptive behavior refers to an individual's typical performance of the day-to-day activities required for social and personal sufficiency. Active play is considered to be the occupation of children and if children with ASD have limited ability to engage in active play due to their motor skills this might have an impact on adaptive behaviour as well.
Objectives: To determine the impact of a 12-week motor skill intervention in 3-5-year-old children with ASD on FMS and adaptive behavior.

Methods: 14 children with ASD (11 male, 3 female, Mean age = 3.51 ± .52) were recruited for a 12 week, 2 hours/week, wait-list controlled fundamental motor skill intervention. Participants were randomly assigned to the intervention (n = 7, Mean age = 3.74 ± 0.69) or control group (n = 7, Mean age = 3.38 ± 0.13). The Test of Gross Motor Development-2 (TGMD-2) was used to measure motor skills before and after the intervention and determine the Gross Motor Quotient (GMQ). The Vineland Adaptive Behavior Scales (2nd ed.) was used to score overall adaptive functioning. The Adaptive Behavior Composite (ABC) is a composite score that summarizes the individual's performance across four domains related to adaptive functioning: Communication, Daily Living Skills, Socialization and Motor Skills.

Results: There were no significant differences between the groups at the pre-test. Group 1: the ABC standard score (mean = 71.86 ± 8.26), GMQ (mean = 81.57 ± 19.09) and Group 2: ABC Standard Score (mean = 80 ± 11.11), GMQ (mean = 77.29 ± 12.59) at the pre-test. After the 12-week intervention, scores for post-test in Group 1: ABC (mean = 79.29 ± 12.02), GMQ (mean = 91.86 ± 20.91), and Group 2: ABC (mean = 75.29 ± 8.34) and GMQ (mean = 87.57 ± 14.33). There was a significant effect for the group by time interaction (p= 0.003) for the ABC but no significant effect for time. For the GMQ, there was a significant effect for time (p = 0.002) but the group by time interaction was not significant.

Conclusions: These preliminary results indicate that a fundamental motor skill intervention may have a positive impact on adaptive behaviour in 3-5-year-old children with ASD. This intervention was an age appropriate, skill-based intervention focusing on the skills needed for active play. Overall, the results are promising and indicate the need for further research in this area.

165 **141.165** Community Implementation of Social ABCs: Program Description, Feasibility, and Acceptability

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Background: Naturalistic Developmental Behavioral Interventions (NDBIs) have been shown to be effective in toddlers with confirmed or suspected ASD in well-controlled research settings. The Social ABCs is an evidence-based caregiver-mediated NDBI involving in-home live-coaching for toddlers. Next steps involve implementation in community settings.
Objectives: To describe a collaborative effort between the Social ABCs developers and community team to implement Social ABCs with confirmed or suspected ASD in a large community program. Information about the program, sample, training model, referral/service delivery model, feasibility, acceptability, and key factors related to implementation will be described. Effectiveness data will be described in a linked submission (Parent and Toddler Outcomes...).

Methods: Social ABCs is one of four NDBI models involved in a government-funded pilot demonstration initiative underway in Canada. Community implementation took place at Ron Joyce Children's Health Centre in Hamilton, Ontario, where parents received 12 weeks of one-on-one coaching. Implementation included engagement with community stakeholders to understand local needs. *Participants:* a) Social ABCs developers ("expert team"): program developer (J.B.), psychologist, lead trainer, and additional trainers; b) Community team: 5 coaches, program coordinator,

psychometrist, and psychologist; and c) Family participants: toddlers aged 12 to 30 months and one caregiver. *Training/supervision:* A positive and collaborative training approach included: a) week-long workshop (didactic, practice, video review); b) training phase (direct implementation, coaching supported by lead trainer); and c) ongoing training/supervision by lead trainer tapering over time (onsite/video review in individual/group format) and expert team (via Telemedicine). *Evaluation:* Caregivers completed a Caregiver Diary and satisfaction survey. Fidelity measures for caregivers and coaches were obtained, as well as child responsivity to parents' prompts. Implementation facilitators were recorded during supervision sessions.

Results: Five front-line staff ("coaches") have been trained; mean time for fidelity of implementation and coaching was 119 days. Mean supervision hours during training was 4.8 hours/week per coach. To date, of the 215 toddlers referred, 159 have been enrolled (111 boys, 48 girls); age range: 15-34 months (*M* age = 25.4 months, *SD* = 4.16). Of 159 enrolled, 109 completed, 18 still completing, 23 waiting, and 9 dropped out. Caregivers reported child improvements, and child responsivity doubled from week 1 to 12 (from 33% to 66%). Caregivers reported increased adherence and competence, and 93% achieved the pre-established rate of 75% fidelity by weeks 8-12. Caregivers reported high satisfaction. Engagement of community stakeholders led to improvements in internal and external referral processes, including decreases in age at time of referral (from *M* = 30.8 to *M* = 22.7 months) and earlier referral for diagnostic assessment. Drivers of success included a careful and collaborative planning approach, shared decision-making, consideration of contextual issues, an opinion leader, institutional support, and a program coordinator with clinical training.

Conclusions: The Social ABCs intervention was successfully implemented in a large community program. Parent coaches achieved fidelity in a timely manner, caregiver- and child-level improvements were obtained, with positive feedback from coaches, caregivers and community partners. Findings highlight the feasibility and acceptability of the Social ABCs for implementation within a community service-delivery model.

166 **141.166** Content and Process of Communication Intervention for Toddlers with Autism: Trends and Current Status

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Background:

Intervention models for toddlers on the autism spectrum have emerged and evolved since 2000. While subsequent research has focused largely on outcomes, the communication-focused content and intervention processes that influenced those outcomes are relatively unexplored.

Objectives:

The study's aim was to explore intervention content and process variables described in recent studies of communication-focused intervention for toddlers with autism and to assess their alignment with recommendations from extant reviews of early intervention for this population.

Methods:

A search of intervention studies of toddlers with autism yielded 23 intervention descriptions as reported in 31 original studies (some duplicated). Studies were limited to peer-reviewed publications since 2010 that reported on communication-focused interventions with all participants under age 36 months. The intervention descriptions were coded for intervention content (primary outcomes and communication focus/level) and process (strategies, setting, agent, and learning framework). A parallel search of published reviews of interventions for toddlers with autism yielded seven reviews, which were ordered chronologically with findings classified by their component studies' approaches, foci, agents, and settings as well as by overall identified needs. Original studies and reviews were independently coded with consensus on coding reached by the full team (all presenters).

Results:

Viewed chronologically, the seven reviews revealed a decreasing use of exclusively behavioral and a commensurate increasing use of developmental and combined approaches, an increasing focus on preverbal social communication with a decreasing focus on verbal language, an increasing use of natural environments, and minimal change over time in the use of parent- versus professional-implemented interventions. Needs cited by multiple reviews included more developmentally grounded intervention focusing on prelinguistic social communication, more implementation in natural environments, and greater use of family-centered/capacity-building practices with parent implementation. The parallel review of the 23 recent communication intervention descriptions showed interventions focused on social communication (8), general communication (6), or a mixture (9) that targeted pre-symbolic (8), symbolic (4), or mixed (11) levels. Interventions were relatively evenly distributed between home-only (12) and preschool/clinic/lab/mixed (11) settings and between implementation exclusively by parents (12) and fully/partially by professionals (11) with the majority of home-only interventions implemented by parents and non-home-only at least in part by professionals. A review of intervention strategies revealed theoretical mechanisms assumed to guide child learning: These included response to reinforcement, modeling, and/or prompting (7), reciprocal contributions to learning (4), response to environmental arrangement (1) or a mixture (11).

Conclusions:

Paralleling recommendations from the seven reviews, analysis of 23 recent intervention descriptions revealed that, while progress toward developmentally grounded content and recommended practices is evident, continued advancement toward a primary emphasis on social communication at the preverbal level, active facilitation of the parent role in implementation, and delivery in natural environments is needed. A number of recent interventions relied primarily on external reinforcement strategies or prompting/modeling while fewer relied primarily on reciprocal learning processes that might promote child active engagement and initiations. Future investigations should explore the role that interventions driven by differing underlying learning assumptions might play in promoting meaningful interactive social engagement on the toddlers' own volition.

167 **141.167** Diminished Responsiveness to Parental Tutoring in Preschoolers with ASD: Implications for the Guided Participation Relationship

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Background:
In a Guided Participation Relationship (GPR), parents scaffold children's performance during instructional activity to promote competence and autonomy (Rogoff, Ellis, & Gardner, 1984) within their children's Zone of Proximal Development (Vygotsky, 1978). Mothers of securely attached preschool children tend to provide more sensitive feedback, and are unlikely to use physical guidance (Meins, 1997). Feedback and responsiveness from their children help parents provide sensitive scaffolding. Children with Autism Spectrum Disorder (ASD) and their caregivers face challenges negotiating the GPR as measured by the Dyadic Coding Scales (DCS: Beurkens, Hobson, & Hobson, 2013).

Objectives:

We aimed to assess whether caregivers and their preschool-aged children with ASD differed from those without ASD during free play and parental tutoring. We predicted differences in the quality of the GPR. We studied whether there was change in a subset of the children with ASD who (with their parents) received an intervention designed to foster the GPR (Relationship Development Intervention, RDI).

Methods:

In addition to language testing and a confirmation of diagnoses with the ADOS-2, 30 children (16 with ASD) and their caregivers were administered the Relationship Development Assessment – Research Version (RDA-RV: Larkin, Guerin, Hobson, & Gutstein, 2013) at the beginning and end of the preschool year. Two sets of coders, blind to the study design, rated the RDA-RV according to the DCS and also caregivers' ability to tutor their children within the 'region of sensitivity to instruction' (Meins, 1997).

Results:

At baseline, children with ASD were more likely to ignore or fail to adjust their behavior in response to parental feedback, t(28) = - 2.72, p = .011. Children in the comparison group were more likely to accommodate to parental suggestions, t(28) = - 2.43, p = .022. Parents in both groups provided equally sensitive responses, although those with children with ASD were more likely to use physical prompts. Parent-child dyads containing children with ASD were rated significantly lower on the Dyadic Coding Scales, t(28) = 3.68, p < .001. Child negative responsiveness was inversely correlated with dyadic scores on the DCS, even after taking into account variability associated with verbal mental age, partial-r = -.49, p = .008. Scores on the DCS improved significantly over the course of the school year for dyads participating in RDI, F (1,14) = 9.04, p = .009.

Conclusions:

Children with ASD and their parents showed impairments in aspects of the GPR as assessed with the RDA-RV applying the Dyadic Coding Scales (Beurkens, Hobson, & Hobson, 2013; Hobson, Tarver, Beurkens, & Hobson, 2015). Despite children with ASD being more resistant to parental tutoring strategies, parents remained sensitive to their child's needs. However, higher resistance to parent input in children with ASD was related to lower quality of dyadic relatedness on the DCS. Although ASD may present challenges for the child-caregiver GPR, results of the present study reveal the potential for improvements in the GPR when this is a treatment focus.

168 **141.168** Disparities in the Amount of Early Intervention Services Received By Toddlers with ASD: The Role of Demographic Factors

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Background: Early access to a diagnosis of ASD can lead to earlier, more intensive intervention, which has been shown to result in optimal developmental outcomes (Peters-Scheffer et al., 2012; Warren & Stone, 2011). However, disparities in the age of diagnosis have been documented, with children of racial/ethnic minority backgrounds being identified much later than White children (Mandell et al., 2009). Less research has extended this work to consider whether such disparities persist, beyond the age of initial diagnosis, to the intensity and amount of early intervention (EI) received.

Objectives: To examine whether demographic factors (parental education, poverty, English proficiency, race/ethnicity, US-born status) predict the amount of early intervention services received by children with ASD. We consider these predictors in the context of a screening and evaluation program that is designed to minimize health disparities in the initial age of diagnosis; as such, our study enables us to consider whether, even in the context of relative equity in the age of ASD diagnosis, health disparities persist in the intensity of EI services received by young children with ASD.

Methods: 381 children (ages 14-36 months) were diagnosed as part of an EI-based, multi-stage screening and university-based diagnostic assessment protocol designed to reduce health disparities. 51% of this sample were of families living below the poverty line, 34% English learners, 50% immigrants, 45% White, 46% Hispanic, 26% Black, and 6% Asian. Follow up interviews were then conducted with 130 of the families of children to ascertain the amount of EI services received post-diagnosis. Next, using a latent class analysis (LCA), we identified six demographic clusters of families to predict ASD service receipt.

Results: First, the six demographic clusters of families revealed that these families were primarily distinguished by their race and US-born status. Additionally a one-way between subjects ANOVA indicated that across all six classes, on average, families from classes holding multiple marginalized identities were receiving significantly fewer hours of weekly services than families with more privileged identities [F(5, 124) = 4.36, p = 0.001]. However, the two classes that were distinguished as being White, differed in immigration status yet still had the same mean hours of weekly intervention services (White immigrants = 13.7 hrs; U.S. born non-Hispanic White = 13.7 hrs). Across other classes, U.S. born Black parents reported receiving significantly fewer hours (m = 6.3) than White immigrants and U.S. born non-Hispanic Whites. Latinx immigrants reported receiving fewer hours (m = 7.2) than White immigrants and U.S. born non-Hispanic Whites.

Conclusions: Despite having a timely access to an ASD diagnosis, disparities continued to persist in subsequent receipt of post-diagnosis intervention services. Our class solutions suggest that these demographics play a significant role in service attainment. Findings may help properly address and identify groups in need of additional support when it comes to service attainment and suggests that there may be systemic barriers at play.

169 **141.169** Effect of Project Impact on Social Imitation in Children with ASD: A Randomized Controlled Trial

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Background: Children with ASD show deficits in imitation skills, which are especially pronounced in a social-interactive context (Rogers et al., 2003). Research has shown that social imitation during play is related to language, social reciprocity and symbolic play in children with ASD (Ingersoll & Meyer, 2011). Project ImPACT (Ingersoll & Dvortcsak, 2010) is a parent-implemented intervention, focusing on social communication in children with ASD. One of the intervention targets is the increase of social imitation through the use of interactive and behavioural strategies during daily routines. Previous studies have shown positive effects on language and communication (e.g., Ingersoll & Wainer, 2013; Stadnick et al., 2015). Studies on the effect of Project ImPACT on social imitation are lacking. Moreover, as yet no RCT's have been published.
Objectives: The goal of the present study was to test the effect of Project ImPACT in a community setting on the spontaneous imitation skills of children with ASD.

Methods:

Participants: 29 children between 22 and 49 months (two girls) were recruited through two services for home guidance for children with ASD. Clinical diagnoses were confirmed using the ADOS-2. Participants were randomly assigned to either an ImPACT intervention group (n = 14) or a treatment as usual (TAU) condition (n = 15). The mean age in both groups was 37 months. There was no significant difference in the developmental index on the Mullen between ImPACT (M = 68.54, SD = 21.80) and TAU (M = 61.93, SD = 16.19), $t(25) = 0.90$, p = .38.

Intervention: Children in the ImPACT group received 18 weekly individual parent training sessions. Children in the TAU condition received regular home guidance, with a frequency of one session every 2-3 weeks, mainly targeting daily living skills.

Procedure: Imitation skills were assessed with the spontaneous imitation task (Ingersoll, 2008) before and after receiving Project ImPACT (M = after 5.86 months, SD = 1.23) or after a similar time interval (M = 5.60 months, SD = 0.74) in the TAU group. Administrators were blind for group assignment. Imitation skills were coded afterwards from video by coders who were blind for group assignment and testing moment.

Results: A repeated measures ANOVA showed no main effect of time, $F(1,27) = 2.03$, p = .17. However, there was a significant time*group interaction, $F(1,27) = 4.29$, p = .048, $\eta p2$ = .14. Children in the ImPACT group showed a marginally significant improvement in their imitation skills from pre (M = 5.64, SD = 3.20) to post intervention (M = 8.71, SD = 5.66), $t(13) = 2.11$, p = .055, while children in the TAU group did not show this improvement from pre (M = 6.00, SD = 4.39) to post intervention (M = 5.43, SD = 4.07), $t(14) = 0.56$, p = .59.

Conclusions: Project ImPACT seems to improve social imitation skills of children with ASD through parent training. This is an important finding, given the association of imitation with other social-communicative skills. Results on a larger sample, including follow-up data will be presented at the meeting.

170 **141.170** Effectiveness of a Parent-Mediated in-Home Feeding Intervention for Families with Children with Autism Spectrum Disorders

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Background: Up to 89% of children with autism spectrum disorder (ASD) have feeding challenges impacting their development, health, social interactions, and parent–child relationships. Feeding challenges are heterogeneous in presentation and include a range of behavioral, sensory, and health problems that put children at risk for decreased/excessive caloric intake, abnormal growth patterns, atypical social interactions, and difficulty participating in peer and family activities. Current evidence for intervention is limited even though the prevalence and negative effects on the family have been clearly established.
Objectives: The purpose of this pilot study was to examine the feasibility, acceptability and evaluate the preliminary effectiveness of an in-home parent-mediated intervention for children with ASD and feeding challenges.

Methods: A convenience sample of seventeen children diagnosed with ASD ages 2 to 7 years participated in a parent-mediated intervention that occurred in the home. A quasi-experimental pre-test/post-test design was used. Families received approximately 32 visits over six-months that included a combination of parent training, direct intervention, and parent coaching. Intervention was delivered by occupational therapists, a dietitian, and graduate students. Measures of feasibility were collected from parents and interventionists. Goal Attainment Scales (GAS), the primary outcome, were used to assess intervention effectiveness using a paired-sample t-test. GASs were collaboratively set with families at the initiation of the intervention following standardized GAS procedures. Parents did not view the GAS during or upon completion of the study. Parents were interviewed prior and post intervention along with videotaped mealtimes.

Results: The parent-mediated intervention was feasible to implement and acceptable to parents and interventionists. Fifteen children/families (88%) completed the intervention with two families withdrawing due to significant parent schedule changes. 100% of parents completing the intervention reported being satisfied. However, they described different aspects of the intervention (e.g., parent training versus direct intervention) as being most beneficial for their child and family. Results identified significant positive changes in GAS scores ($p<.05$). GAS for the families fell into three primary categories of mealtime behaviors, self-help skills, and selective diets. The most challenging goal to achieve across families was adding portion-sized vegetables to their diet. However, other common goals such as decreasing mealtime behavior, improving nutritional content of meals, adding food to the child's food repertoire, and improving self-help skills were more likely to be achieved. Parent report indicated increased self-efficacy and decreased stress. At the close of the intervention, parents also expressed an increased knowledge base and skills to address future mealtime challenges and feeding difficulties with their children.

Conclusions: The parent-mediated intervention to address feeding challenges for children with ASD was feasible and viewed positively by families in the study. Interventionists and families collaborated to achieve goals directly related to the child's health and nutrition, eating behaviors, and family mealtime. Families met the majority of their goals for their children. Although not all goals were met and families expresses their children still had inconsistent eating patterns at times, they expressed an increased knowledge and confidence of know how to approach their child's feeding challenges in the future.

171 **141.171** Effects of Early Social-Communicative Intervention on the Brain Activity of Toddlers with ASD: An ERP Study.

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Background:
There is large consensus that objective and insightful evaluations of autism interventions should include neurophysiological measures.

Objectives:

This randomised controlled trial tests the effects of Project ImPACT, an early parent-run intervention targeting social-communicative skills, on the behaviour and brain activity of toddlers with Autism Spectrum Disorder (ASD).

Methods:

Toddlers with ASD have been randomised to receive either Project ImPACT or treatment as usual (TAU), which does not specifically focus on social-communicative abilities. Researchers involved in data acquisition and analysis were blind to group assignation. Outcome measures include event related potentials (ERPs) in response to standard and deviant voice and non-voice stimuli.

The ImPACT (n=12, 1 girl, mean age: 3.1 ±.6, mean IQ: 62.67 ± 24.42) and TAU groups (n=8, 1 girl, mean age: 3.5 ±.5, mean IQ: 59.38 ± 22.5) were compared at baseline and outcome separately to typically developing (TD) children (n=16, 4 girls, mean age: 3.0 ±.9) in the P1, N2, P3 and N4 time windows. Sample size will increase to n = 20 or higher per group before the INSAR meeting. A 2 X (voice/non-voice standard sound) X 2(voice/non-voice deviant sound) X 2 (group) interaction was tested using permutation-based t-test (n=5000) over differences between levels and between factors. Time was added as a two-level factor when comparing ImPACT and TAU.

Results:

This section highlights the most prominent findings of this study (complete overview in Table 1).

A significant main effect of group was found over N2 mean voltages when comparing the ImPACT group at baseline and the TD group ($t(1,26) = 1.849$, $p = .031$), as well as the TAU group at baseline and the TD group ($t(1,22) = 1.759$, $p = .048$).

For the ImPACT group, the difference with TD became non-significant after the intervention ($t(1,26) = .576$, $p = .279$). For the TAU group, the difference with TD was still significant after the intervention ($t(1,22) = 1.937$, $p = .033$). A paired samples t-test within the ImPACT group confirmed the effect of treatment on the N2 component ($t(1,11) = 3.256$, $p = .005$), which became less negative (Figure 1).

The differential effect of intervention over the N2 response to deviant stimuli was further supported by the time X group interaction approaching significance when comparing the ImPACT and TAU groups ($t(1,18) = 1.412$, $p = .085$).

Exploratory analysis suggests that a larger N2 in children with ASD correlates with worse response to joint attention ($r = .442$ [.017 767], $p = .049$). We will further investigate whether the treatment effect on the N2 ERP component is associated with improved response to joint attention.

Conclusions:

Initial group differences, as well as treatment effects, were mostly observed on the N2 ERP component. A larger N2 response at baseline in children with ASD may reflect hypersensitivity to sound change or a more effortful attentional disengagement, with possible repercussions on the children's social behaviour. These preliminary results suggest a deeper effect of early intervention focused on social-communicative skills training compared to intervention that does not primarily focus on social communicative abilities.

172 **141.172** Effects of Family Factors on Joint Engagement in a Caregiver Mediated Intervention

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Background: Intervention research in autism spectrum disorder (ASD) primarily focuses on child outcomes; however, increasing literature addresses caregiver well-being and its impact. Consideration of caregiver experiences related to intervention is critical, as factors such as low resources and stress can negatively impact outcomes (Obsborne et al, 2008; Gabriels et al, 2001). Stressors include increased time demands for caregivers and financial strains. These effects may be exacerbated in low resource families because of the additional demands of travel and time away from work that they may not be able to afford. The literature exploring the impact low resources have on outcomes is limited while the literature on caregiver stress is conflicting. Examining these underexplored factors could elucidate how intervention affects families and inform implementation modifications to maximize impact.

Objectives: Examine how family factors (i.e., resources and stress) affect joint engagement (JE) in a caregiver-mediated intervention for young children with ASD from predominately low resource families.

Methods: Children aged 2-5 (N=112) and their caregivers were randomized to a caregiver education module (CEM) or caregiver mediated module (CMM) informed by JASPER (Joint Attention, Symbolic Play, Engagement, and Regulation) intervention. This home based intervention lasted 12 weeks. Measures were administered at baseline and exit. In our sample, 66% were a racial/ethnic minority and 61.6% were low-income. Measures included the Parenting Daily Hassles (PDH) and Family Resource Scale (FRS); the PDH evaluates both the frequency and intensity of stressful daily events. JE was assessed from a 10-minute videotaped interaction between the caregiver and child, using a validated coding scheme. Linear mixed models were used to examine the association between PDH and FRS on JE and whether the associations differ by intervention.

Results: As noted previously, JE was significantly improved in the CMM group over the CEM group (Kasari et al, 2014). In this study, baseline hassle *frequency* positively predicted joint engagement ($F(1,96)=4.38$, $p=0.039$) at all time points, but baseline hassle *intensity* did not. There was a strong trend toward significant moderating effect of baseline hassle intensity (i.e., low versus high) on treatment effects on JE from baseline to exit ($F(1,94)=3.75$, $p=0.056$). Specifically, improvement in JE was more favorable in the CMM group regardless of having low or high hassle intensity. Overall hassle *frequency* positively predicted increases in JE in the CMM group, but hassle *intensity* did not predict improvements in JE from baseline to exit in either group. Chi-square analyses indicated that race/ethnicity was associated with baseline JE, but income and family resources were not.

Conclusions: Improvements in joint engagement were predicted by higher frequency and intensity of daily caregiver stress pre-intervention. While not consistent with our prediction, this relationship may suggest that families who encounter more caregiving stress are poised to benefit more from intervention focused on engagement. These results mirror other psychotherapy literature indicating that individuals with higher mental health symptoms can benefit most from treatment. Overall, results suggest that community interventions targeting this population, and with consideration of structure and schedule to ease time and financial burdens, can impact parent/child engagement.

173 **141.173** Effects of Parent-Mediated Intervention Coaching Vs. Psychoeducation on Social Communication Development of Lower-Resourced Young Children with Autism Spectrum Disorder: A Feasibility Study

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Background: As children with autism spectrum disorder (ASD) are identified at increasingly younger ages, parent-focused intervention has become an essential component of comprehensive early intervention programs. However, the implementation and effectiveness of these parent-focused intervention programs varies widely across intervention providers, particularly for lower-resourced families. This study examined how traditional parent-focused intervention programs for young children with ASD may be modified to be more practical for lower-resourced families (i.e. those with limited resources and education, low incomes).

Objectives: The purpose of the proposed project was to adapt and evaluate a modified version of an early intervention program working with caregivers from a lower-resourced population. We hypothesized that a parent-mediated intervention (PMI) would demonstrate greater change in child language and social communication behaviors, as well as increased effectiveness in parents' use of specific treatment strategies when compared to a parent psychoeducation intervention consisting of information, education, and support(IES). Further, it was hypothesized that the design and modifications to the protocol (i.e., liberal cancellation and rescheduling policy, individualized home visits, case management and advocacy, and crossover design) would promote engagement in the treatment and decrease attrition compared to previous studies.

Methods: Six mother-child dyads participated in a randomized crossover design in which PMI was compared to IES over 3 months of treatment. Parent outcome was measured using parent fidelity of implementation (FI) of treatment techniques. Child outcome was measured using the Brief Observation of Social Communication Change (BOSCC), a new social communication behavior measure.Account was taken of the repeated measures on estimated confidence intervals and significance by fitting random effects models.

Results: Parent and child outcomes did not differ by type of parent-focused intervention (PMI vs. IES) in our sample. However, overall parent FI scores measured across both conditions improved significantly over the course of treatment [5.18 per month (95% CI 1.88 to 8.49; p=.002)], and was mirrored by nonsignificant but similar changes in the children's scores on the BOSCC [-1.88 per month (95% CI -4.06 to 0.31; p=.093)]. In addition, rich qualitative data gathered during the study concerning parent experiences, as well as feedback regarding the research protocol are discussed and recommendations for implementing parent-focused intervention programs with lower-resourced families are proposed. Four major themes emerged regarding the importance of 1) the intervention strategies and psychoeducation information learned, 2) parent coach flexibility and social support, 3) case management and advocacy, and 4) the relationship between the child and the parent coach.

Conclusions: This study provides preliminary evidence that parent-focused intervention programs can be carried out in a positive fashion with families with few resources in order to teach parent intervention techniques to support the social communication development of their young children with ASD. Parents of children with ASD are generally stressed and overscheduled, especially lower-resourced families. Partnering with families to provide a parent-focused intervention program based on the needs of the families they serve would help practitioners get the most "bang for their buck", particularly when implementing evidence-based programs within resource-poor community settings.

174 **141.174** Effects of a Parent-Mediated Intervention on Expressive Language Among Toddlers with Autism: A Randomized Controlled Trial

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Background: The purpose of this presentation is to report results of a randomized controlled trial pilot study of a parent-mediated intervention, focused primarily on enhancing parent support of toddler joint attention (Schertz et al., 2011). The Joint Attention Mediated Learning (JAML) program is a relationship based, developmentally oriented intervention that does not directly target expressive language promotion, but has consistently demonstrated large effects on joint attention (Schertz et al., 2013; 2017). Prior research has shown a relationship between establishment of joint attention and language development in young children with ASD (Markus et al., 2000; Bottema-Beutel, 2017). However, for preverbal toddlers with autism, it is not clear whether receipt of brief parent-mediated interventions, which do not intentionally target expressive language, are sufficient for improving expressive language outcomes.

Objectives: The current study examines effects of the Joint Attention Mediated Learning intervention on expressive language of toddlers with autism.

Methods: Participants included 30 toddlers diagnosed with autism. Participants were randomly selected from a larger sample (Schertz et al., 2017) to include a subset of 15 families who received the JAML program and 15 control group families. Demographics of the subset of 30 families are presented in Table 1. Pre- and post-intervention assessment videos of parent-child interactions at home were coded using the Early Communication Indicator (ECI; Greenwood, Walker, & Buzhardt, 2010). Based on direct observation, gestures, vocalizations, single words, and multiple words are coded for occurrence based on six minutes of direct observation of parent-child interactions in family homes. Coders were naïve to treatment condition and time point. Interobserver agreement (IOA) was examined for 20 percent of the videos. Mean IOA was 88%, ranging from 80% to 100% (SD=5.14). Analysis consisted of General Linear Mixture Models (GLMM), using lme function of the R nlme package, for parametric data (gestures). GLMM (Poisson, quasi-Poisson, and negative binomial) analyses were conducted with the glmmPQL function from the MASS package for non-parametrically distributed data, evidencing zero-inflation (single-words and multiple word). GLMM logistic regression, using lme4's glmer function, analyses were conducted on whether or not any word was uttered.

Results: Analyses of gestures, single words, and multiple words did not show significant treatment by time differences within this low powered sample. However, there was a significant treatment X time interaction wherein any word utterance (Z=3.31, p < .001) increased significantly for the JAML group (Pre= 20%, Post=67%; OR=8.0[95%CI=1.52-42.04] p<.001), but not the control group (Pre=33%, Post=40%; OR=1.33[95%CI=0.30-5.91], p=.71). See Figure 1.

Conclusions: In contrast to families in the control condition, families receiving the JAML intervention showed significant pre- to post- assessment gains in any word utterance during interactions with their parents at home. Although the JAML program does not directly target language acquisition, it had large effects on expressive language of toddlers with autism. These results are encouraging and warrant sufficiently powered analyses with the full study sample and other studies. Limitations of this study as well as considerations for future study will be presented.

175 **141.175** Encouraging Toddlers with ASD to Request: An Exploration of Expectant Pausing and Engagement Strategies

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Background: Deficits in requesting are an early social communication risk factor for ASD in toddlers (Barbaro & Dissanayake, 2009) and are successfully targeted through intervention (Leung, 1994). Evidence-based interventions address a number of social communication deficits. However, little is known about how specific interactional strategies (i.e., ways interventionists interact with children to elicit or respond to behavior within an intervention session) function individually, and in combination, on requesting.

Objectives: The current study evaluated examiner use of two levels of two interactional strategies (i.e., positive affect, expectant pausing) on child requesting. Positive affect was defined as examiner use of animated facial expressions and expressive vocal intonation (levels: consistently positive affect, low affect with contingent positive affect). Expectant pausing was defined as the amount of time between an examiner's prompt before s/he delivered the next prompt on a hierarchy of increasing support (levels: 2 seconds, 7 seconds). Child interest (none, moderate, high) was examined as a potential moderator of child requesting. Child expressive language and ASD symptom severity were considered as covariates of child requesting.

Methods: As part of a larger screening study, toddlers were recruited and randomized to one of four conditions (positive affect by expectant pausing) following confirmation of an ASD diagnosis made with gold-standard assessment tools and clinical judgment (n=58, M=28.24 months [4.61]). Within the assigned condition, unfamiliar examiners led children through a series of 5 hierarchical prompts in an attempt to elicit requesting.

Results: Generalized estimating equation (GEE) analyses revealed a significant three-way interaction between positive affect, child interest in materials, and trial number when controlling for expressive language (See Figure 1). In high child interest trials in which children were randomized to the consistently high engagement versus the low with contingent high engagement condition, children were more likely to request in earlier trials than in later trials. In contrast, in medium child interest trials, in which children were randomized to the low with contingent high engagement versus the consistently high engagement condition, children made more requests independent of trial number. Low child interest trials rarely resulted in a request, irrespective of engagement condition or trial number. Pause length was not associated with requesting. Children with higher levels of expressive language were more likely to request.

Conclusions: A major finding to emerge from this study is that a child's level of interest in materials is an important consideration when attempting to elicit a request. This study provides initial evidence that children with varying levels of interest in materials may respond better to different levels of clinician use of positive affect (i.e., consistently high, versus low with contingent high). Further, beyond child interest in materials and clinician engagement condition, child developmental factors matter. Children with higher levels of expressive language were more likely to request. Additionally, the present study demonstrates a novel method for evaluating potential active ingredients of intervention in an experimental manner. Further exploration of individual interactional strategies may lead to both more personalized interventions for toddlers with ASD and more directive guidelines for clinicians.

176 **141.176** Examining Coaching Outcomes in the Social ABCs Parent-Mediated Intervention

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Background: The *Social ABCs* is a parent-mediated intervention (Brian et al., 2016; 2017) based on empirically supported Pivotal Response Treatment (PRT; Koegel & Koegel, 2006). The main targets of the *Social ABCs* are functional early (vocal/verbal) communication and positive affect sharing between child and caregiver for infants/toddlers who have suspected or diagnosed Autism Spectrum Disorder (ASD).

Objectives: The present study examines the training for *Social ABCs* parent coaches with a focus on the training of parent coaches across multiple Canadian sites in both research and clinical contexts. We present data on the consistency of coaching fidelity across training sites, and highlight that the success of training coaches, will increase community capacity for implementation.

Methods: Our team has trained a total of 15 coaches, with a range of educational, clinical, and research backgrounds, across 4 major Canadian cities in 3 provinces; Toronto and Hamilton (Ontario), Halifax (Nova Scotia), and Edmonton (Alberta). From this population of coaches, we have 3 identified trained-trainers, and 3 trained supervisors who are PhD-level clinical psychologists. Using video-coded indices, fidelity of the parent coaches has been analyzed using (1) a measure of coaching fidelity across 3 separate parent/child dyads and (2) fidelity of parent implementation for 3 separate parent/child dyads, across 15 coaches. The parents' implementation served as a proxy measure for the overall success of the coaches' skill level.

Results: Coaching fidelity and parent implementation fidelity were consistently high across research sites, and slightly higher in the community cohort of coaches, with parent fidelity ranging from 80-100% by week 12 of the intervention, demonstrating that the coaches are highly skilled at training parents in the Social ABCs. The length of time required to train parent coaches has decreased significantly over time. In the Social ABCs pilot study (Brian et al 2016) the training of the first coaches took 1 year of intense supervision until independent coaching began. Currently, training takes half the time (about 6 months), a training process which has been maintained from our initial Randomized Control Trial (Brian et al., 2017). This has remained as a successful model for training within a large community demonstration project currently underway. More recently, in a group-based clinic-delivery model, our team has trained two experienced Speech-Language Pathologists to provide parent-coaching in a shorter, 3-month period.

Conclusions: We define coaching within the Social ABCs as providing live, moment-to-moment, positive coaching strategies. These positive strategies are defined as the verbal acknowledgement of correct in-the-moment behaviours exhibited by the caregivers with the child, and setting families up for success in using the techniques. It is this positive coaching which supports caregivers in learning the Social ABCs strategies. All 15 parent coaches have achieved a high level of coaching fidelity across research sites and community settings. Our increased efficiency in training coaches contributes to the feasibility and sustainability of this model.

177 **141.177** Feasibility and Acceptability of Using an Online Platform to Deliver Training in Evidence-Based, Parent-Mediated

Interventions for ASD

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Background:

Access to intervention for Autism Spectrum Disorder (ASD) is limited. The high cost, frequent sessions, and distance of reputable medical centers create barriers that prevent families from gaining access to empirically validated interventions, such as Pivotal Response Treatment (PRT). PRT is a naturalistic intervention that targets social communication skills. Previous findings have shown that caregivers can readily implement PRT (Vernon, Koegel, Dauterman & Stolen, 2016). More recently, studies have aimed to explore methods of using technology to deliver behavioral interventions and training for parents of children with ASD (Lindgren et al., 2016). MindNest Health is a digital behavioral health tool that delivers parent education and training in evidence-based, parent-mediated interventions through didactic instruction and animated demonstrations of key concepts.

Objectives:

To examine the feasibility and acceptability of using MindNest to deliver training in PRT principles.

Methods:

MindNest provides eight online training modules that include didactic information, as well as demonstrations of behavioral strategies using animated simulations. For example, the simulations illustrate how a parent can prompt their child to ask or respond to questions. Additionally, participants completed four one-hour videoconferencing sessions with a clinician. The duration of the study is ten weeks, and videoconferencing sessions are scheduled during the first, third, seventh, and tenth week. During sessions, clinicians provided direct instruction and feedback on parents' PRT implementation.

Parents acceptance of MindNest was assessed using the Client Credibility Questionnaire (CCQ) at week 2. The CCQ is an eight-point scale that asks parents how logical the training seems, how confident they are in its success, how confident they feel in recommending it, and how confident they feel that it will improve other areas of development, such as sadness, anxiety, or school work.

Results:

To date, 15 families with children with ASD between the ages of 2-7 have enrolled in the program. All families independently completed the online enrollment process and gained access to the training platform. Six families are in the process of completing the program and 2 families withdrew from the study. Seven families successfully completed all training modules and videoconferencing sessions.

Parents rated items on the CCQ on an 8-point scale ranging from 0 (*not at all logical/confident*) to 8 (*very logical/confident*), with a total score range of 0 to 32. On average, participants rated a 7.2 on *logical* (*N*=15, *SD*=.941), 5.8 on *confidence* (*N*=15, *SD*=1.42), 6.27 on *recommend* (*N*=15, *SD*=1.75), 4.93 on *other* (*N*=15, *SD*=1.75), and a 24.20 total score (*N*=15, *SD*=5.08).

Conclusions:

MindNest is a novel platform used to attain scalable education and training in PRT. This addresses the need for improved access to affordable evidence-based interventions, and reduces the economic burden of providing care to individuals with ASD. Successful completion of the program supports the idea that this program is a feasible option for delivering training in PRT, which will increase accessibility to service. Acceptability ratings reveal that, on average, participants find the program to be very logical. This could result from integrating parent-friendly content on behavioral principles with videoconferencing based support from a clinician.

178 **141.178** How Does the Broader Autism Phenotype Affect Parent-Mediated Interventions for Children with Autism?

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Background:

The broader autism phenotype (BAP) describes sub-diagnostic threshold traits of autism/autism spectrum disorder (ASD) that are commonly found in family members of people with autism, but also the general population. BAP is associated with a number of difficulties, including language, face processing, cognitive, social, rigidity and psychiatric conditions. Parent-mediated interventions can benefit children with autism; however, very little research has investigated how the presence of parental BAP might influence parent-mediated intervention and consequently affect outcomes. One small pilot study (n=18; Parr et al., 2015) showed a significant negative correlation between BAP and measures of mother-child interaction post-intervention. The authors concluded that this required further investigation using larger samples, including a control group who received treatment as usual (TAU).

Objectives:

The aim was to determine how parental BAP affects outcomes following parent-mediated intervention or TAU. We hypothesised that BAP would impact parent-child interaction and effectiveness of parent-mediated intervention.

Methods:

PACT 7-11 was a follow up (FU) of a parent-mediated social communication intervention RCT for children aged 2–4 years with core autism. FU was conducted at a median of 5.75 years from the original trial endpoint (mean age=10.5 years (SD=0.8)). Parental BAP traits, measured at FU using the Family History Interview-Subject (FHI-S) Factor Score, were assumed stable and applied retrospectively for analysis. The following blinded endpoint and FU outcomes were treated as multivariate pairs: Autism Diagnostic Observation Schedule (ADOS) comparative severity scores (CSS); Dyadic Communication Measure for Autism (DCMA) of the proportion parent acts that were synchronous with child attention (DCMA Parent Synchrony); and DCMA proportion of child initiations when interacting with the parent (DCMA Child Initiations). Full Information maximum likelihood structural equation modelling in STATA was used to make use of the full sample and repeat post-randomisation outcomes. Adjusting for baseline outcome value and treatment group, the effect of FHI-S (square root transformed) on each outcome was examined, both as main effect and moderator of treatment effect.

Results:

121 (80%) of the 152 trial participants (PACT intervention=59 [77%] of 77, TAU=62 [83%] of 75) completed follow up analysis. Of these, FHI-S scores were available for 102 participants (PACT intervention=49, TAU=53). The models on the full sample confirmed the strong group effects on all outcomes (p<.001) reported in previously published work. FHI-S was not correlated with baseline ADOS CSS, DCMA Parental Synchrony, or DCMA Child Initiations. FHI-S had no effect on outcome ADOS CSS or DCMA Parent Synchrony. There was a marginally significant main effect of FHI-S (p=.079), and a marginal moderation effect (p=.097) on DCMA Child Initiations, and no significant interactions.

Conclusions:

In this sample, BAP appears to have a limited role in outcomes following parent-mediated intervention. The finding may be specific to the particular behaviours targeted by the PACT therapy and the relatively low FHI-S scores of the PACT parents. More information is needed to understand how interventions should be tailored to parents, children, and particular environments.

179 **141.179** Implementing an Early Intensive Behavioral Intervention Program (EIBI): Description of Combined Approaches

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Background:

Research effort has been made over the past several years to demonstrate the efficacy and the effectiveness of EIBI for young children with ASD (eg., Boyd *et al*., 2014; Smith et al., 2010; Eikeseth, 2009). Despite the fact that a part of the scientific community recognizes that EIBI should be favored as an intervention for young children with ASD, this assumption is nonetheless accompanied by some criticisms regarding the studies conducted. They include a poorly detailed description of the independent variables specifying the curriculum and important intervention elements (Lechago and Carr, 2008). Love *et al*. (2009) drew a more complete portrait of caseworkers' EIBI practices. The authors underscore the great variability of the implemented programs. More specifically, they stress the fact that supervisors report using more than one curriculum manual, thus suggesting that none of the available curriculums meet all the needs.

Objectives:

The objective of this presentation is to describe the choices made by rehabilitation centers in the context of a universal community based on Early Intensive Behavioral Intervention program (EIBI) for 2 to 5 year-old children with ASD in Quebec (Canada). The approaches and strategies used by professionals are investigated to identify the most frequent and the possible combinations.

Methods: The selected model for evaluating the implementation is the one based on the program theory proposed by Chen (2015). According to Chen's (2015) model, one of the essential components of an action plan that targets the implementation of a program and that guides its evaluation is the intervention and service delivery protocol. A questionnaire about implementation (translated and adapted from Love *et al*. (2009) and Gamache, Joly and Dionne (2010)) was completed by 114 stakeholders from 14 rehabilitation centers across the province. A descriptive analysis was used to examine the results obtained through the questionnaire.

Results:

When asked about the approaches used within the EIBI program, stakeholders have multiple responses. One hundred (87%) say they use Applied Behavior Analysis (ABA). Seventy-two people (62.6%) report using PECS and environmental structuring respectively, while 65 (56.5%) use sensory integration and 32 people (27.8%) use Verbal Behavior. Thirty-four respondents (29.6%) report using other intervention approaches that they do not consider to be part of the EIBI program. Among the other approaches and strategies reported, the most common is the naturalistic approach (8.7%). The combination of approaches and strategies is frequently mentioned. For the 100 people who use AAC, 66 use it in conjunction with PECS, 69 with TEACCH, 30 with Verbal Behavior and 62 with sensory integration.

Conclusions:

This study enabled us to describe the choices made by the large majority of the centers mandated by the province of Quebec to offer a free universal EIBI program to children under 6 years of age with ASD. It confirms the diversity of choices. This study thus contributes, albeit modestly, to the advancement of the emerging Implementation Science by describing the organizations' choices, a major, yet barely studied, link in the implementation of such complex programs.

180 **141.180** Improvement in Social Communication Skills Following the PEERS® for Preschoolers Intervention

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Background: Social impairment is a hallmark feature of neurodevelopmental disorders, and significantly affects individuals with ASD regardless of cognitive and language functioning (Carter et al. 2005). While social challenges emerge early, and are highly impairing across the lifespan (Howlin et al, 2000; Rao et al. 2008), few evidence-based social skills interventions (SSIs) exist, particularly for young children with ASD. Children with generally average cognitive abilities have unique SSI needs; however, even fewer programs exist for this group (Reichow et al. 2013). These children are likely to be socially motivated, and to be aware of their differences, leading to distress if social skills impairments are unaddressed. Objectives: To develop and test a time-limited SSI for young children with ASD with average cognitive abilities. Multiple components which were previously found to bolster treatment gains were included, including active parent education and training, play-based group format, multimodal teaching strategies, and teaching of concrete skills for friendship building. In addition to studying treatment efficacy, predictors of treatment gains were investigated.

Methods: An open-trial (Study 1) and a randomized-controlled trial (Study 2) were completed. Study 1 included 5 children with ASD (mean age = 5.28 years); Study 2 included 11 children with ASD (mean age = 4.89 years). Methods across studies were similar. The PEERS® for Preschoolers intervention is a parent-assisted social skills treatment program that met once weekly over the course of 16 weeks. Each session was 90 minutes; parents and children attended separate and joint concurrent sessions that focused on key strategies for friendship development and maintenance. At baseline, the KBIT-2 and VABS-2 were collected. At baseline and post-treatment, the QPQ, SSiS, SRS-2 and ADOS-2 were collected. Select measures will be discussed here.

Results: Study1: Parent-reported SRS-2 Total Scores decreased by 9.00 T-score points (p=.158, d=.776), indicating a strong trend with a medium/large effect overall. Parent-reported *SSiS* Social Skills scores increased by 5.40 Standard Score (SS) points (p=.633, d =.132) and *SSiS* Problem Behavior scores decreased by 2.20 SS points (p=.782, d=.231); effect sizes were small. Study2: Parent-reported SRS-2 Total Scores decreased by 9.45 T-score points (p=.001, d=1.40), indicating a clinically and statistically significant improvement with a large effect size. From pre- to post-treatment, there was a significant decrease in parent-reported *SSiS* Problem Behavior scores (-5.90 SS points, p=.032, d=.803, large effect). There was a strong trend toward a significant improvement in parent-reported *SSiS* Social Skills. Predictors of treatment gains: Across studies, treatment gains were independent of baseline KBIT-2, VABS-2, and ADOS-2 comparison scores. Treatment gains on the SSiS Social Skills domain were predicted by baseline SSiS Social Skills scores (r=.531; p=.042, r^2=.282). No predictors were identified for improvements in SSiS Problem Behaviors or SRS-2 Total Scores.

Conclusions: Though results should be interpreted with some caution and are limited due to small sample sizes, they suggest social growth and a decrease in problematic behaviors following the PEERS® for Preschoolers intervention. Treatment gains are largely independent of baseline functioning, indicating that the program is likely to be beneficial for many young children with ASD.

181 **141.181** Psychoeducational Intervention in Preschool Age

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Background: Early and intensive intervention on pervasive developmental disorders such as autism, is regarded by specialists everywhere, as vital for a better prognosis. We developed an intensive and systematic program (Psychoeducational integrated intervention) , with a multidisciplinary team (with psychologists, occupational therapists, speech therapists), for children with ages under 6 years old, with autism spectrum disorders The program takes place at the clinical setting but also in the child's school and home, integrating all the resources of family. Parents are invited to participate in the sessions, to learn daily strategies to promote their child's development at home. The success of the intervention is evident with monthly monitoring and adjusting of objectives.
Objectives: To evaluate the success of this program in ASD children

Methods:

- All children were assessed with ADOS (Autism Diagnostic Observation Shedule and the Psychoeducational Profile III (PEP-III; Schopler, Lansing, Reichler, & Marcus, 2005) in at least two distinct moments. The results obtained in the two evaluation moments were analyzed, with approximately 12 months of interval between the first and second moments.
- In this study 25 children were selected, who attended the program for a period equal to or greater than 12 months; The children selected were aged between 20 and 70 months.

Results:

- As can be seen from the results , from Moment 1 to Moment 2, approximately 12 months apart, great progress was observed in all children. All the children showed evolution, with a greater number of items in which they are successful, as well as a greater number of skills that are emerging.

Conclusions: This early intervention program integrating different resources involving therapists anf parent training may contribute for a better prognosis in ASD

Poster Session
142 - Neuroimaging
5:30 PM - 7:00 PM - Room: 710

182 **142.182** Autistic Traits Are Both Distributed and Localised within Structural and Functional Brain Networks

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Background: Autism, the autism spectrum and the broader autism phenotype are behaviourally defined constructs whose physiology remains murky. Impairments in theory-of-mind present a major aspect of autism's 'core' social communicative symptoms, although it's unclear to what extent such symptoms may be fractionable features which interact only later in development (Valla & Belmonte, 2013; doi: 10.1016/j.dr.2013.08.004). Behavioural measurements have tended to be coarse, failing to capture the often subtle variability of theory-of-mind across the autism spectrum, and this limitation holds doubly when it comes to dimensional variation beyond the autism spectrum: Most assays have used a binary outcome- success or failure at the theory-of-mind question- which cannot assess a dimensional continuum, and narrative presentations which can confound theory-of-mind with verbal working memory.
Objectives: We ask whether both psychometric measures of autistic traits and a continuous, reaction-time measure of theory-of-mind, in a visual presentation, might correlate with neural network integrity at whole-brain and regional scales.

Methods: In 30 right-handed normal volunteers (12 females) aged 27.29±2.88, we studied the relationship between anatomical (diffusion tensor imaging (DTI)) and physiological (500 s of 2 Hz eyes-closed rs-fMRI) measures of brain connectivity, and psychometric (Social Responsiveness Scale (SRS), Autism Spectrum Quotient (AQ), Systemising Quotient (SQ)) and behavioural (the Attention Network Test (ANT)), and key-press reaction time difference associated with a computer-game theory-of-mind condition) measures of autistic traits. The AAL-90 atlas was warped to functional scans and to grey/white segmented T1-weighted anatomical scans to label regions. A functional correlation matrix was constructed over mean fMRI time series within each pair of regions. Similarly, segmented T1-weighted anatomical scans and the entire diffusion-weighted

series were rigidly registered to the corresponding first b=0 image, the AAL-90 atlas was warped to these, and probabilistic tractography was conducted from grey-matter voxels to construct an anatomical connection strength matrix over all region pairs. These functional and anatomical correlation matrices produced network measures of clustering coefficient, characteristic path length, and efficiency (Rubinov & Sporns, 2010; 10.1016/j.neuroimage.2009.10.003).

Results: For the functional connectivity data, high SRS scores were associated with strong clustering (r=+.45, p=.008), short path length (r=-.39, p=.018) and high efficiency (r=+.47, p=.006), globally and within regions spanning temporo-parietal and prefrontal cortices. Similar trends manifested for AQ scores. Likewise, delayed orienting of attention (lower orienting effect) in the ANT was associated with strong clustering (r=-.42, p=.0095), short path length (r=+.44, p=.007) and high efficiency (r=-.46., p=.0133). For the structural connectivity data, SQ was associated with strong clustering (r=+.37, p=.023) and efficiency (r=+.38, p=0.018) in a relation driven specifically by temporal pole; theory-of-mind reaction time trended towards relation with strong clustering (r=-.27, p=.0766) and efficiency (r=-.28, p=0.0655) overall, but this relationship became highly significant within right supramarginal gyrus.

Conclusions: Autistic traits as indexed by SRS, AQ and SQ, and slowed attention shifting in the ANT, are associated with more efficient distributed resting-state functional networks. Theory-of-mind, in contrast, relates largely to localised structural integrity within right temporoparietal junction. Measured localisation of function depends not only on the cognitive capacity assayed but also on the assay itself.

183 **142.183** Autistic Traits Predict Individual Differences in Salience Network Connectivity in Absolute Pitch Musicians

ABSTRACT WITHDRAWN

Background: Absolute pitch (AP) and Autism Spectrum Disorder often co-occur in individuals, are both heritable, and are associated with atypical brain connectivity (Mottron, 2013). Previous attempts to explain these similarities in terms of locally-biased perceptual processing have had limited success. Low cognitive flexibility and greater sensitivity to sound may better explain the relation between autistic traits and possession of absolute pitch. Here, we examine to what extent such a profile is associated with atypical functioning of the fronto-insular salience network (Uddin, 2013), which plays a role in integrating external sensory information to coordinate goal-directed behavioural responses and may provide a unifying framework for the co-occurrence of AP and autism.

Objectives: We investigated functional brain connectivity using resting-state fMRI in salience and default-mode networks (DMN) in musicians with and without AP, and investigated individual differences in autistic traits and salience network connectivity.

Methods: 120 musicians completed an online survey about their musical experience, possession of absolute pitch and autistic traits as measured by the Autism Spectrum Quotient (AQ, Baron-Cohen, 2001). A subset (n=32) with and without AP (AP=17, non-AP=15), matched on age (mean=24±6 years) and years of musical training (mean=18±5 years), completed a musical discrimination task (Wallentin, 2010), the Wechsler Adult Intelligence Scale (Wechsler, 1939), and resting-state functional MRI in a 3T scanner while viewing a fixation cross. Connectivity of the salience network (seeded in the fronto-insular region) and DMN, using seed-to-voxel connectivity was estimated using the CONN toolbox in SPM12. Group differences in brain connectivity between AP and non-AP possessors are reported at p<.05, false-discovery-rate corrected (FDR). AQ-connectivity relationships were assessed within (regression) and between (ANCOVA) AP and non-AP groups.

Results: The AP musicians had AQ scores in a higher range (17±7) than the non-AP ones (15±5) although the difference was not statistically different (p=.2). Participants did not differ in melody or rhythm discrimination (mean percent accuracy=84±5, p=.7) nor on full-scale IQ (mean=113±14, p=.5). Seed-based elicitation of salience network connectivity co-occurred with decreased correlations with the posterior default mode network in both groups (Fig.1). The AP group contrasted against the non-AP showed hyperconnectivity of the salience network, particularly with DMN regions in the posterior cuneal and occipital cortex (p<.05-FDR corrected, Fig.2a), but no differences in the DMN itself. These differences in salience network connectivity were positively related to AQ score within the AP group (p=.04, Fig.2b) but not the non-AP group (p=.14).

Conclusions: Individuals with AP show increased connectivity in the fronto-insular salience network which is predicted by their AQ score. The hyperconnectivity of SN occurs in combination with reduced suppression of the DMN. Reduced dynamic switching between these large-scale networks can impair cognitive flexibility (Menon, 2010) and might explain common features of both AP and autism. Although there is tremendous heterogeneity in executive functions in both AP and autism, these findings provide support for further investigation of cognitive flexibility and salience network connectivity to account for their co-occurrence in a subgroup of individuals. This link from physiology to perception and cognition in turn can provide further avenues for fractionating the ASD phenotype.

184 **142.184** Specific Association between at-Rest Alpha Power and Restrictive and Repetitive Autistic Traits: Replication and Extension in a Clinical Sample

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Background: Previous literature suggests that different domains of autistic traits are associated with dissociable patterns of at-rest neural activity. Better understanding of the neural drivers of specific domains of symptoms may inform the neurobiological basis of behavioural variation and help to parse heterogeneity in autism spectrum disorder (ASD). Recently, a specific association between alpha power and restricted and repetitive traits has been reported in typically developing adults. These findings require replication and testing in clinical samples.

Objectives: We aimed to replicate and extend previous work by: (1) testing for a positive association between alpha power in the parietal region and restricted and repetitive traits in a sample of typically developing (TD) adolescents (N=61; 34 males, mean age= 13.07, mean IQ= 106.97); (2) examining this relationship in a clinical cohort of adolescents with ASD (N=91; 70 males, mean age= 13.67, mean IQ= 101.70) and by differentiating between low (6-8Hz) and high (8-12Hz) alpha.

Methods: ASD traits were assessed using parent-report Social Responsiveness Scale-2 (SRS) subscales (social awareness, social cognition, social communication, social motivation, restrictive and repetitive behaviours (RRB)). Indices of normalized power were extracted from at-rest EEG activity. As the primary goal was to replicate previous findings, analyses focused on traits measured by the RRB subscale.

Linear regression was used to test the association between RRB traits and low and high alpha power in the TD and the ASD samples separately. Where significant associations were found, age, IQ and sex were included as covariates. Following from this, multivariate regression assessed both

topographical and oscillatory specificity. Ongoing analyses examine (1) the relationship between other indices of alpha (e.g., peak alpha frequency) and RRB traits and (2) RRB traits, alpha power and anxiety, measured by the Childhood Behaviour Checklist (CBCL) and Childhood Anxiety Sensitivity Index (CASI).

Results: No associations were found in the TD group, likely reflecting a restricted range in SRS scores (range of 41-66 in the TD group vs. range of 45-110 in ASD group on the RRB subscale). Consistent with prior work, a positive association between parietal alpha power, specifically in the low frequency band, and RRB traits was observed in the ASD group (p=0.02; Figure 1), which remained when covariates were included in the model (p=0.03). A comparable association between RRB traits and low alpha power to that reported in the parietal region was found in the central (p=0.02), but not in the frontal or occipital regions. No significant associations were found between delta, theta, beta or gamma power in the parietal region and RRB traits.

Conclusions: Consistent with prior findings for autistic traits in adults, we found a positive association between lower alpha power in the parietal region and RRB traits in a clinical sample of youth with ASD. Contrary to our previous work in adults, we did not observe this relationship in the TD sample; this may reflect the constrained range of RRB traits observed in the sample, or it may suggest that the effects represent a developmental phenomenon emerging in later adolescence or early adulthood.

185 **142.185** Atypical EEG in Autism Spectrum Disorder: Comparing a Dimensional and a Categorical Approach

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Background: While many studies have found group differences in neural dynamics between people with and without autism spectrum disorder (ASD), the extent to which variation in neural dynamics is related to variation in the autism phenotype across the population is not known. **Objectives:** The aim of this study was to establish whether neural variables, namely inter-trial phase coherence (ITC) and multiscale entropy (MSE), that have previously been shown to differ at a group level between people with and without ASD, also correlate with individual differences in the autism phenotype across the population. ITC and MSE were selected for analysis as they reflect different aspects of neural information processing, including consistency of the neural response (phase coherence) and complexity of the EEG signal (MSE). Furthermore, both variables have been suggested by previous studies to represent either an endophenotype or a biomarker for ASD. **Methods:** Data were obtained from ninety-nine adults, thirty-eight of whom had an ASD diagnosis and sixty-one of whom did not. Phenotypic information was obtained from the Social Responsiveness Scale (Revised), the Repetitive Behavior Questionnaire, the WHO Adult ADHD Self-Report Scale Screener and the Beck Anxiety Inventory (Trait version). Neural dynamics were computed from EEG data acquired during visual stimulation (presentation of 200 black and white checkerboard stimuli) and during a period of eyes-closed rest. **Results:** The phenotypic questionnaires revealed individual differences in autistic traits across the population, reflecting many previous reports that traits and behaviours associated with the autism phenotype are continuously distributed. Individual differences in both ITC and MSE were also found. However, non-parametric correlation analyses indicated that none of the phenotypic variables were related to either ITC or MSE: rho <.200; p >.05, Bayes Factors (BF_{01}) evaluating the strength of evidence for the null hypothesis > 3. Despite finding no relationship between neural dynamics and the autism phenotype, group-level statistics showed that both ITC and MSE were more likely to be reduced in people with ASD than in those without. Discriminant function analyses indicated that associations between group (with ASD, without ASD) and both ITC and MSE were significant, ITC: $\chi^2(1) = 7.99$, Wilks $\Lambda = .825$, p =.005; MSE:, $\chi^2(1) = 4.34$, Wilks $\Lambda = .90$, p =.037, however not all participants with ASD showed reduced MSE or reduced ITC. **Conclusions:** These data suggest that there are likely to be multiple neural profiles underpinning ASD, and highlight that while the autism phenotype is continuously distributed across the population, this distribution is not underpinned by individual differences in these measures of neural dynamics.

186 **142.186** A Better Approach to Measuring Brain Volume in Autism Spectrum Disorder

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Background: Total brain volume (TBV) and intracranial volume (ICV) have been extensively researched in individuals with Autism Spectrum Disorder (ASD). Though, findings are often inconsistent. Additionally, some past studies did not account for age and gender, and were often based on small to moderate sample sizes.

Objectives: Brain volume data from studies examining autistic and typically developing (TD) participants were gathered to develop the Autism Neurophysiological Parameters Atlas (ANPA). Brain volume trends in light of age were compared between these two groups.

Methods: Following a systematic search, 34 and 30 studies measuring TBV and ICV, respectively, were included. Raw data, or the means and standard deviations of brain volume and age, were obtained from 3,316 autistic participants and 2,744 TD participants. ANCOVA's, controlling for age, compared raw data of autistic participants to TD individuals for males and females separately across a number of age groups. The frequency of extreme (±1.5 SD) TBV and ICV were also explored.

Results: Compared to TD males, findings revealed autistic males to have larger TBV and ICV during late childhood and adolescence (p<.05), respectively, as well as smaller TBV during adulthood (p<.05). In contrast, brain volume was not different between autistic and TD females. Extremely small (OR=3.11), and extremely large (OR=7.17), TBV was more common in autistic than TD males aged two to four years. Compared to controls, autistic males were more likely to have extremely large TBV and ICV between nine to 12 years (OR=3.73), and between 13 to 17 years (OR=6.02), respectively. During adulthood, autistic males were more likely to have extremely small TBV than TD males between 18 and 24 years (OR=3.41), and above 25 years (OR=4.04).

Conclusions: We conclude that for those diagnosed with autism, brain volume is dynamic over age, and varies considerably between autistic individuals. Although some mean differences were observed, a greater amount of variance in brain volume was present in autistic than TD males. Future research investigating brain volume in ASD is needed to account for such variance rather than comparing means between groups. Unlike meta-analyses and independent studies, the ANPA properly accounts for outliers by capturing the entire variance in the data. Hence, the ANPA more effectively describes brain volume in ASD compared to previous methods.

187 **142.187** A Clinical and Behavioral Protocol for Obtaining Electrophysiological Data with Children with Low Language and Cognitive

Ability

***E. S. Kuschner**, M. Kim, M. DiPiero, M. Ku, L. Bloy, J. C. Edgar and T. P. Roberts, Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Neuroscience research conducted with individuals with autism spectrum disorder (ASD) has historically been limited to those with age-appropriate cognitive abilities who are considered "high functioning" cohorts. Children who are nonverbal or have intellectual disability have frequently been excluded from research given anticipated barriers such as tolerating loud sounds associated with magnetic resonance imaging and remaining still during an imaging exam (South et al., 2013). Including individuals with lower intellectual and language abilities in neuroimaging research is needed to obtain a more complete understanding of ASD (and associated disorders). As such, there is a need for approaches to: 1) improve data quality across age and performance range; and 2) identify non-pharmacological, non-sedative, and awake recording strategies. Identifying new approaches for individuals previously excluded from neuroimaging research is a critical step in understanding the genetic expression of ASD, and more specifically, language development (Tager-Flusberg et al., 2017).
Objectives: To develop and implement a clinical and behavioral protocol for obtaining electrophysiological data using magnetoencephalography (MEG) with minimally verbal or nonverbal children with ASD (8-12 years).

Methods: Participants were 14 children with ASD (11 males, mean age=9.9 years, SD=1.3; Nonverbal IQ mean=54.9, SD=13.2) meeting the study definition of minimally verbal or nonverbal (i.e., expressive vocabulary of fewer than 30 words used spontaneously, flexibly, and communicatively). With the support of the newly developed *MEG Protocol for Low-language/cognitive Ability Neuroimaging* (MEG-PLAN), all participants completed MEG protocols using a 275-channel CTF MEG system. Paradigms were short (five to fifteen minutes) and were passive and thus did not require task performance. Data are presented from a pure tone paradigm. 150 trials each of interleaved 500Hz and 1000Hz tones were presented at a pseudo-randomized interstimulus interval (ISI) in the range of 1500 to 2000 ms (approximately 5 minute acquisition). Test-retest reliability was evaluated for a subset (n=8) of participants.

Results: Based on stakeholder feedback, MEG-PLAN was developed as an interdisciplinary protocol to integrate clinical/behavioral (presented here) and technical components to be implemented by a team of clinicians, scientists, and MEG technicians (see Figure 1). Clinical and behavioral components focus on using parents as partners, with strategies based on the principles of applied behavior analysis, including systematic desensitization and habituation, differential reinforcement, visual supports, and individual tailoring. MEG-PLAN is implemented in three parts via (1) initial assessment, (2) plan and preparation for the family and team, and (3) *in vivo* support at the MEG Visit. Using MEG-PLAN, a 75% success rate for obtaining evaluable MEG data was achieved. Moreover, results were reproducible; based on data from eight participants who were scanned twice, M50 latency values were found to be reliable (interclass correlation coefficient = 89%).

Conclusions: Results indicate that children with ASD who are minimally verbal or nonverbal, and often have co-occurring intellectual disability, can be effectively and comfortably supported to complete neuroimaging paradigms that yield valid and reproducible results. MEG-PLAN is a protocol that can be disseminated and implemented across research teams, and likely adapted across technologies to collect neuroimaging data in a previously understudied group of individuals.

188 **142.188** A Diffusion Weighted Imaging Tract Based Spatial Statistics Study of Autism Spectrum Disorder in Preschool Aged Children

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Background: The core symptoms of Autism Spectrum Disorder (ASD) are widely theorized to result from altered brain connectivity. Diffusion weighted magnetic resonance imaging (DWI) has been a versatile method for investigating underlying microstructural properties of white matter (WM) in ASD. Despite phenotypic and etiological heterogeneity, DWI studies in majority male samples of older children, adolescents and adults with ASD have largely reported findings of decreased fractional anisotropy (FA) across several commissural, projection, and associative fiber tracts. However, studies in young preschool aged children (<30-40 months) suggest an inverse relationship between WM diffusion properties and ASD earlier in development
Objectives: We sought to characterize WM diffusion properties associated with ASD in a sample of male and female preschool aged children.

Methods: We analyzed 127 individuals with ASD diagnoses (85♂,42♀) and 54 typically developing controls (42♂,26♀), aged 25.1-49.6 months. DWI were acquired in 30 independent directions with five interleaved non-diffusion weighted images. An accompanying phase map image was acquired to correct for field inhomogeneities. Images were preprocessed using MRtrix3 and the FSL diffusion toolbox and included; 1) denoising, 2) Gibbs artifact correction, 3) eddy current correction, 4) between and within volume motion correction, and 5) field distortion correction. Tensor maps were used to calculate corresponding maps of FA, mean diffusivity (MD), radial diffusivity (RD), and axial diffusivity (AD). Whole brain voxel-wise statistical analysis of FA, MD, RD, and AD maps was conducted using tract based spatial statistics (TBSS). Voxel-wise effects of group were estimated by regression of a general linear model including sex, age in months, mean absolute and relative RMS motion parameters as covariates. Interaction effects between group, sex, and age were also tested by adding the appropriate term to the above model.

Results: Males and females with ASD had significantly increased measures of FA in eight clusters (TFCE $p<0.05$) that incorporated several WM tracts including regions of the genu, body, and splenium of the corpus callosum as well as the corona radiata, inferior and superior longitudinal fasciculi, cerebellar peduncles and corticospinal tract. No significant between group differences were observed for measures of MD, RD, or AD. A group-by-sex interaction was observed in measures of AD across six significant clusters (TFCE $p<0.05$) incorporating areas of the body, genu, and splenium of the corpus collosum as well as areas of the right corona radiata and external capsule. In these tracts ASD females showed increased AD compared to TD females while ASD males showed decreased AD compared to TD males. No significant group-by-age, sex-by-age, or group-by-sex-by-age interaction effects were observed.

Conclusions: The current findings support growing evidence that young children with ASD have atypical measures of WM microstructure that appear to differ in directionality from alterations observed in older individuals with the condition. To our knowledge this study represents the largest sample of females with ASD to be evaluated using DWI. Microstructural differences associated with ASD largely overlapped between sexes. However, differential relationships of AD measures indicate that sex likely modulates ASD neural phenotypes.

189 **142.189** Accelerated Decline of Motor Tracts and Links with Symptom Severity in Older Adults with ASDs

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Background: Motor function often declines in healthy aging, with negative consequences for quality of life. In autism spectrum disorders (ASDs), motor deficits are common and can be detected even before core diagnostic symptoms (e.g. socio-communicative deficits) become evident. Much less is known about motor functions in older adults with ASDs. A few studies have suggested impaired motor function and a possible increased risk for Parkinsonism, but little is known about brain changes in the motor system in adults with ASDs past the age of 40 years.
Objectives: To characterize the microstructure of motor and premotor tracts in older adults with ASDs compared with a matched neurotypical group (NT), and identify the relationship between path structure, age, and behavior.

Methods: Diffusion weighted MRI data were collected from older adults (40-65 years): 19 with ASDs (mean age 50.5 years, 2 female, 1 left-handed) and 24 neurotypical (mean age 51.3 years, 3 female, 3 left-handed). Diagnostic groups were matched for gender, age, handedness and head motion. Motor function was assessed with the Bruininks motor ability test (BMAT). The primary motor, dorsal pre-motor, ventral pre-motor, supplementary motor and pre-supplementary motor cortices of the Human Motor Area Template were warped to individual diffusion space and used as seed regions for probabilistic tractography (FSL). Only ipsilateral streamlines passing through the posterior limb of the internal capsule and cerebral peduncles were retained. Left and right tracts were recoded to dominant and non-dominant based on hand dominance. To study group, age and group by age interactions, ANCOVAs were run on tract measures (fractional anisotropy [FA], mean diffusivity [MD], volume) for dominant and non-dominant hemispheres, covarying for head motion and protocol. To investigate relationships between structure and behavior, partial correlations were run between tract measures and BMAT and ADOS-2 scores controlling for age, head motion and protocol.

Results: Only 3 out of 5 tracts were reliably identified (Fig. 1A). We found a significant group by age interaction for MD of the dominant dorsal premotor tract (Fig. 1B, p=.006) using a Bonferroni-corrected threshold. Follow-up partial correlations showed a positive relationship with age for MD in the ASD, but not the TD, group. Behavioral partial correlations revealed a significant positive association between volume of the dominant primary motor tract and ADOS-2 comparison score in ASD (partial r=.814, p<.001), using an FDR-corrected threshold (Fig. 1C). Additional correlations with medium effect size (|r|≥.5) were found between structural measures and the BMAT (summary score, manual dexterity) and ADOS-2 (social affect, restricted and repetitive behavior), in ASDs but did not survive FDR correction.

Conclusions: In older adults with autism, we found atypical decline of the dominant dorsal premotor tract, which may reflect disruption of learning associations between sensory input and action, and could reflect accelerated decline in ASDs. The association between motor tract structural measures and both motor performance and autism symptoms found in older adults with ASDs suggests possible decline beyond the motor system or an at-risk subgroup among those with higher ASD severity.

190 **142.190** Age Related Differences in Hippocampal Anatomy and Correlates with Episodic Memory and Executive Function in Autism Spectrum Disorder

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Background: Over the last 30 years, a rise in autism spectrum disorder (ASD) diagnoses has led to a large group of aging individuals with ASD. Little is known about how aging will affect these individuals' neuroanatomy, compared to the neurotypical (NT) population. Recently, our group found that older adults with ASD have reduced executive functioning and smaller hippocampi compared to NT adults (Braden et al., 2017).
Objectives: This study sought to expand on previous findings from our group by segmenting the hippocampus into 12 unique subfields and determine the difference in relationships between the volumes of the individual subfields and age in ASD compared to NT adults. In addition, this study tested whether relationships between hippocampal subfield volumes and measures of executive functioning and episodic memory existed and if they were different in ASD compared to NT adults.

Methods: This project used Freesurfer 6.0 to perform a cross-sectional analysis of 12 hippocampal subfield volumes in adults with ASD (n = 53) and NT (n =39) from structural MRI scans. Using ANOVA with discrete age cohorts (young-adult: ages 18-25 years, n=42; middle-age: ages 40-70 years, n=50). Correlations were examined between subfield volumes and measures of executive function (Wisconsin Card Sorting Task [WCST] and Tower of London [ToL]), as well as episodic memory (Auditory Verbal Learning Task [AVLT]) with a false discovery rate of p=0.05 to correct for multiple comparisons. All participants with ASD had their diagnosis confirmed with the Autism Diagnostic Observation Schedule-2.

Results: There were significant interactions in several hippocampal subfield volumes (e.g. left and right hippocampal tail, subiculum, CA1, molecular layer, dentate gyrus, CA4, and fimbria, right presubiculum, and left hippocampal amygdala transition area) such that adults with ASD showed larger age-related differences compared to NT adults. Correlations with behavioral measures showed that AVLT performance was related to many subfield volumes across all participants. There were no significant relationships between hippocampal subfield volumes and WCST or ToL performance that survived correction for multiple comparisons. Correlations between behavioral measures and hippocampal subfield volumes were not significantly different between ASD and NT participants.

Conclusions: Results indicate that adults with ASD may be at risk for accelerated age-related hippocampal volume loss; however, this warrants confirmation with a longitudinal sample (in progress). Behaviorally, our study suggests hippocampal size is more strongly related to episodic memory than executive functioning performance, and that this relationship does not differ between adults with ASD and NT adults of either cohort age.

191 **142.191** Altered Activation and Functional Connectivity during Implicit Language Learning in 9-Month-Old Infants at Risk for ASD

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Background: Word segmentation is a fundamental aspect of language learning, since the identification of word boundaries in continuous speech must occur before the acquisition of word meanings can take place. We previously used fMRI to show that children with autism spectrum disorder

(ASD) are less sensitive to statistical and speech cues that guide implicit word segmentation. Prior studies have shown that neural activity related to language processing can be detected in 2-day-old neonates during natural sleep; to date, however, very little is known about the neural mechanisms underlying language learning during infancy and how this may be associated with risk for developing ASD.
Objectives: We examined the early neural signatures of language-related learning to characterize the neural networks subserving language acquisition in 9-month-old infants at high (HR) and low risk (LR) for ASD. We also related early measures of brain activity to longitudinal behavioral measures of language development and ASD symptom severity.

Methods: During natural sleep, infants were exposed to speech streams consisting of concatenated syllables where the statistical regularities and prosodic speech cues to word boundaries were manipulated across three conditions: 1) Stressed Language containing prosodic cues (i.e., stress; higher pitch, increased amplitude, and longer duration for the first syllable of the trisyllabic words used to created the speech stream) and strong statistical regularities, 2) Unstressed Language containing solely strong statistical regularities, and 3) Random Syllables containing weak statistical regularities and no prosodic cues. Risk status was determined by virtue of having one or more older siblings with a confirmed ASD diagnosis. A linear function was used to model changes that occurred over the course of exposure to each condition to estimate learning-related signal increases and compared these across groups. Next, a psychophysiological interaction (PPI) analysis examined differences in functional connectivity during exposure to the speech stimuli. Lastly, parameter estimates of brain activity and connectivity were correlated with behavioral measures collected at later time points.

Results: Compared to HR infants, LR infants showed more learning-related signal increases in left temporal regions during the Stressed Language condition, which contained both strong statistical regularities and speech cues. During this condition, the PPI analysis revealed greater functional connectivity between bilateral primary auditory cortex and right anterior insula in LR infants compared with HR infants. Interestingly, learning-related signal increases at 9 months correlated with later language outcome (CDI Receptive Advantage; 12 months) as well as ASD symptom severity (ADOS-2; 36 months); in addition, functional connectivity was associated with later language outcome (MSEL Verbal Score; 36 months).

Conclusions: In line with prior evidence in older children with ASD, HR infants already show diminished neural responses associated with implicit language learning by 9 months of age. Compared to the HR group, LR infants show greater brain activity as well as stronger functional connectivity in regions implicated in salience detection. Our findings indicate that early differences in the neural networks underlying language learning may predict altered trajectories in language development and ASD symptomatology before delays in language acquisition can be observed overtly at the behavioral level.

192 **142.192** Anomalous Patterns of Inferior Parietal Lobule Functional Connectivity and Handwriting Impairment in Children with Autism

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Background: Children with Autism Spectrum Disorder (ASD) exhibit handwriting impairments, particularly in letter formation. Although multiple studies have examined neural networks involved in handwriting in neurotypical children and adults, the neural features of handwriting in children with ASD are unknown. The inferior parietal lobule (IPL) is a multi-modal association cortex hub that is heavily involved in skilled motor behavior and handwriting. Differences in functional connectivity of the IPL may account for handwriting impairments in ASD.
Objectives: To examine differences in intrinsic functional connectivity of the IPL, as it relates to handwriting letter formation in typically developing (TD) children and children with ASD.

Methods: Resting-state fMRI data was acquired from seventy-six children (38 ASD) aged 8-12 years. Groups were matched on age, gender and framewise displacement. Masked independent components analysis (ICA) estimated functional connectivity of the IPL, separately for left and right hemisphere (5 independent components/hemisphere), followed by dual regression to estimate whole-brain connectivity maps for each IPL subnetwork. Outside of the scanner, participants completed three conditions of the Minnesota Handwriting Assessment (MHA), on a digitizing tablet. Participants first copied a sentence (Copy), traced the same sentence at a comfortable speed (Trace), and lastly, traced the same sentence as fast as possible (Fast Trace, FT). Letter-form was assessed using Large Deformation Diffeomorphic Metric Mapping (LDDMM) to quantify a participant's deviation from a template, where high form scores indicated poor performance. MHA measures were included as covariates in a second-level GLM of dual-regression whole-brain maps, with significant results meeting FWE cluster-correction ($p<.05$).

Results: A significant effect of diagnosis was observed for FT, such that children with ASD demonstrated worse letter formation than their TD peers ($F(1,73) = 7.33$, $p<.01$). There was no effect of diagnosis for Copy or Trace conditions. IPL functional connectivity analyses revealed a significant interaction effect of FT letter formation with diagnosis (ASD vs. TD) on connectivity of the posterior supramarginal gyrus (pSMG) component bilaterally: While better letter formation was associated with greater pSMG connectivity in children with ASD, for TD children better letter formation was associated with lesser pSMG connectivity. Specifically, the diagnosis x FT interaction was observed for: a) left pSMG connectivity with left precuneus, left dorsolateral prefrontal cortex (DLPFC) and bilateral occipital fusiform gyrus, and b) right pSMG connectivity with the right superior lateral occipital gyrus.

Conclusions: The interaction of connectivity between diagnosis and FT letter formation highlights the known role of the pSMG in the cognitive-motor control of everyday goal-directed skilled actions, including handwriting. The autism-specific association of greater pSMG connectivity with better FT letter formation may reflect increased necessity to recruit higher-order cognitive-motor control during speeded tracing of overlearned letters, which taxes internal model output. In contrast, the detrimental impact of pSMG network recruitment for TD children suggests that these children may do best when relying on more efficient primary motor circuitry to guide speeded tracing of highly practiced orthography. These results indicate a promising first step in understanding the neural circuitry underpinning handwriting: a critical developmental skill that is often impaired in ASD.

193 **142.193** Association between White Matter Microstructure and Autistic Traits across the Diagnostic Divide

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Background:
There is growing evidence that suggests autistic traits lie on a continuum in the general population. Many studies have examined the relationship between white matter (WM) microstructural properties and autistic traits with few studies reporting associations [Lidaka et al. 2012; Gibbard et al. 2013] whilst other studies showed lack of associations [Cedric et al. 2015]. The discrepancies in the results of previous studies led us to carry out this study to find whether the autistic traits in the non-clinical population are associated with WM microstructural abnormalities. Moreover, previous Diffusion Tensor Imaging (DTI) studies in Autism spectrum disorders (ASD) compared to healthy controls have consistently shown reduced fractional anisotropy (FA) and increased mean diffusivity (MD) values in the regions including the superior longitudinal fasciculus (SLF), uncinate fasciculus (UF), inferior longitudinal fasciculus (ILF), and inferior fronto-occipital fasciculus (IFOF) [Catani et al., Brain 2016; Boets et al., 2018; Gibbard et al., 2013]. These brain regions play a significant role in acquiring socio-communication skills, emotional recognition and visual processing skills. In this study, we sought to replicate the above findings and to correlate the diffusion indices with Autism spectrum quotient (AQ) scores in a combined sample of neurotypicals and ASD. It was hypothesized to determine the possible relationship between the WM microstructural integrity and autistic traits.

Objectives:

To determine the white matter microstructural correlates of the autistic traits in the combined sample of neurotypicals and ASD.

Methods:

Fifty three adults (28 neurotypicals, 25 ASD: 31 males, 22 females, age 18-50 years) were recruited for this study. This study was approved by University Research Ethics Committee. Siemens 3T MRI scanner was used to acquire the whole brain DTI images with a 32-channel head coil and high resolution MPRAGE at the Centre for Integrative Neuroscience and Neurodynamics, University of Reading. All the participants also completed the AQ questionnaire. Tract based spatial statistics was employed, on the output of which standard space masks were applied to extract all the mean FA and MD values from the bilateral SLF, UF, ILF and IFOF which were then correlated with the AQ scores.

Results:

Pearson correlation (one-tailed) was used to find the associations between FA, MD values and AQ scores in the combined sample of neurotypicals and ASD while controlling for age, gender and IQ. Negative correlation was found between FA and AQ in right inferior longitudinal fasciculus (r = -0.275, P = 0.027) which was the only statistically significant region. No significant positive correlation between MD and AQ was found.

Conclusions:

In this study, the results replicate the significant findings between the white matter microstructural properties and autistic traits in the right inferior longitudinal fasciculus. This finding is consistent with previous reports of case-control differences in this tract (Gibbard et al., 2013), and provides evidence for the relationship between the white matter microstructural properties and autistic traits across the diagnostic divide. The absence of association in other regions may be due to the inadequate sample size and/or unknown patterns of interaction between age and autistic traits.

194 **142.194** Association of Choline Levels on the Severity of Social Anhedonia in Adults with Autism Spectrum Disorder

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Background: High functioning adults with autism spectrum disorder (HFA) often experience social anhedonia and depression although their pathogenesis remains poorly understood. Recent studies show increased choline levels in the brains of adults with HFA, as well as in participants diagnosed with major depressive disorder (MDD; Murphy *et al.*, 2002; Riley *et al.*, 2018). Increased concentrations of choline in the anterior cingulate cortex (ACC) are reported to alter brain activity and connectivity between the medial prefrontal cortex (mPFC) and posterior cingulate cortex (PCC) in adults with ASD (Libero *et al.*, 2015). Prior research has linked higher choline levels in the brain to increased depression and length of illness in adults with MDD (Riley *et al*, 2018; Portella *et al.*, 2011).

Objectives: The aim of the present study was to examine the association of brain choline levels with severity of social anhedonia, depression and rumination symptoms among adults with HFA.

Methods: Participants were 16 adults (18-45 years) with ADOS-defined ASD; IQs (≥80). (1)H-MRS data was acquired with a 3T scanner for the metabolite choline, which was performed with one voxel (30×30×20 mm^3) in the ACC using a TR/TE of 2000/68 ms with a spectral bandwidth of 2 kHz and 16 water reference lines. Prior to the scan, participants completed the Hamilton Depression Ration Scale, Social Anhedonia Scale – Revised, Kaufman Brief Intelligence Test Second Edition.

Results: After controlling for ASD severity there was a positive correlation found between choline levels and severity of social anhedonia (r= .548, p= .034), severity of depression (r= .621, p=.018), and rumination (r= .560, p= .037).

Conclusions: These findings provide a tentative support for the notion that brain choline levels may be associated with processes involved in the severity of social anhedonia, depression and rumination among HFA. Moving forward, additional studies with larger samples are necessary to fully understand this possibility.

195 **142.195** Association of the Anterior Cingulate Volume and Emotion Regulation in Girls but Not Boys with Autism Spectrum Disorder

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Background:
Children with autism spectrum disorder (ASD) have been observed to experience challenges with controlling emotional responses that are often expressed as aggression, self-injurious behavior and mood dysregulation. Previous literature has looked at the amygdala, anterior cingulate

cortex (ACC) and prefrontal cortex (PFC) as essential brain regions involved in emotional regulation (ER). While influences of sex based differences on ER have been well established, there is still a lack of investigation at the brain and behavior level looking at ER in ASD children with the impact of sex.

Objectives:

To examine brain-behavior associations underlying emotion dysregulation in boys and girls with ASD, as compared with their typically developing (TD) peers.

Methods:

104 ASD (16 girls, 88 boys) and 163 TD (32 girls, 132 boys) participants were balanced on age, sex, socioeconomic status and IQ score. The emotion lability (EL) t-score from the Conners parent rating scale was used to assess ER. Volumes of cortical regions (amygdala, ACC, dorsolateral PFC) were derived from high resolution T1-weighted images using FreeSurfer version 6.0. Multiple regression analyses were performed to investigate: 1) the effect of diagnosis, sex, and interaction thereof (diagnosis*sex) on EL scores, and 2) associations of cortical regions with EL t-scores and effects of diagnosis, sex, and diagnosis*sex on the relationship between cortical regions and EL t-scores; significant associations were followed-up with Pearson correlations.

Results:

Multiple regression revealed a statistically significant effect of diagnosis ($F(1,263) = 5.213$, $p = 0.023$), sex ($F(1,263) = 96.457$, $p < 0.001$), and interaction of diagnosis*sex ($F(1,263) = 4.029$, $p=0.046$). Follow up post hoc analyses tests revealed elevated EL t-scores in children with ASD compared to TD children. Significant interactions were found such that both girls and boys with ASD showed higher EL scores compared to TD peers, although it was significantly stronger in girls (M=66.19, SD=14.232) than boys (M=59.39, SD=11.165). Regression analyses of brain-behavior associations revealed that there was a marginal diagnosis*sex interaction ($F(7,259) = 22.266$, $p=0.094$) for the relationship between the left ACC volume and the EL t-score. Specifically, as figure 1 indicates, the left ACC volume showed significant correlations with the EL t-scores in ASD but not TD girls. Lower left ACC volumes were negatively correlated with higher EL t-scores in ASD girls ($r=-.579$, $p=0.019$). No significance was found with the amygdala and PFC regions.

Conclusions:

Findings reveal that children with ASD face difficulty with ER when compared to TD peers but this may be a problem that is more present in girls with ASD. Furthermore, ASD girls show a unique association with the left ACC volume; therefore, the dysfunction of the left ACC may contribute to the emotional challenges experienced by girls with ASD.

196 **142.196** Atypical Cerebral Lateralization in Children with Autism Spectrum Disorder

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Background: Autism Spectrum Disorder (ASD) affects 1 in 59 children, yet relatively little is known about its etiology or development before the emergence of symptoms. Recent research has focused on identifying biomarkers to understand how abnormalities in neural development lead to the ASD phenotype. Prior work has suggested that ASD is characterized by abnormal network connectivity (Wass, 2011). Similarly, previous work has identified abnormal lateralization of functional connectivity at rest in prematurely born individuals—a group at high risk for developmental delay—with greater lateralization associated with poorer language ability (Scheinost et al., 2015). This study utilized resting-state fMRI to investigate cerebral lateralization in children with ASD to elucidate potential mechanisms of aberrant neurodevelopment.
Objectives: Investigate whether children with ASD demonstrate atypical cerebral lateralization.

Methods: Using resting-state fMRI data from the Autism Brain Imaging Data Exchange, we examined connectivity lateralization in children with ASD aged 6-14 years compared to typically-developing (TD) peers. We used cross-hemisphere intrinsic connectivity distribution to correlate each voxel to every other time course in the series in the ipsilateral and contralateral hemispheres independently and then calculated ipsilateral connectivity minus contralateral connectivity. Functional connectivity was performed using linear regression while controlling for sex, age, site, and motion. Analyses included 309 children with ASD and 434 TD peers.Significance was assessed at $p<0.05$, corrected for multiple comparisons.

Results: Children with ASD compared to TD peers exhibited increased connectivity lateralization in right BA-22, right BA-19, and right BA-23/31, and decreased connectivity lateralization in right BA-10. To identify the functional connection most likely responsible for these cross-hemisphere connectivity differences, follow up seed connectivity analysis was performed with these regions as seeds. For children with ASD compared to TD peers, seed connectivity from right BA-22 revealed greater ipsilateral connectivity with right fusiform and middle temporal gyrus and greater contralateral connectivity with left medial prefrontal cortex (mPFC), posterior cingulate cortex (PCC), and inferior frontal gyrus (IFG). Seed connectivity from right BA-19 revealed greater ipsilateral connectivity with right inferior and middle temporal gyrus. Seed connectivity from right BA-23/31 revealed greater contralateral connectivity with the left insula and weaker contralateral connectivity with the left mPFC, PCC, and IFG. Seed connectivity from right BA-10 revealed greater ipsilateral connectivity with right fusiform and angular gyrus, greater contralateral connectivity with the left precuneus, and weaker contralateral connectivity with the left putamen.

Conclusions: Findings suggest that children with ASD demonstrate increased right-hemisphere lateralization in temporal and parietal regions relative to their TD peers. However, children with ASD demonstrated reduced right-hemisphere lateralization in a frontal region relative to peers. This atypical lateralization is associated with multiple resting-state brain networks including the default mode (PCC, mPFC), fronto-parietal (fusiform), ventral-attention (middle temporal gyrus), cingular-oppercular (insula), and subcortical networks (putamen). These findings are consistent with prior work suggesting long-range under-connectivity and short-range over-connectivity in ASD (Lewis et al., 2014)and lend support to the hypothesis that ASD is associated with altered cerebral network development. Future work will investigate plasticity of this lateralization across development and its functional significance.

197 **142.197** Atypical Functional Network Connectivity to Emotional Faces in Adults with ASD

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Background:

Pronounced socio-emotional impairments, including atypical emotional face processing, are inherent to autism spectrum disorder (ASD). At the neural level, differences in functional networks during face processing in ASD compared to controls have been highlighted recently (Kana et al., 2016), which may be associated with difficulties in social functioning. However, few studies have used magnetoencephalography (MEG) to investigate functional connectivity during affective processing in ASD. MEG is ideally suited to examine functional connectivity - it is a direct measure of neural activity and offers good spatial and excellent temporal resolution.

Objectives:

We investigated whole-brain functional connectivity using MEG in the largest sample to date of adults with ASD 48 (M_{age}= 26.76, *SD*= 5.21) and 60 typical developed age-matched controls (M_{age}= 26.64, *SD*= 5.87) during the implicit presentation of emotional faces.

Methods:

Adults participated in an emotional faces task, in which each trial consisted of a happy or angry face and a scrambled pattern (target stimulus) simultaneously presented for 80ms on either side of a central fixation cross. Participants indicated the location of the target (left or right) as rapidly as possible by pressing a button. Structural MRIs were obtained for MEG co-registration. MEG data were epoched by emotional face type. Time series were estimated from 90 cortical and subcortical sources of the AAL atlas using the LCMV beamformer. The phase-lag index was used to assess phase synchronization of ongoing neural oscillations among sources (Stam, Nolte & Daffertshofer, 2007).

Results:

We found a network of increased beta-band phase synchrony 58-228ms following angry faces in adults with ASD compared to controls (35 edges, 35 nodes; p_{corr}= 0.019). This network involved almost exclusively connections among bilateral frontal, including orbitofrontal areas and the right ACC, and temporal regions, including left superior temporal gyrus. Additionally, reduced phase synchrony in the low-gamma frequency band 85-283ms following angry face onset was found in the adults with ASD (51 edges, 47 nodes; p_{corr}< 0.001). This network was anchored in frontal regions, including orbitofrontal areas and the right ACC, and connecting to occipital, and temporal regions, also including the right amygdala.

Conclusions:

These results indicate atypical patterns of hyper- and hypo-connectivity during angry face processing in the beta and low-gamma frequency bands in adults with ASD compared to typical controls. The current findings may suggest atypical top-down/bottom-up functional connectivity in ASD. In particular, beta-band synchronization is implicated in top-down influences, while gamma-band synchronization is involved in bottom-up influences (Fries, 2015). In the current study, greater beta-band phase synchrony may suggest increased top-down influences from primarily frontal areas in adults with ASD compared to controls, whereas reduced gamma phase synchrony may suggest lower bottom-up influences of regions, including the amygdala, which may contribute to difficulties with selective attention of emotional faces in ASD. Abnormal top-down functional connectivity has recently been proposed in this population (Mamashli et al., 2018). Overall, findings are consistent with previous work reporting abnormal neurodevelopment of functional connectivity to emotional faces in ASD (Mennella et al., 2018; Safar et al., 2018).

198 **142.198** Between Group Differences in Correlation of FA with Performance IQ and Age in Autism Spectrum Disorder. Results from EU-AIMS Diffusion Imaging.

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Background:

European Autism Interventions is a multicentre initiative aiming to stratify biomarkers for Autism Spectrum Disorder (ASD) through acquisition and integration of large datasets from different imaging modalities and behavioural measures. We are investigating Diffusion MRI data acquired as part of EU-AIMS. Previous studies have implicated Fractional Anisotropy (FA) differences in the corpus callosum[1], the uncinate[1,2]and reduced volume in the arcuate[3]with ASD.

Objectives:

We aimed to investigate voxel-wise differences between a large cohort (N=187) of ASD and Typically Developing (TD) subjects imaged at King's College London. We also investigated the relationship between FA and Performance IQ (PIQ) behavioural scores and age between our cohorts.

Methods:

Diffusion Imaging data is taken from the King's College London cohort of EU-AIMS. Following exclusion for anatomical/genetic abnormality, high subject motion[8]and intellectual disability we obtain a cohort of 144 subjects (61 TD 83 ASD; *ages 6-30,mean=18.2 STD=5.8*). Data acquisition parameters were: voxel size 2x2x2 mm, b-value = 1500 s/mm^2, 60 diffusion weighted directions and 6 b0s.

Data was de-noised[4], corrected for Gibb's ringing[5], for motion and eddy-current distortions using exploreDTI[6]and outlier replacement using FSL eddy[7]. PIQ for each subject was evaluated using the Wechsler Abbreviated Scale of Intelligence (WASI), including matrix reasoning and block design. Voxel-wise statistical analysis of Fractional Anisotropywas carried out using TBSS (Tract-Based Spatial Statistics[9]) part of FSL[10]. In this study we present results for group differences in Fractional Anisotropy (FA) while correcting for sex and age, and correlation of FA with PIQ and Age.

Results:

Group comparison (TD vs ASD): We find collections of significant *(p<0.05)*voxels across the Corpus Callosum body, Superior Cerebellar peduncles and Uncinate fasciculus *(fig .1)*. These results replicate previously published results from UK-AIMS[2](males, *age 18-40)*.

Significant correlations were found with performance IQ in ASD but not in the whole cohort (p<.05) in regions consistent with U-shaped fibres connecting medially to Caudal Inferior Parietal Lobule *(fig .2, .3)* in left hemisphere.

Finally, correlation of FA with age produces large areas of highly significant (p<.01) voxels, as expected from our large cohort age ranges (6-30) *(fig*

.4). By creating masks of significant voxels for each cohort and subtracting TD from ASD we find areas in the genu and splenium of the Corpus Callosum which correlate strongly with age in ASD only *(fig .3)*.

Conclusions:

Group differences observed in this preliminary analysis of the EU-AIMS cohort and their replication with previous diffusion results from the UK-AIMS cohort identify the Corpus Callosum, Uncinate Fasciculus and the Cerebellar Peduncles as anatomical targets for further analysis. FA in the Genu and Splenium also emerge as showing more correlation with age in ASD than TD, suggesting that brain development in autism may follow a delayed developmental trajectory[11]within these areas. PIQ measures used feature matrix reasoning and block design tests. Block design tests have been previously implicated in autism in the central coherence account[12]. Correlation of performance on these tasks with a parieto-temporal region only in ASD may be of interest to this view of ASD.

199 **142.199** Brain Activity Underlying Fluid Reasoning in School-Aged Autistic Children

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Background: Autistic children perform as well as typically developing (TD) children at visual analogy tests measuring fluid reasoning (Green et al., 2014; 2016; Morsanyi & Holyoak, 2010; Sahyoun et al., 2009). Previous fMRI studies in adults revealed stronger posterior brain activations paired with weaker prefrontal and parietal activations in autistic relative to non-autistic participants during fluid reasoning (Soulières et al., 2009). However, the development of brain mechanisms underlying fluid reasoning has not yet been investigated in young autistic children.
Objectives: To investigate the cerebral activity patterns during a fluid reasoning task in autistic and TD children aged between 8 and 14 years old.

Methods: Sixteen (1 female) autistic and 14 (2 females) TD children (data collection in progress) equivalent in age (M=12.39, SD=1.81), Raven's Progressive Matrices raw scores (M=40.23, SD=8.88) and percentiles (M=53.97, SD=30.14), and laterality were scanned in a 3T MRI scanner while completing a computerized reasoning task containing 168 problems. Problems were 4x4 pictorial matrices with the last entry to be filled with one of 3 response choices. The problems varied in content (either semantic or visuospatial content) and in complexity, implemented as the number of relations to jointly consider in order to solve the problem (0, 1 or 2 relations). SPM12 was used for preprocessing and whole-brain analyses (k=20 voxels, FWE corrected p=.05) of the fMRI data.

Results: Autistic and TD children did not differ in accuracy (p=.65) and response times (p=.93) at the reasoning task. There was a Content X Complexity interaction (p=.02), the 2-relations visuospatial condition being the hardest in both groups. Accuracy also correlated with age in both groups (r=.378). At the cerebral level, a large reasoning network was revealed in both groups, involving mainly occipital, temporal and parietal regions. Autistic children presented stronger activations in the pulvinar, left superior temporal and inferior frontal gyri than TD children, who showed stronger cingular and cerebellar activations. For the semantic problems, there was stronger pulvinar activity in the autistic group. For the visuospatial problems, the precuneus was more active in the TD group. In terms of complexity, there was no significant between-group differences for the 2-relations versus easier problems. In both groups, performance at most complex visuospatial problems was positively correlated with cerebral activity in the occipital lobe and inferior frontal gyrus.

Conclusions: In line with previous findings (Santarnecchi et al., 2017), fluid reasoning was supported by a network of frontal, temporal, parietal and occipital activations in both of our groups. However, even with similar fluid reasoning skills, autistic and TD children presented distinct cerebral activity patterns. In the semantic problems, autistic children seemed to rely on regions involved in visual cognition, such as the pulvinar (Bourne & Morrone, 2017), more so than TD children. During the visuospatial problems, the TD children may have relied more extensively than autistic children on the precuneus (involved in motor and/or visual imagery), a finding we previously reported in adults (Soulières et al, 2009). Thus, cerebral activity would differ between autistic and TD children according to the content of reasoning.

200 **142.200** Brain-Behavior Associations Underlying Praxis Impairments in Girls and Boys with ASD

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Background:
Studies have consistently reported that children with autism spectrum disorder (ASD) show impaired performance of skilled motor gestures, consistent with a developmental dyspraxia. Praxis may therefore serve as a biomarker informative to diagnosis and intervention. There is increasing awareness that autism presentation may differ in girls and boys. Despite this, there has been limited investigation of the impact of sex on praxis in autism.

Objectives:

To examine the impact of sex on praxis and its association with morphology of relevant frontal-parietal circuits in children with ASD and typically-developing (TD) peers.

Methods:

Data from 165 participants (55 girls, 42 ASD) balanced on age, socioeconomic status (SES), IQ, and handedness. Praxis was assessed using the Florida Apraxia Battery, modified for children (total percent correct). The volumes of the left and right inferior parietal cortex (IPC) and the premotor cortex (PMC), structures important to praxis, were processed with Free-surfer. Multiple regression analyses was performed to investigate: 1) the effect of diagnosis, sex, and interaction thereof (diagnosis*sex) on praxis performance, and 2) associations of brain volumes with praxis performance and effects of diagnosis, sex, and diagnosis*sex on the relationship between IPC and PMC morphology with praxis performance; significant associations were followed-up with Pearson correlations.

Results:

Multiple regression revealed a significant effect of diagnosis (p=.000). Effect of sex and diagnosis*sex were not significant. Effect sizes were strong for both girls and boys, although somewhat stronger for boys (see Table 1). Regression analyses of brain-behavior associations revealed that for

right hemispheric IPC and PMC there was a significant diagnosis*sex interaction (F(1, 157)=4.5714, p=.0341; F(1, 157)=9.6430, p=.0023 respectively) (see Figure 1). Specifically, for right IPC and PMC volumes, TD girls showed significant positive correlations, such that higher volumes correlated with better praxis score (r(40)=.343, p=.028); whereas, girls with ASD showed significant negative correlations such that higher volumes correlated with worse praxis score (r(13)= -.744, p=.002). No significant correlations were observed for boys or for left hemisphere in girls.

Conclusions:

Girls and boys with ASD both showed impaired praxis performance compared with their TD peers. The findings suggest that performance of skilled motor gestures is broadly impaired in children with autism. Investigation of brain-behavior associations revealed a pattern specific to girls. For girls with ASD, impaired praxis was found to be associated with larger volumes within a frontal-parietal praxis network (in contrast to TD girls who show better praxis with larger volumes). The findings suggest that right hemisphere morphology may uniquely contribute to dyspraxia in girls with autism.

201 **142.201** Can Resting-State fMRI be Used to Inform Differential Diagnosis between ASD and ADHD?

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Background: Autism spectrum disorder (ASD) and attention deficit/hyperactivity disorder (ADHD) are difficult to differentiate in clinical settings (Miodovnik et al., 2015; Smith et al., 2017), as both exhibit atypical patterns of attention and executive functioning (Gioia et al., 2002; Johnson et al., 2014). Further, children with ASD and ADHD have shared and distinctive patterns of long-range functional connectivity in the brain (Di Martino et al., 2013), though such patterns have not yet been used to mechanistically distinguish between these two disorders. Two brain networks have been implicated in these disorders and are of interest: the salience network (SN), which is related to attentional processes for internal and external events, and the FPN, which plays a role in flexible goal-driven behavior (Seeley et al., 2007). Functional connectivity between these two networks may reveal meaningful subgroups for those with ASD vs. ADHD.

Objectives: The aim of this project is to determine whether community detection, a graph-theory algorithm for subtype identification, can differentiate children with ASD from children ADHD using patterns of SN and FPN connectivity.

Methods: Functional and structural Magnetic Resonance Imaging (MRI), and phenotypic data were selected from the Autism Brain Imaging Data Exchange (ABIDE), its follow-up project ABIDE-2, and the ADHD-200 database. All data were used from New York University Langone Medical Center in order to match datasets on scanner protocol. After excluding subjects with high motion the final dataset consisted of 60 children with ASD, 64 children with ADHD, and 65 typically developing (TD) controls. 5mm spherical regions of interest (ROIs) were chosen for the SN and FPN using Neurosynth (Yarkoni et al., 2011). Group Iterative Multiple Model Estimation (GIMME), a graph theory approach (Gates and Molenaar, 2012), was used with scrubbed resting state data from each subject. Subsequently, a community detection algorithm was used to identify subgroups characterized by SN-FPN connectivity patterns.

Results: ASD and ADHD groups did not differ on age, FSIQ, sex, and motion (all *p*s>.21). GIMME identified two subgroups. Subgroup A had 70 cases and was characterized by hyperconnectivity of SN-FPN nodes. Subgroup B had 119 cases and was characterized by hypoconnectivity of SN-FPN nodes. A chi-square test was performed and a relationship was found between diagnostic status (ASD, ADHD, TD) and the frequency of subgroup membership, X^2 (1, N=189)=7.18, p<.05. Of note, 71.7% of the ASD group and 67.7% of the TD group were in subgroup B. The ADHD group demonstrated more heterogeneity in network patterns with 50% in subgroup B.

Conclusions: ASD and ADHD were not characterized by distinct subgroup patterns, though analyses revealed more heterogeneity in ADHD than in ASD. Hyperconnectivity in SN-FPN nodes may reveal specific inattention or executive function difficulties. These results suggest potential for functional connectivity of the SN-FPN in understanding the similarities and differences in ASD vs. ADHD. It will be important for future research to collect phenotypic data in symptom severity and executive function domains in order to best understand what factors impact subgroup membership and play a role in the heterogeneity of brain networks.

202 **142.202** Changes in Brain Functional Connectivity Associated with the Emergence of Reaching and Grasping in Infants at Risk for Autism

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Background: Early reaching experiences are associated with outcomes across multiple domains implicated in autism spectrum disorder (ASD), including socially oriented attention and language. While the consequences of the transition to independent reaching have been studied, little is known about the underlying neural systems. Characterizing brain changes involved in this motor milestone may inform our understanding of both typical and atypical developmental trajectories and potentially aid in ASD early identification.

Objectives: To identify brain functional connectivity (fc) changes associated with the emergence of reaching and grasping. We hypothesized that children showing the largest changes in manual motor behavior between 6 and 12 months would show the largest concurrent changes in fc between a subset of brain regions.

Methods:

Participants: The Infant Brain Imaging Study collected behavioral and resting-state fc magnetic resonance imaging (MRI) data from high risk (HR;

with a sibling with ASD) and low risk (LR; with a typically developing sibling but no familial history of ASD) participants. Analyses included 71 IBIS participants (24 LR) with fcMRI and behavioral assessments at both 6 and 12 months. This mixed-risk sample enabled investigation of brain-behavior relationships across a broad continuum relevant to both typical and atypical outcomes.

Imaging: Each participant completed 2-3 fcMRI scans (3T; 130 frames/scan, TR=2.5 s). A framewise displacement (FD) threshold of .2 mm was used to eliminate motion-contaminated data, and 150 clean frames were used for each participant. fcMRI time traces for 230 functionally defined regions of interest (ROIs) were correlated on a pairwise basis to generate whole-brain fc matrices at each age for each participant (Fig.1b). ROIs were sorted into twelve putative functional networks using the Infomap community detection algorithm run on the average fc matrix across all subjects at both ages (Fig.1a). Six-month fc values were subtracted from 12-month fc values to generate an fc change matrix for each subject (Fig.1b).

Measures: Raw fine motor scores and a "reaching and grasping (RG) composite" derived from the Mullen Scales of Early Learning were used to index manual motor ability. Six-month scores were subtracted from 12-month scores to evaluate behavior change (Fig.1c).

Brain-behavior enrichment analysis: Pearson's correlation was calculated between ROI-ROI fc change and motor score change (Fig.2a) and thresholded at $p<.05$ to identify "strong" fc-behavior relationships (Fig.2b). X^2 and hypergeometric tests identified greater-than-chance densities of strong fc-behavior relationships within network pairs for each motor measure, and empirical significance levels were determined using permutation.

Results: Our brain-wide search revealed maturation of functional connections clustered in motor networks and between motor and subcortical/cerebellar regions were important for both measures of manual motor development (Fig.2c,d). For RG, important fc changes also extended to more of the motor system as well as to visual and attention networks (Fig.2e).

Conclusions: This marks the earliest known description of changes in functional brain systems that underlie the emergence of visually guided reaching. As hand-eye coordination may play a role in socially oriented attention during infancy, future work will investigate whether these fc changes are also important for the emergence of early social behaviors.

203 **142.203** Cluster Analysis of Responsivity to Citalopram in Autism Spectrum Conditions: Preliminary Evidence of Neurobiological Sub-Groups.

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Background: Alterations in excitatory (E) glutamate and inhibitory (I) GABA systems, have been reported in Autism Spectrum condition (ASC). Modulating E/I balance may therefore be considered a target for pharmacological management of autistic symptoms. E/I can be indirectly modulated by the serotonergic system. However, there are also differences in the serotonin system in some, but not all individuals with ASC, making it unlikely that everyone with ASC will respond in the same way to a serotonergic drug challenge.
Objectives: Therefore, here we tested the hypothesis that there are E-I responsivity differences to selective serotonin reuptake inhibition (SSRI) with citalopram within a group of individuals with ASC and between ASC and neurotypical controls.

Methods: This study used MEGAPRESS proton magnetic resonance spectroscopy ([^{1}H]-MRS) to measure concentrations of GLx (glutamate + glutamine) and GABA in unmedicated adult men with ASD (n=19) and age- and IQ- matched controls (n=20). Individuals were scanned twice, once after oral administration of 20mg of citalopram and once under placebo in a randomised double-blind procedure. Scans were at least 8 days apart to ensure full washout of the drug. Spectra was acquired in the dorsomedial pre-frontal cortex (DMPFC). Responsivity was defined as percentage change (placebo to citalopram) for each metabolite. Two-step cluster analysis was performed in order to identify subgroups based on response.

Results: There was a significant group by drug interaction on Glx levels ($p<0.05$). Overall Citalopram decreased Glx in controls but had no significant impact on Glx in ASD. However, this result masked marked individual variation in response to citalopram in both groups. Cluster analysis revealed a three-cluster solution with 'good' fit (average silhouette = 0.7). Clusters could be characterised as 1) 'responders with decreased Glx after citalopram' (ASD=4, Control=6 average response = -18.30%), 'non-responders' (ASD=10, Control= 13, average response = -0.71%) and 'responders with increased Glx after citalopram' (ASD=6, Control=0, average response = +21.42%). There were no significant interactions or main effects of GABA.

Conclusions: These findings suggest that Glx response to an SSRI is significantly different in ASD compared to controls. The considerable individual variation in pharmacological response which may inform efforts to stratify individuals with ASC into more biological homogeneous subgroups. This may encourage future work to examine whether these responsivity differences are predicative of treatment response.

204 **142.204** Combining Supervised and Unsupervised Learning to Subgroup Autism Spectrum Disorder According to Regional Brain Volumes

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Background: Autism Spectrum Disorder (ASD) is a highly heterogenous condition with an unknown number of potentially unique neural phenotypes with distinct etiological causes. One biological factor that may be important in efforts to fractionate the autism spectrum into more homogenous subgroups is brain size. Recently it has been shown that a proportion of individuals with ASD have persistent disproportionate megalencephaly, i.e. brain volume disproportionate to body size (ASD-DM). There is some evidence that individuals with ASD-DM, on average have poorer outcomes. However, it is unknown if certain brain regions in ASD-DM are disproportionately affected and how regional variation in brain volumes in ASD-DM may contribute to the severity of ASD phenotypes.

Objectives: Utilizing both supervised and unsupervised machine learning techniques we aim to 1) identify the most important brain volumes for classifying ASD-DM and individuals with ASD but more typical brain volumes (ASD-N) and 2) use these identified brain regions to cluster individuals into groups with more homogenous volumetric neural phenotypes.

Methods: We acquired structural magnetic resonance imaging (MRI) scans of 147 male preschool aged children with ASD. ASD-DM classification was defined as having a total cerebral volume greater that 1.5 standard deviations from an established sample of age matched typically developing (TD) children, resulting in 16 ASD-DM and 131 ASD-N cases. Volumetric data from 239 brain regions were extracted using an automated T1-segmentation pipeline (https://mricloud.org) and normalized for total brain volume. Regional brain volumes were input as features for classification of ASD-DM and ASD-N using a RandomForest model. Model accuracy (ACC), specificity (SP) and sensitivity (SN) were estimated using a 10-fold cross validation scheme utilizing SMOTE to account for sampling bias as well as within an independent sample of 7 ASD-DM and 36 ASD-N cases. Model significance was assessed via *n*=1000 permutations of the class labels. The most discriminative features were determined according to measures of MeanDecreased accuracy and Out-of-Bag (OOB) error. Hierarchical clustering was then performed on the entire sample utilizing the most discriminative volumetric features in order to identify clusters of individuals with homogenous volumetric neural phenotypes.

Results: RandomForest was able to classify ASD-DM from ASD-N with a cross-validated ACC=89%/SN=74%/SP=90%. Similar results were observed when tested on an independent sample (ACC=86%/SN=75%/SP=87%). Permutation testing showed all classification results to be significant below chance level ($p<0.05$). After ranking features according to mean decreased accuracy it was determined that selecting 28 features resulted in the lowest OOB error, thus the top 28 features which included the superior frontal gyrus, middle temporal gyrus, and posterior cingulate gyrus, were further exported for hierarchical clustering of the entire sample. Cutting the resulting dendrogram at the second level resulted in two clusters containing *n*=4 ASD-DM/110 ASD-N and *n*=12 ASD-DM/21 ASD-N respectively.

Conclusions: Combining supervised and unsupervised machine learning techniques offers a powerful methodological framework for classifying and grouping individuals across the autism spectrum according to more homogenous biologically based subgroups. Such techniques represent a valuable tool in future efforts to identify new ASD subgroups with shared biological features.

205 **142.205** Cortical and Cerebellar Contributions to Pupillary Light Reflex in Individuals with and without Autism Spectrum Disorder

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Background: Accumulating evidence suggests that autism spectrum disorder (ASD) has its roots in early development, however diagnosis is not made until at least two years of age. Thus research in this field has mainly focused on the identification of behavioral, cognitive and neurophysiological markers that may serve as indicators for increased risk and also provide more insight into the neurophysiological mechanisms of ASD. Pupillary light reflex (PLR) which represents a stimulus-driven phenomenon whereby the pupil automatically dilates in response to the presentation of a bright luminance change is one such potential marker. Findings from previous studies suggest that PLR may be abnormal in individuals with ASD. Although the basis for ASD-related PLR is unclear, one possibility is that atypical PLR may arise from damage or disruption of other cortical and cerebellar areas not directly associated with modulation of the autonomic nervous system (ANS).
Objectives: We sought to further elucidate the neural basis for atypical PLR in individuals with ASD.

Methods: Twelve adolescents aged 13-18 years (*M* =16.1 yrs) with ASD and comparison sample of 12 neurologically uncompromised individuals without ASD aged 12-19 years (*M* =16.1 yrs) participated. We utilized a MRI-compatible eye monitoring system in concert with functional MRI (fMRI) to evaluate pupillary response and associated neural activity. Participants performed a passive viewing task in which they were shown a series of red-filtered, emotionally-neutral images that changed every 5 s. Every 20s the imperative stimulus (bright, dim, or black intensity levels) was superimposed over the red-filtered background. For each participant, PLR and neural responses were recorded for a total of 96 light stimulus trials (32 per condition). Trials were intermixed and presented over the course of 8 bold runs.

Results: Analysis of the eye tracking data revealed a main effect of condition (dim, bright) for constriction amplitude and time but not for latency. Greater constriction amplitude (18.3 ± 8.1 vs 10.4 ± 5.6) and time (469.4 ± 49.8 vs. 439 ± 49.1) were observed for the bright compared to the dim condition [$F(1, 22) > 6.0$, $p < .05$ in both instances]. There was no main effect of group (ASD, non-ASD) nor interaction effect of group and condition for any of the three PLR parameters. For the fMRI analyses, we found a group-by-PLR condition interaction for several regions including left cerebellum (-46, -64, -22), right ventral PFC (22, 32, -2), and right superior parietal lobule (30, -72, 46). In all cases, the activation contrast (Bright+Dim > Black) was greater for the ASD group as compared to the non-ASD group [$t > 2.6$, $p < .05$ in all instances].

Conclusions: Findings are consistent with previous studies (e.g., Nowinski et al, 2005) that have found that secondary regions such as cerebellum which project to the primary PLR circuitry are compromised in individuals with ASD and may possibly contribute to abnormal PLR.

206 **142.206** Cortical Folding Differences in Autism Spectrum Disorder (ASD) and Attention-Deficit/ Hyperactivity Disorder (ADHD) Relative to Typically Developing Peers (TD): Data from the Pond Network

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Background: ASD and ADHD are relatively common neurodevelopmental disorders (NDDs), with onset in early childhood. Due to their high comorbidity and rate of co-occurring symptoms, investigation of both NDDs in a single cohort will add clarity to our understanding of the shared and disorder-specific underlying neurobiological mechanisms that may drive these conditions. Magnetic resonance imaging (MRI) has been used extensively to study atypical brain development in both NDDs, however, cortical folding as a specific measure derived from MRI has received less attention.

The limited number of studies that have investigated cortical folding in ASD and ADHD present contradictory results. To the best of our knowledge, no study has investigated cortical folding across individuals with ASD and ADHD and typically developing controls (TD), and little is known about the relation of this measure to clinical symptoms.

Objectives: We examined cortical folding in children and adolescents with ASD and ADHD relative to TD, and the relation between cortical folding and social, attention, behavioural and adaptive functioning difficulties across disorders.

Methods: T_1-weighted MRI, cognitive and behavioural data of children and adolescents with ASD, ADHD and TD, between 6.1-15.9 years of age, were obtained from the Province of Ontario Neurodevelopmental Disorders (POND) Network dataset, an Ontario Brain Institute-funded multi-site study. FreeSurfer software was used to obtain whole-brain 3-D measures of cortical folding using *l*ocal Gyrification Index (*l*GI), a surface-based measure providing vertex-wise quantification of cortical folding. General linear model (GLM) analyses was conducted, on the module QDEC (Query, Design, Estimate, Contrast) on FreeSurfer to examine *l*GI differences between groups.

Results: 42 ASD (mean age: 12.11, SD: 2.76), 17 ADHD (mean age: 11.97, SD: 2.43) and 76 TD (mean age: 12.79, SD: 3.11) participants with IQ>70 were included in this preliminary study, which revealed significantly reduced cortical folding in individuals with NDDs relative to controls in a left hemisphere cluster located in the superior parietal lobe ($p<0.0001$). No significant difference in cortical folding was found on comparison of ASD versus ADHD groups. Decrease in cortical folding was associated with better adaptive functioning, less hyperactive/impulsive & inattention impairments, but more repetitive behaviours across all children with NDDs. No significant relation was found between cortical folding and social communication deficits. All results were corrected for multiple comparisons using Monte-Carlo simulations.

Conclusions: Findings of cortical folding differences in individuals with ASD and ADHD relative to TD point to an early marker of altered development in these conditions that predates clinical onset and may drive other brain alternations. Findings of no significant differences between ASD and ADHD suggests further similarities between these two NDDs.

207 **142.207** Cortical Activation Patterns during a Joint Cooperation Task in Children with and without Autism Spectrum Disorder (ASD)

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Background:

Children with ASD present with social impairments and comorbidities in sensori-motor control that impairs their ability to adjust their actions to that of others (Bhat et al., 2011). We aimed to examine the underlying cortical mechanisms important for social cooperation, specifically, mirror neuron system (MNS) and sensori-motor activation in the frontal, temporal and parietal cortices as well as executive functions in the prefrontal cortices during a naturalistic social cooperation game of Lincoln logs using functional near-infrared spectroscopy (fNIRS), a cutting-edge neuroimaging tool that allows for study of cortical activity during naturalistic social interactions and turn-taking between people.

Objectives:

To compare social cooperation behaviors and associated prefrontal, frontal, temporal, and parietal cortex activation between children with and without ASD.

Methods:

Fifteen children with ASD and 17 typically developing (TD) children without ASD between ages 6 and 17 years wore an fNIRS cap embedded with a 3x11 probe set covering bilateral middle frontal gyrus (MFG), pre/post-central gyri (PSG), inferior frontal gyrus (IFG), superior temporal sulcus (STS), and inferior parietal lobule (IPL). Both, children and adults sat across a table to complete the building game involving four randomized blocks/conditions: a) *Coincide (C)*: each partner builds their own structure, b) *Lead (L)*: child leads the building and adult partner follows as they build own structures, c) *Follow (F)*: child follows the adult partner in building as they build own structures, and d) *Turn-take (T)*: child and partner alternate turns to build a common structure. The average oxy-hemoglobin response was analyzed to study differences between groups, tasks, hemispheres, and regions.

Results:

Our results are based on a smaller dataset (n=10 per group). Results from the entire dataset will be presented at the conference. In general, the children with ASD had lower cortical activation across multiple building conditions compared to the TD children without ASD across bilateral prefrontal, frontal, superior temporal, and left inferior parietal cortices. However, children with ASD had greater right inferior parietal cortex activation compared to the TD children without ASD. In terms of hemispheric differences, in the TD group, all conditions led to greater left hemispheric activation in the MNS regions except in the joint condition there was more bilateral activation. However, the ASD group showed no hemispheric lateralization or had greater right lateralization in the MNS regions.

Conclusions:

Children with ASD displayed errors during social cooperation as well as lower cortical activation across bilateral prefrontal, frontal, superior temporal, and left inferior parietal cortices compared to age-matched TD peers. There was differential activation across varying contexts with the TD group showing left lateralization in the MNS ROIs for all conditions except the Joint condition. Interestingly, the ASD group rarely showed left lateralization and often showed more right lateralization for the majority of the conditions. During social cooperation, children with ASD showed clear differences in processing of sensori-motor and social information compared to TD peers. Each of the aforementioned contexts affords a different challenge and should be used as therapeutic contexts to facilitate cooperation between children with ASD and their peers.

208 **142.208** Comparing fNIRS-Based Cortical Activation Patterns during Communicative Gestures between Children with and without Autism Spectrum Disorder (ASD)

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Background:
Children with Autism Spectrum Disorder (ASD) have difficulty using communicative gestures with others. In this study, we investigated the neural mechanisms underlying this gestural impairment. Specifically, we examined the activation within the Mirror Neuron Systems (MNS) including the inferior frontal gyrus (IFG), superior temporal sulcus (STS), and inferior parietal lobule (IPL). Past studies have used fMRI to study gesture control in relatively unnatural contexts (within a scanner bore facing 2D displays). Functional near-infrared spectroscopy (fNIRS) is a neuroimaging tool that allows for more naturalistic, face to face gestural communication between people.

Objectives:

In this study, we compared MNS activation between children with and without ASD as they observed of performed communicative gestures with an adult partner.

Methods:

Fifteen children with ASD and 16 typically developing children with ASD between the ages of 6 and 17 years wore an fNIRS cap embedded with 3x3 probe sets covering bilateral MNS regions including the inferior parietal, superior temporal and inferior frontal cortical gyri. Each child was seated across from an adult social partner. The gestural task involved 3 conditions completed using a randomized block design: a) *Watch (W)*: child observed adult's gestures, b) *Do (D)*: child performed a gesture on their own c) *Together (T)*: child performed the gesture in synchrony with the adult. 18 trials were collected, 6 per condition using a randomized blocked design. The oxy-hemoglobin response was analyzed to study differences between groups, tasks, hemispheres, and regions.

Results:

In terms of group differences, children with ASD had lower activation in the Left IFG and STS regions than the TD children, mainly for the Do/solo action condition. In contrast, children with ASD showed greater activation in the right IFG and both PI regions compared to the TD children, mainly for the Watch/observe and Together/synchrony conditions. In terms of hemispheric differences, the TD children showed greater cortical activation in the left inferior frontal and superior temporal regions compared to the right homologues for these unilateral tasks. In contrast, children with ASD had symmetrical activation across multiple ROIs even though the tasks were unilateral in nature.

Conclusions:

Children with ASD showed reduced cortical activation in the superior temporal cortices and in contrast showed greater cortical activation in the right inferior frontal and inferior parietal cortices compared to TD children. Children with ASD lack the left lateralized pattern of cortical activation clearly seen in the TD children during unilateral tasks. Multiple neurobiomarkers associated with gestural communication were obtained and seemed atypical in the children with ASD. In the future, we hope to test intervention contexts to facilitate gestural communication and normalize activation patterns in children with ASD.

209 **142.209** How Is fNIRS-Based Cortical Activation Different in Children with Autism Spectrum Disorder (ASD) Compared to Those without ASD during Synchronized Postural Sway.

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Background:
Apart from diagnostic impairments, children with Autism Spectrum Disorder (ASD) present with fundamental motor impairments in motor coordination and balance as well as difficulties with socially-embedded motor skills such as imitation/interpersonal synchrony. These motor impairments may contribute to the fundamental social impairments of children with ASD. Using functional near-infrared spectroscopy (fNIRS), we have reported reduced Mirror Neuron System (MNS) activation in the Inferior Frontal Gyrus (IFG) and Superior Temporal Sulcus (STS) and greater activity in the Inferior Parietal Lobule (IPL) in children with ASD compared to TD peers during a reaching synchrony task. However, the reaching task was limited to arm use and did not involve whole body movements. In the present study, we extend our research to studying cortical activation during synchronized postural sway.

Objectives:

We compared cortical activation and connectivity between prefrontal, frontal, parietal, and temporal cortices between children with and without ASD during synchronized postural sway.

Methods:

Fifteen children with ASD and 18 TD children between 6 to 17 years of age and fifteen TD adults participated. Each participant wore a cap embedded with a 3x11 fNIRS probe set that covered multiple cortical regions including bilateral middle frontal gyrus (MFG), inferior frontal gyrus (IFG), pre- and postcentral gyrus (PSG), superior temporal sulcus (STS), and inferior parietal lobe (IPL). The participants were asked to stand face to face with an adult social partner or to face a computer screen to complete four conditions: a) *Watch*: the participants stood still and watched the social partner swayed; b) *Do*: the participants swayed with a bar showed on a computer screen, c) *Face*: the participants swayed face to face with an adult social partner, and d) *Touch*: the participants swayed face to face with an adult social partner and with their fingertips touching. The oxy-hemoglobin response of the fNIRS signal was analyzed.

Results:

In the TD children and adults, greater activation was found in conditions requiring action execution (Solo, Face, and Touch) compared to the Watch condition. In the left hemisphere, greater activation was found during the Touch compared to the Solo and Face conditions whereas in the right hemisphere greater activation was found in the Solo compared to the Touch and Face conditions. Lastly, while IFG and STS regions were highly active across all conditions, the PSG region showed increased activation during the Solo condition only. We also expect reduced cortical activation in the children with ASD across multiple cortical regions including MNS regions such as IFG and STS compared to those without ASD.

Conclusions:

Our preliminary results show that left MNS regions are important for whole body movement synchrony with social partners. In addition, the primary sensori-motor cortices played a greater role during non-biological, whole body movement synchrony. We also expect more sway errors

and reduced cortical activation in children with ASD as they engage in synchronized postural sway compared to controls. In the future, we will utilize these shared social and motor neurobiomarkers to develop socially-embedded motor interventions that target the neural impairments of children with ASD.

210 **142.210** Differences in fNIRS-Based Cortical Activation Patterns between Children with and without Autism, during Object-Related Gestures.

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Background:
Children with Autism Spectrum Disorder (ASD) have significant impairments in gestural performance including errors during tool use, pantomime, as well as meaningless actions. Children with ASD have more errors during meaningless gestures compared to tool use or pantomimed actions that involve a clear context (Smith & Bryson, 2007). Gestural impairments could be attributed to poor gesture perception, planning, or execution of motor programs/sequences required for gesture production (Dowell et al., 2009). Mirror Neuron Systems (MNS) in the inferior frontal gyrus (IFG), inferior parietal lobule (IPL), and superior temporal sulci (STS) play a role in the aforementioned processes when performing object-related gestures.

Objectives:

In the current study, we compared cortical activation in the MNS and sensori-motor regions during three naturalistic, object-related gestural tasks - object use, pantomime, meaningless.

Methods:

14 children with ASD and 15 children without ASD between 6 and 16 years were seated at a table with a hammer and pegboard. The task was administered in a randomized, blocked fashion. Participants held a hammer and hit eight pegs on a pegboard in 3 different ways: a) *Holds hammer*: child hits pegs with an actual hammer, b) *Pantomimes*: child pretends to hammer, and c) *Meaningless*: the child taps the air. The oxy-hemoglobin response of the fNIRS signal was further analyzed to study differences in activation patterns between tasks, hemispheres, and the aforementioned regions of interest.

Results:

TD children showed greatest right MNS activation (IFG, STS, and IPL) in the Pantomime and Meaningless condition and both significantly differed from the Hammer condition; which had the lowest level of activation. There were no conditional differences in the left hemisphere. In contrast, children with ASD had fewer condition-based differences except for the right STS region wherein the pantomime condition led to greatest activation compared to both, meaningless and hammer conditions. In terms of group differences, TD children had greater bilateral STS activation whereas the children with ASD had greater right IFG and IPL activation than the TD group. In terms of lateralization, TD children had clear left lateralization in all MNS regions whereas the children with ASD showed bilateral activation except in the IFG in spite of the unilateral nature of the task.

Conclusions:

Children with ASD showed reduced activation in bilateral STS regions; however, compensatory enhanced activation was seen in the right IFG and IPL regions. Pantomime and meaningless conditions led to greatest MNS activation in the TD children. In contrast, only pantomime led to higher activation in the children with ASD. Children with ASD also do not show clear left lateralization during unilateral gestures; which was clearly seen in the TD children. We may have identified neurobiomarkers of object-related gestures that could be used to explain gestural deficits and to develop contexts to facilitate gesture understanding/production in children with ASD.

211 **142.211** Default Mode and Striatal Connectivity in Youth with Co-Occurring Autism Spectrum Disorder and ADHD

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Background: It is currently estimated that ~70% of youth with autism spectrum disorders (ASD) have at least one co-occurring psychiatric condition, with Attention Deficit Hyperactivity Disorder (ADHD) being one of the most common (Leyfer et al., 2006; Simonoff et al., 2008). These two conditions share various behavioral symptoms including deficits in executive function and social communication, and atypical neural phenotypes have been observed in both ADHD and ASD within default mode network (DMN; Assaf et al., 2010; Lynch, 2013; Uddin, 2008) and corticostriatal networks (Bush et al., 2005; Cao et al., 2009; DiMartino et al., 2011); however, little is known about the shared and distinct neural connectivity patterns of individuals with ASD with co-occurring ADHD.
Objectives: This study aims to parse apart the neural heterogeneity within the DMN and striatal regions of individuals with ASD and co-occurring ADHD (ASD+ADHD) as compared to age-, IQ-, and gender-matched individuals with ASD without ADHD (ASD-), ADHD without ASD (ADHD-), and typically developing controls (TDC). Understanding the common and unique neural signatures across co-occurring psychiatric conditions in ASD may serve to inform diagnosis, as well as guide research by addressing heterogeneity within ASD samples.

Methods: Resting state functional magnetic resonance imaging (rs-fMRI) data from the ABIDE and ADHD-200 initiatives included 33 ASD-, 46 ADHD-, 29 ASD+ADHD and 51 TDC youths (ages 5-14; see Table 1). The present study used Group Iterative Multiple Model Estimation (GIMME), a causal search algorithm that can identify patterns in neural connectivity across individuals and groups. Specifically, the GIMME confirmatory subgrouping algorithm was employed using diagnostic subgroups (group cutoff: 0.65, subgroup cutoff: 0.5) to examine resting state connectivity patterns within the DMN and striatal regions (see Table 2). Participants with maximum head motion >2mm in any direction were excluded, and all volumes with framewise displacement >.3mm were removed.

Results: At the group level (i.e., significant for participants across all groups), there were several significant bilateral connections and connections between anatomically close regions; however, there were few group-level, long-range pathways linking anterior and posterior regions (see Figure 1). Indeed, subgroup-level analyses revealed differences between diagnostic subgroups in connections from parietal to frontal regions (see Figure

1). In addition, both ASD groups showed attenuated striatal connectivity compared to the TDC and ADHD- groups. Neither of the ADHD groups recruited the anterior medial prefrontal cortex. Furthermore, the ASD+ADHD group showed anterior to posterior connections most similar to the ASD- group, and both ASD groups omitted connections between the posterior cingulate cortex and restrosplenial cortex.

Conclusions: The psychiatric subgroups, primarily the ASD subgroups, showed relatively reduced between network (i.e., DMN, striatal) interaction compared to the TDC subgroup. These findings also provide evidence of both distinct and shared neural connectivity patterns across individuals with ASD, ADHD, and ASD+ADHD that may have implications for core symptoms of each disorder.

Table 1. Participant Demographics.

	ASD- (n=33)	ADHD- (n=46)	ASD+ADHD (n=29)	TDC (n=51)
FSIQ	105.48 (15.55)	109.85 (15.51)	110.00 (20.23)	105.48 (15.55)
Age	10.01 (2.78)	10.23 (1.89)	9.57 (2.10)	10.27 (2.60)
% Female	9.09%	21.74%	10.34%	17.65%

Poster Session
143 - Neurology
5:30 PM - 7:00 PM - Room: 710

212 **143.212** Spinal Deformities Assessment in ASD Subjects: A CROSS Sectional Study

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Background: The term “spinal deformity” includes conditions such as post-traumatic deformities, iper-kyphosis, iper-lordosis and idiopathic adolescence scoliosis. Early identification and effective treatment of mild scoliosis could slow or stop curvature progression before skeletal maturity, thereby improving long-term outcomes in adulthood (US task force JAMA 2018). In a systematic review (PROSPERO registration number CRD 42018100894), we found that spinal deformities appear to be understudied within autism research and that no studies on spinal deformities assessment in ASD subjects exist. Since severe spinal deformities may be associated with adverse long-term health outcomes (e.g. pulmonary disorders, disability, back pain, psychological effects, and reduced quality of life), the value of spinal deformities screening becomes increasingly relevant.

Objectives: Our study aims to assess the applicability of a spinal deformities screening protocol in ASD subjects.

Methods: The screening protocol included two tests: the “Adam Test”, measured with the Bunnell method for assessing the trunk asymmetry on the frontal plane, and the “Sagittal Index” as suggested by Zaina that gives a measure of spinal deformities on a sagittal plane. The Literature indicates that subjects who present “Adam Test” or “Sagittal Index” values above cut-off limits are in need of second level clinical assessment. We also considered the three ASD severity grades and the four intellectual disability (ID) categories (mild, moderate, severe and profound) as suggested by DSM-V.

Results: Sixty-one subjects (mean age 14.03 – SD 4.26; 55 males) were included in the study. Seven out of 61 subjects (11,5%) presented grade 1, 26 (42,6%) grade 2, and 28 (45,9%) grade 3 ASD severity. Three subjects (4,9%) exhibited mild ID, 22 (36,1%) moderate ID, 34 (55,7%) severe ID, and 2 (3,3%) profound ID. Despite the relatively high autism severity of our sample, we found the screening test applicable to 92% of our population. Five subjects were non-testable because of their behavioral difficulties; all of them had high ASD severity grades and moderate to severe ID. Using this protocol screening, we found 11 ASD subjects (18%) presenting abnormal values: three subjects (4,9%) with Adam’s test values over cut-off (>5°), and eight subjects (13,1%) with “Sagittal Index” values over the cut-off (>9,5 cm). Using a chi-square test, we found that subjects over the cut-off limits had higher ASD severity (p=0.039), and ID severity (p=0.002).

Conclusions: The screening protocol for spinal deformity is generally applicable in ASD, also in subjects with high ASD severity and severe ID. About 20% of ASD subjects present spinal deformities, a value in line to what described in the general population (15%-20% over cut off) therefore deserving special attention for eventual adverse long-term health outcomes.

213 **143.213** Spinal Deformities and Autism Spectrum Disorders: A Systematic Review

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Background: The function of the vertebral column is to support humans in upright positions, mechanically balance the stress of gravity, permit locomotion and assist in purposeful movements. The term “spinal deformity” includes conditions such as post-traumatic deformities, iper-kyphosis, iper-lordosis and idiopathic adolescent scoliosis. Severe spinal curvatures may be associated with adverse long-term health outcomes (e.g. pulmonary disorders, disability, back pain, psychological effects, and reduced quality of life). Early identification and effective treatment of mild scoliosis could slow or stop curvature progression before skeletal maturity, thereby improving long-term outcomes in adulthood. There is scientific evidence to support the value of spinal deformity screening in general population. This is true also for children with Autism Spectrum Disorder (ASD) for which untreated spinal deformity can interplay with impairments in fine and gross motor skills, motor planning, motor coordination and praxis.

Objectives: The aim of this systematic review is to critically describe the current knowledge on spinal deformities in ASD subjects in terms of prevalence, assessment methods and treatment.

Methods: The systematic review protocol was previously registered on the PROSPERO database (registration number CRD 42018100894). We conducted an extensive literature search in PubMed, CINAHL, PsycINFO, The Cochrane Library, and Scopus databases. We also considered grey literature sources such as: Opengray, Penn Libraries and International Society for Autism Research (INSAR) Congress archives. There were no restrictions on the types of study design eligible for inclusion, publication date or language. The main keywords used were: ASD, Autism, Autistic Disorder, Spinal deformities, Scoliosis and Spine.

Results: Following the PRISMA statement study selection process, we screened 2640 records after removing duplicates for eligibility. We found 11 eligible studies (figure 1). All of them were excluded because the main object was not pertinent to our aim. The main topics found were genetics, spinal surgery or surgery outcomes, since ASD is also used in the literature as the acronym for Adult Spine Deformity.

Conclusions: Spinal deformities appear to be an understudied topic within autism research. At present, in all the literature screened, there is no evidence on prevalence, assessment methodology and treatment of spinal deformities in ASD subjects. Since adolescent idiopathic scoliotic curves typically progress most rapidly during adolescent growth and clinical settings reveal it is possible to find developing ASD subjects presenting spinal deformities, it becomes relevant and important to conduct studies that verify the applicability of screening protocols in developing ASD subjects.

Poster Session
144 - Neuropsychology
5:30 PM - 7:00 PM - Room: 710

214 **144.214** A Comparison between Traditional and Musical Working Memory Assessments and the Associated Cognitive and ASD Behavioural Correlates

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Background: Autism Spectrum Disorder (ASD) is often associated with executive functioning difficulties, which can be exacerbated by autism-related symptoms such as restricted and repetitive behaviours. Individuals with ASD also tend to possess strengths and weaknesses in visual-spatial and verbal skills, respectively. Music perception is considered a strength in ASD, with most studies investigating perception of music-evoked emotions, pitch and melody, and long-term musical memory. One aspect of music-related cognition that has yet to be systematically assessed in ASD is musical working memory, and how it relates to cognition and behaviour.

Objectives: **Aim 1):** Compare the performance on traditional and musical short-term working memory tests to examine whether music could be used as an alternative assessment modality of working memory in ASD. **Aim 2):** Compare the cognitive (i.e., visual-spatial and verbal skills) and behavioural ASD correlates (i.e., restricted and repetitive behaviours) of traditional vs. musical short-term working memory in children with ASD.

Methods: Fifty-nine children with ASD participated in this study (age= 9-16, M=12.37, SD=2.11, male n=51). **Aim 1)**: The Working Memory Index (WMI) subtests (i.e., Digit and Picture Span) of the Weschler Intelligence Scale for Children-Fifth Edition (WISC-V) were used as measures of traditional working memory. To assess musical working memory (MWM), sequences of 3, 4, and 5 pitches were presented in pairs to participants who were asked to identify whether sequence-pairs were similar or different. Total performance (3,4, and 5 pitch sequences combined) on the MWM task was calculated as Hits minus False Alarms (Hit-FAs). **Aim 2)**: The Verbal (VCI) and Visual Spatial (VSI) Indices of the WISC-V (cognitive correlates) as well as the Restricted Interests and Repetitive Behavior (RIRB) sub-scale score (ASD behavioural correlate) of the Social Responsiveness Scale-Second Edition (SRS-2) were correlated with both the MWM task total performance (Hit-FAs Total) and the WMI scores.

Results: **Aim 1)**: Paired sample t-tests (using standardized values) revealed that participants performed significantly better on the MWM task (M=.52, SD=.32) than on the Digit Span (M=.12, SD=1.09, p = .013) and the Picture Span (M=.14, SD=1.02, p = .009) subtests of the WISC-V. **Aim 2)**: Significant correlations were found between MWM task performance and the VSI (p=.001) and the RIRB sub-scale scores (p=.02). MWM task performance was not significantly correlated with the VCI score (p=.46). In comparison, the WMI score was significantly correlated with the VCI (p< .00), the VSI (p<.00), and the RIRB sub-scale scores (p=.05).

Conclusions: Our findings reveal that children with ASD performed better on a MWM task in comparison to traditional working memory tasks. Furthermore, both traditional and musical working memory were associated with visual-spatial skills, a well-documented strength in ASD, and with RIRBs, which are related to executive functioning. Furthermore, in comparison to traditional working memory tasks, musical working memory seems independent of verbal abilities. Results provide preliminary evidence for the use of music as a strength-based modality to assess the working memory abilities of children with ASD, which may be underestimated by traditional cognitive testing relying on verbal skills often impaired for this population.

215 **144.215** Executive Function and Academic Achievement in Autism Spectrum Disorder

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Background: Executive function (EF) is predictive of academic achievement in the general student population (Ahmed et al., 2018). Children who come to pre-Kindergarten with fewer EF skills have trouble engaging in learning opportunities in the classroom and thus make fewer gains in math and literacy during the school year (Nesbitt et al., 2015). The limited evidence to date suggests associations between EF and academics in Autism Spectrum Disorder (ASD); however, the two existing studies have focused on children in the preschool to early primary school age range (Pellicano et al., 2017, St. John et al., 2018). EF might exert an even greater influence over academic outcomes in older children and adolescents with ASD.

Objectives: To determine whether performance-based EF tasks of working memory, inhibition, and flexibility predict academic performance on mathematical and literacy tasks in children and adolescents with ASD.

Methods: 60 individuals (28 with ASD, 32 neurotypical controls [NT]), ages 8-18 years (M=12.94, SD=2.5) matched on age and gender ratio (see Table 1) completed testing procedures. IQ was estimated with WASI Vocabulary (Voc, M=57.78, SD=10.11) and Block Design (BD, M=54.67, SD=10.81)

T-scores. For all regressions examining EF-academics relations, Model 1 (M1) included diagnostic group, age, gender, Voc and BD as nuisance variables, while Model 2 (M2) added performance-based measures of EF: WISC-V Digit Span (DS) measuring working memory, TEA-Ch Walk Don't Walk measuring inhibition, and DKEFS Switching Accuracy measuring flexibility. Academic performance-dependent variables included WIAT-III Math Fluency, WJ-IV Math Calculation, GORT-V Reading Fluency, and GORT-V Reading Comprehension.

Results: WIAT Math Fluency (N=45): M2 explained a significant proportion of the variance in math fluency, R^2=.45, F(8, 36)=3.62, p<.05. In M2, DS significantly predicted math fluency, b=2.31, t(36)=3.90, p<.001.

WJ Calculation (N=38): M2 explained a significant proportion of the variance in math calculation, R^2=.55, F(8, 29)=4.45, p<.05 (see Figure 1). In M2, DS significantly predicted math calculation, b=2.06, t(29)=2.92, p< .05.

GORT Reading Fluency (N=44): M2 explained a significant proportion of the variance in reading fluency, R^2=.63, F(8, 35)=7.33, p<.001. In M2, there was a significant association between gender, b=1.62, t(35)=2.01, p=.05; Voc, b=0.15, t(35)=3.06, p<.05; DS, b=0.32, t(35)=2.85, p<.05, and reading fluency.

GORT Reading Comprehension (N=43): M2 explained a significant proportion of the variance in reading comprehension, R^2=.72, F(8, 34)=10.85, p<.05. In M2, there was a significant association between gender, b=1.75, t(34)=2.35, p<.05; Voc, b=0.15, t(34)=3.52, p=.001; DS, b=0.34, t(34)=3.31, p<.05; and reading comprehension. For both reading fluency and comprehension, girls have higher mean scores than boys.

Conclusions: Of the EF measures considered, only DS, a measure of working memory, explained a significant proportion of variance in all four measures of math and reading skills. This study suggests that during the school years, EF, specifically working memory, is associated with academic performance in ASD, consistent with studies of younger children with ASD (St. John et al., 2018) and the broader population of school age youth (Ahmed et al., 2018). Further work should consider whether scores from more ecologically-valid measures of EF play a predictive role in academic performance in ASD.

216 **144.216** Neurobehavioral Phenotype of Autism Spectrum Disorder Associated with Germline Heterozygous Mutations in PTEN

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Background: Mutations in *PTEN*, the gene that encodes phosphatase and tensin homolog, have been identified in up to 20% of children with autism spectrum disorder (ASD) and macrocephaly and are associated with marked abnormalities in the white matter of the brain.
Objectives: This study sought to comprehensively characterize the neurobehavioral phenotype of *PTEN*-ASD.

Methods: Comprehensive neurobehavioral evaluations were conducted in 28 children/adolescents (ages 3 to 21 years) with *PTEN*-ASD and compared to two groups of controls: non-syndromic ASD with macrocephaly (Macro-ASD, n=20) and *PTEN* mutations without ASD (PTEN-no ASD, n=19). ANOVA, ANCOVA, or Kruskal Wallis tests were used to examine group differences on neurobehavioral measures (cognitive, behavioral, sensory, and adaptive functioning) and, for select measures, t-tests were used to compare group performance to healthy control norms.

Results: There is a distinct neuropsychological profile associated with mutations in *PTEN* suggesting primary disruption of frontal lobe systems (i.e., processing speed, motor coordination, attention/working memory, executive functioning). Cognitive deficits in *PTEN*-ASD are more severe than those in *PTEN*-no ASD and extend to other areas of neurobehavioral function (i.e., adaptive behavior and sensory deficits). Interestingly, group differences in IQ were no longer apparent after controlling for processing speed. While core ASD symptoms are similar in *PTEN*-ASD and Macro-ASD, *PTEN*-ASD had lower clinical ratings of autism severity and showed more sensory abnormalities.

Conclusions: *PTEN*-ASD has a distinct neurobehavioral phenotype compared to idiopathic ASD that is likely to warrant special consideration for overall assessment and treatment.

217 **144.217** Salivary Sex Hormone Responses to Intranasal Oxytocin in Autistic and Neurotypical Women

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Background: Oxytocin may be of therapeutic use for enhancing social functioning in autism spectrum conditions (ASC). Given recent evidence that (i) response to oxytocin treatment in ASC may depend on baseline hormone levels and (ii) oxytocin treatment may alter short-term production of other socially-relevant hormones, further investigation of the relationships among endogenous hormone levels and oxytocin treatment is warranted.
Objectives: This study aimed to assess baseline levels of estradiol and testosterone in adult women with and without an ASC diagnosis and to test relationships between these sex hormones and psychological variables of relevance to autism. Changes in endogenous estradiol and testosterone levels following single intranasal administration of oxytocin or placebo—and whether such changes were dependent on ASC diagnosis—were also explored.

Methods: As part of a larger fMRI experiment with a cross-over design (Bethlehem et al., 2017), saliva samples were collected from 47 women (age range 18–50) at three timepoints: (1) baseline, (2) after intranasal administration of placebo or 24 IU oxytocin (Syntocinon, Novartis), and (3) at the end of scanning (approximately 2 hours after administration). Participants comprised 16 women with an autism-spectrum condition (ASC group) and 31 neurotypical women (NT group) who completed the Autism-Spectrum Quotient (AQ) and Empathy Quotient (EQ). Salivary estradiol and testosterone were quantified by an independent lab blinded to the research hypotheses using commercially-available enzyme-linked immunosorbent assay kits (Salimetrics). Baseline sex steroid levels were calculated as the mean of the two pre-administration saliva samples per participant. The ratio of baseline estradiol to testosterone was then determined. Post-administration changes in estradiol and testosterone levels were calculated as percent change relative to individual baseline.

Results: Baseline sex steroid levels did not differ between age- and IQ-matched ASC and NT women. Baseline estradiol to testosterone ratio was

negatively correlated with AQ (r = -0.34, p=0.02) and positively correlated with EQ (r=0.35, p=0.02). For the overall population, both estradiol and testosterone levels showed small but significant decreases over time, consistent with diurnal patterns. Percentage change in estradiol and testosterone from time 1 to time 3 differed significantly between the ASC and NT groups (p<0.01). For estradiol, the mean change was +12% for the ASC group and -9.9% for the NT group (Tukey HSD, p = 0.01) for combined drug conditions. For testosterone, the mean change was +7.8% for the ASC group and -14.6% for the NT group (Tukey HSD, p = 0.001). The percentage change testosterone showed an even larger between-group difference under the oxytocin condition (+14.4% for the ASC group vs. -15.5% for the NT group, Tukey HSD, p = 0.013). Interestingly, in the overall population under the oxytocin condition, there was a trend of a positive relationship between AQ score and percent change testosterone (r= 0.36, p = 0.06).

Conclusions: These findings support a relationship between sex steroid levels in women and psychological traits of relevance to autism. Further, they present evidence of a difference in endogenous sex steroid response to intranasal oxytocin between neurotypical women and women with autism or higher levels of autism-spectrum traits.

218 **144.218** Susceptibility to Relative Saliency in Processing Hierarchical Figures Among Adolescents with ASD

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Background: One of the consistent characteristics of individuals with Autism spectrum disorders (ASD) is hypersensitivity to small details in their surroundings. It has been previously claimed that while typically developing (TD) individuals exhibit a perceptual bias towards processing of the 'whole' over the small details, individuals with ASD favor the processing of small/local elements. However, findings from studies that used hierarchical figures (HF) with individuals with ASD are inconsistent. One possible reason for such discrepancies is the differences between the stimuli's physical characteristics that were employed in previous studies which can affect the relative saliency of the global and local levels.
Objectives: The present study aimed at examining the effects of relative saliency of the global/local aspects of HF (by manipulating the size of the local elements of compound figure, with fixed distance between the elements) on local and global perception among adolescents with ASD compared to TD adolescents. We hypothesized that the perceptual bias of participants with ASD will be influenced by relative saliency.

Methods: Participants were 51 adolescents aged 15-20. Twenty-six were high functioning individuals with ASD (22 males, 3 females) and 25 (21 males, 4 females) were TD participants. To assess global and local perception we used hierarchical numerals (i.e., large numeral comprised of small numerals). We manipulated the saliency of each level relative to the other level by changing the visual angle of the stimuli. Three sizes were employed: *small* – the global level was more salient than the local level; *medium* – both levels were equally salient; *large* –the local level was more salient than the global level.

Results: Participants from both groups were influenced by the saliency manipulation as was evidenced by a triple interaction between Level, Size and Congruency. In addition, triple interaction between Group, Level and Size indicated that TD participants showed global precedence with small figures (where global level was more salient than local level), whereas participants with ASD exhibited global precedence with small figures and local precedence with large figures (when local level was more salient than global level). Importantly, with medium figures no Level effects were obtained. Also, an interaction between Group and Congruency revealed that ASD participants exhibited larger congruency effects compared to TD participants.

Conclusions: Participants with ASD were more sensitive to saliency manipulations compared to TD participants. Furthermore, while global bias was demonstrated by TD adolescents, no level preference was recorded among adolescents with ASD. Rather, ASD participants were equally biased towards salient information regardless of level of processing. Moreover, they exhibited increased difficulty in filtering irrelevant information compared to TD adolescents. Taken together, our results do not corroborate the notion of superior local processing among individuals with ASD but instead consistent with the idea that participants with ASD do not develop efficient perceptual organization mechanisms, which may further impair top-down suppression of irrelevant information. The results of the present study may have clinical implications such as developing computerized perceptual and cognitive training programs for improving visual perceptual organization and better cognitive control among individuals with ASD.

219 **144.219** The Local and Global Conceptualization of Autistic Cognitive Processing

S. Lung, *J. Oh and A. Bertone, McGill University, Montreal, QC, Canada*

Background: Rigidity and inflexibility are one of the core diagnostic features of Autism Spectrum Disorder (ASD; APA, 2013). Results from cognitive performance-based tasks such as the Wisconsin Card Sorting Task (WCST) and informant-based measures such as the Behavior Rating Inventory of Executive Function (BRIEF) suggest that autistic individuals demonstrate unique cognitive processing (Leung & Zakzanis, 2014). They tend to persevere on narrow topics and struggle with transitions or seeing novel relationships. At a perceptual level, autistic information processing has been conceptualized in a local and global manner, as suggested by the Weak Central Coherence theory (Happé & Frith, 2006) and Enhanced Perceptual Functioning hypothesis (Mottron et al., 2006). Given the robust use of local and global conceptualization in studying autistic perception, we extend this approach to cognitive processing with a specific focus on cognitive flexibility.
Objectives: This study aims to (i) explore the relationship between measures that are commonly used to define cognitive flexibility in ASD, and (ii) assess the possibility of conceptualizing cognitive flexibility measures in local and global dimensions.

Methods: Twenty-nine adolescents with ASD, M_{age} = 14.82 (1.21), were administered the WCST, Conners Performance Test – 3rd Ed. (CPT-3), and Wechsler Abbreviated Scale of Intelligence – 2nd Ed. (WASI-II). From these tests, T-scores from (i) WCST Perseveration errors, (ii) WCST Correct responses, (iii) CPT-3 Perseveration errors and (iv) WASI-II Matrix Reasoning (MR) subtest were obtained and entered into correlation and factor analyses.

Results: Descriptive statistics of the four scores tended to gather around two clusters: $M_{WCST\text{-}Pers}$ = 68.95 (12.33) & $M_{CPT\text{-}Pers}$ = 69.00 (18.59), and $M_{WCST\text{-}Corr}$ = 38.60 (6.36) & M_{MR} = 34.27 (10.74). Correlation analyses indicated that both WCST-Pers and CPT-Pers were negatively correlated with both WCST-Corr and MR T-scores. Three correlations were also found to be significant; a positive correlation between WCST-Corr and MR (r = .59, p = .02) T-scores, and negative correlations between CPT-Pers and MR (r = -.46, p = .03) T-scores as well as between WCST-Pers and WCST-Corr (r = -.63, p = .003) T-scores. Factor analysis and scree plot identified two factors from the scores. The distribution of means, directionality/significance of

correlations, and the elbow from factor analysis support to two cognitive flexibility clusters.

Conclusions: Our findings demonstrate that cognitive flexibility can be organized into two factors in ASD, with one factor measuring perseverative responses (WCST-Pers and CPT-Pers) and another measuring ability to see relationships (WCST-Corr and MR), which we coin as perseveration and concept formation factors, respectively. The perseveration factor measures persistent and random responses to simple, discrete and narrow information, and hence is more locally-oriented. The concept formation factor measures the ability to integrate characteristics of objects, deduce relationships among them and apply the deduced relationship to solve problem, and hence is more globally-oriented. Overall, this study extends the local and global conceptualization to study cognitive processing in autism. It opens avenues to future research on autistic cognitive processing and urges clinicians to address both aspects of cognitive flexibility in autism assessment.

220 **144.220** Thinking in Pictures in Autism Spectrum Disorder

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Background:

Individuals with Autism Spectrum Disorder (ASD) show an important sensory sensitivity (Crane et al., 2009), superior attention to detail (Mottron et al., 2006) and enhanced mental imagery abilities (Soulières et al., 2011). Moreover, some authors hypothesized that the use of mental imagery and visual strategies could partly explain the atypical performances of individuals with ASD (Kunda & Goel, 2011). Furthermore, according to personal reports, individuals with ASD would possess a specific visual cognitive style (Grandin, 2009).

Objectives:

The aim of this study is to assess the presence of a *visual cognitive style* in autistic individuals and to better characterize its manifestations. We also want to verify whether this visual cognitive style is related to the sensory atypicalities present in ASD.

Methods:

Participants: 39 adults with ASD participated in this study (age range 18 to 62, mean = 33.5, SD = 10.6). 104 comparison participants (age range 18 to 69, mean = 37.0, SD = 12.7) were also included. The two groups are matched on age (p = .184), education levels (p = .089) and gender (73.1 % of women in the control group, 71.8 % in the ASD group, p = .878).

Protocol: We used an online questionnaire containing 66 items:

- *Attention to detail*: 6 items from the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001).

- *Mental imagery*: 6 items concerning the colors, level of details, duration, level of abstraction, movements and manipulation of mental images.

- *Cognitive styles*: Participants indicated whether they use images only, words only or both images and words in seven different situations: recollection, problem solving, anticipation, decision making, planning, comprehension and memorization. Two open questions were also asked, for example: “Describe what comes to your mind when you hear the name of a city you've already been to”.

- *Adolescent/Adult Sensory Profile* (AASP; Brown & Dunn, 2002): 42 items including sensory sensitivity.

Results:

Attention to detail (p < .001), the use of mental images (versus words) (p = .005) and the sensory sensitivity (p < .001) are significantly more important in participants with ASD than in controls. Moreover, there are correlations between the use of images, sensory sensitivity (rs = .37, p = .020) and attention to detail (rs = .35, p = .028) only in participants with ASD. In addition, mental images appear to be more persistent in participants with ASD than in controls (p = .052). Finally, qualitative analyses indicate that, when describing their experiences, controls tend to use the lexical field of memories, whereas participants with ASD tend to use the lexical field of perception.

Conclusions:

Our results support the existence of a visual cognitive style in ASD individuals with the frequent and persistent use of mental images. This visual cognitive style is related to the sensory atypicalities present in individuals with ASD. These results question the impact of this particular cognitive style on the daily life of these individuals, especially in terms of learning and attention.

Poster Session
145 - Postmortem studies
5:30 PM - 7:00 PM - Room: 710

221 **145.221** Shift from Scarce Neuropathological Findings to Emerging Pattern of Developmental Encephalopathy in Autism Spectrum Disorders

J. Wegiel[1], *T. Wisniewski*[2], *I. Kuchna*[3], *K. Nowicki*[4], *S. Y. Y. Ma*[5], *W. Kaczmarski*[1] *and J. Wegiel*[1], *(1)NYS IBR, Staten Island, NY, (2)NYU School of Medicine, New York, NY, (3)Developmental Neurobiology, NYS Institute for Basic Research, Staten Island, NY, (4)Developmental Neurobiology, NYS IBR, Staten Island, NY, (5)Department of Developmental Neurobiology, NYS Institute for basic research in developmental disabilities, Staten Island, NY*

Background: Autism is considered a behavioral disorder. Due to scarcity of brains donated for postmortem studies of ASD and limited number of neuropathological studies this functional definition was not questioned for decades. Tissue deficits delayed testing the hypothesis that behavioral changes are associated with a broad spectrum of structural abnormalities corresponding to developmental encephalopathy with brain region and neuronal network specific patterns of structural and functional changes.
Objectives: The overall goal of three groups of researchers from the Mount Sinai School of Medicine, New York State Institute for Basic Research in Developmental Disabilities and University of Maastricht supported by Autism Speaks/Autism Tissue Program was to (a) overcome tissue limitations by examining 14 brain hemispheres of subjects with idiopathic autism and 14 control subjects, (b) examine cases from 4 to 64 years of age to monitor pattern of changes during lifespan, (c) process the entire hemisphere for complex multiregional study which may reveal global and diverse pathology, (d) preserve serial hemispheric sections for qualitative neuropathological studies and unbiased stereological studies of the

number and size of neurons and (f) provide access to these collections of slides for researchers examining dozens of brain structures and their subdivisions.

Methods: Entire hemispheres including cerebellum and brainstem of 14 subjects with idiopathic autism and 14 control subjects were dehydrated, embedded in celloidin, cut into hemispheric 200-µm-thick coronal serial sections and stained with cresyl violet for neuropathological and stereological studies. To compare developmental changes in idiopathic and syndromic autism, the 11 brains of subjects diagnosed with syndromic autism caused by chromosome 15 duplication, 11 diagnosed with idiopathic autism and 11 control subjects were embedded in polyethylene glycol and cut into 50-µm-thick sections for stereological and immunocytochemical studies.

Results: Neuropathological studies revealed in both idiopathic and syndromic autism numerous similarities in type, topography and severity of developmental defects of neuronal migration with ectopias, heterotopias, dysplastic changes and subependymal nodular dysplasia which may contribute to epilepsy. Dysplastic changes of the flocculus might be related to altered gaze control. Reduced size of neuronal soma and nucleus detected in almost all examined cortical and subcortical structures may reflect developmental alterations contributing to autism clinical phenotype. Corpus callosum developmental abnormalities including focal agenesis and diffuse hypoplasia with severe deficit of small, medium size and large axons in all segments connecting prefrontal, premotor, motor, sensory and temporal cortex might be another factor associated with a broad spectrum of autism manifestations.

Conclusions: Studies revealed signs of global developmental encephalopathy in idiopathic and syndromic autism including: (a) abnormal neuronal migration with ectopias and heterotopias, dysplastic changes in the cortex, subcortical structures and cerebellum, (b) reduced size of neurons in almost all examined structures, (c) disruption of long range interhemispheric connectivity with congenital focal CC agenesis and diffuse hypoplasia resulting in a severe deficit of interhemispheric connections in all five CC segments. In general, these studies performed by numerous research groups but on the same material indicate that research driven tissue banking/processing provides powerful alternatives in the study of clinicopathological associations in autism.

Poster Session
146 - Rare genetic disorders
5:30 PM - 7:00 PM - Room: 710

222 **146.222** Autistic Traits and Cognitive Abilities Associated with Two Molecular Causes of Silver-Russell Syndrome

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Background: Silver-Russell syndrome (SRS) is a rare condition associated with restricted growth, estimated prevalence 1 in 30,000. A molecular cause has been identified in approximately 60% of individuals with a clinical diagnosis of SRS. Specifically, 30 – 60% of individuals with SRS have loss of methylation on chromosome 11p15 (SRS 11p15) and 5 – 10% have maternal uniparental disomy for chromosome 7 (SRS mUPD7). Previous research has indicated that autistic traits and intellectual disability may be prevalent in SRS and particularly in SRS mUPD7. However, to date, autistic traits and cognitive abilities associated with the SRS molecular subtypes have not been systematically investigated using standardised assessments.

Objectives: The primary aim of this study was to identify and compare the prevalence of autistic traits associated with two molecular causes of SRS (SRS 11p15 and SRS mUPD7). A secondary aim of this study was to assess cognitive abilities in order to establish and compare the intellectual ability of individuals with SRS 11p15 and individuals with SRS mUPD7.

Methods: The Social Responsiveness Scale, second edition (SRS-2) was used to assess autistic traits via parental report. The parent/caregiver of each participant completed the SRS-2 for 47 individuals with SRS 11p15 (mean age = 8.17 years, SD = 4.24) and 32 individuals with SRS mUPD7 (mean age = 11.63 years, SD = 7.12). The Autism Diagnostic Observation Schedule, second edition (ADOS-2) and the British Ability Scales, third edition (BAS3) were used to assess autistic behaviours and cognitive abilities, respectively. These in-person assessments were completed by a subset of participants: 18 individuals with SRS 11p15 (mean age = 8.63 years, SD = 3.44) and 15 individuals with SRS mUPD7 (mean age = 14.27 years, SD = 6.37).

Results: As assessed by the SRS-2, 45% of participants with SRS 11p15 and 53% of participants with SRS mUPD7 scored above clinical cut-off for ASD (total T-score ≥ 60). In addition, 10% of participants with SRS 11p15 and 38% of participants with SRS mUPD7 scored in the severe clinical range (total T-score ≥ 76). Comparison of SRS-2 mean total T-scores revealed that the SRS mUPD7 group were reported as displaying more autistic traits than the SRS 11p15 group. As assessed by the ADOS-2, 33% of participants with SRS mUPD7 scored in the autism spectrum or autism range, compared to 11% of participants with SRS 11p15. Based on general conceptual ability (GCA) scores, the majority of participants with SRS 11p15 had average intellectual ability (M = 98.56, SD = 19.23), whereas the majority of participants with SRS mUPD7 had borderline intellectual ability (M = 79.86, SD = 8.72). There was no association between SRS-2 total T-scores and GCA or ADOS-2 total scores and GCA for either group.

Conclusions: Overall, the findings demonstrate that individuals with SRS 11p15 and SRS mUPD7 display increased prevalence of autistic traits and these are particularly pronounced in SRS mUPD7. In addition, SRS mUPD7 is associated with increased risk of intellectual disability but autistic traits and intellectual ability are not associated in either of these groups.

223 **146.223** Spontaneous Neural Responses Relate to Behavioural and Psychiatric Traits in 16p11.2 Deletion Carriers: A Joint Analysis of EEG Spectral Power and Multi-Scale Entropy.

R. Al-Jawahiri, *M. Jones and E. Milne, The University of Sheffield, Sheffield, United Kingdom*

Background: Copy number variations (CNV) at the 16p11.2 chromosomal region (~600 kb breakpoints 4–5 (BP4-BP5)) are rare high-risk CNVs associated with myriad clinical features and neurodevelopmental disorders including intellectual disability, developmental delays, and autism spectrum disorder. Previous studies reported atypical event-related neural activity in 16p11.2 deletion carriers in response to auditory (Jenkins *et al.*, 2016), visual (LeBlanc and Nelson, 2016), and social stimuli (Hudac *et al.*, 2015). However, to date, it is not clear if neural responses are related to behavioural and psychiatric traits in 16p11.2 deletion carriers. Here, we investigated resting-state spectral power and entropy in 16p11.2 del carriers and its link to core del symptoms.

Objectives: The aim of this study is to examine the impact of 16p11.2 deletions (del) on neural activity and its relationship to social and communication impairment, autism symptom severity, and other behavioural and psychiatric problems.

Methods: EEG data were previously collected as part of the Simons Variation in Individuals Project (Simons VIP Consortium, 2012). Using spectral power, complexity index (CI), and multi-scale-entropy (MSE) analysis techniques, we analysed whole-brain resting-state EEG data collected from 22 16p11.2 del carriers and 12 typical controls. Given the small sample size, permutation tests were used for investigating group differences in neural responses (i.e., power and entropy levels). Additionally, permutation correlation tests were performed to examine whether del neural responses correlate with scores in the Social Responsiveness Scale (SRS), Autism Diagnostic Observation Schedule Calibrated Severity Score (ADOS-CSS), and Child Behaviour Checklist for ages 1.15-5 (CBCL).

Results: In terms of neural responses, no significant group differences were observed in absolute and relative power within each frequency band (delta, theta, alpha, beta, and gamma) at each of the four examined regions (frontal, occipital, parietal, and temporal). Significant group differences were found, however, in CI and MSE at all brain regions. Specifically, del showed higher levels of CI and MSE than controls at all time-scales (1-20) and regions. In addition, these neural power and entropy responses strongly correlated with most of the CBCL symptoms in deletion carriers. However, no links were found between neural responses and SRS and ADOS-CSS scores.

Conclusions: Atypical neural entropy levels are implicated in 16p11.2 del carriers over all timescales and brain regions. This indicates that local and longer-range information processing were atypical in 16p11.2 del carriers and possibly driving cognitive inflexibility and impairment in CBCL symptoms.

224 **146.224** Links between Autism and the FMR1 Premutation: Insights from Studies of Gaze, Language, and Cognition in Carriers of the FMR1 Premutation

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Background: Fragile X syndrome (FXS) is an X-linked, monogenic disorder resulting from a mutation of >200 CGG repeats in the fragile X mental retardation gene (*FMR1*), and is the most common monogenic disorder associated with autism spectrum disorder (ASD). Importantly, individuals with the *FMR1* premutation (PM; 55-200 CGG repeats) have been reported to exhibit features of the broad autism phenotype (BAP), suggesting that the *FMR1* gene may contribute to ASD-related features. This presentation will report findings from two eye-tracking tasks (that previously documented differences in ASD and the BAP), to investigate underlying cognitive processes related to language and social-emotional processing in PM carriers.

Objectives: To examine links between gaze, language, and social cognition in the *FMR1* PM, to determine whether phenotypic similarities exist with ASD and the BAP.

Methods: Forty-eight PM carriers and 56 controls completed two eye-tracking tasks previously used in studies examining ASD and the BAP: 1) A language fluency task (i.e., rapid automatized naming, or RAN), which involved serially naming common symbols and non-symbols. Refixations (the repeated fixations to previously-fixated items) and eye-voice span (i.e., the coordination between gaze and speech; longer EVS indicating greater automaticity) were variables of interest. 2) A passive viewing emotion processing task using faces from the NimStim Face Stimulus Set, during which gaze to the mouth, eyes, and nose were explored. Social cognitive and language abilities were assessed using the Reading the Mind in the Eyes Test and the Pragmatic Rating Scale, respectively. Correlations between gaze, language, and social-cognitive abilities were examined, and *FMR1*-related variation were explored within the PM group.

Results: PM carriers showed atypical gaze patterns in both tasks. During RAN, the PM group made more refixations (p<.05) and had shorter EVS (p<.10), particularly during the latter portion of the RAN sequence when key executive skills are most heavily taxed (ps<.05). Shorter EVS (i.e., less fluent language processing) was related to poorer social language abilities (but not executive functioning) (r =-.38, p<.01). Greater CGG repeats were also associated with shorter EVS (r=.35, p<.05). In the emotion processing task, the PM group fixated more quickly to the mouth, and spent more time looking at the mouth compared to controls (ps<.01). These atypical gaze patterns were surprisingly related to better social cognitive and social language abilities (rs>|.25|; ps<.05), as well as higher CGG repeats (r=.30, p<.10) in the PM group.

Conclusions: Findings revealed atypical gaze patterns in the PM, consistent with patterns previously observed in the BAP, which were observed across tasks targeting different language and social cognitive processes. Atypical gaze patterns in PM carriers may suggest that common neurocognitive processes are impacted in ASD/the BAP and PM carriers. Associations with CGG expansion suggest that the *FMR1* gene may play a role in modulating gaze and cognition. As such, results from this study may elucidate our understanding of the *FMR1* gene and its contributions to ASD-related features in the PM and more broadly.

225 **146.225** Precision Sensorimotor Control and Neurophysiology in Aging FMR1 Premutation Carriers

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Background:
FMR1 premutation carriers are at risk of developing Fragile X-associated Tremor/Ataxia Syndrome (FXTAS), a neurodegenerative condition characterized by significant motor impairments as well as cognitive and psychiatric issues. It is unknown whether sensorimotor issues are present during aging in premutation carriers who are not yet reporting clinical signs of FXTAS. Studies examining sensorimotor control and associated neural processes in aging premutation carriers may provide important insights into degenerative processes associated with FMR1 premutations as well as neurobiological mechanisms associated with FXTAS.

Objectives:

We sought to (1) characterize precision motor behavior and (2) associated brain activation in aging FMR1 premutation carriers during task-based functional MRI (fMRI). We also quantified the relationships between sensorimotor behaviors and FMR1 premutation allele repeat count.

Methods:

27 FMR1 premutation carriers ages 44-77 years and 38 age-, sex-, and handedness-matched controls completed a visually guided precision gripping task. Participants pressed with their thumb and forefinger against two precision load cells while viewing two horizontal bars. Participants pressed to move the lower bar upwards to the height of the static target bar and maintained a constant force for 2- or 8- seconds. The target bar was set at 15%, 45%, or 85% of their maximum voluntary contraction (MVC). Approximate entropy (i.e., force time series complexity, or ApEn), force variability, force accuracy, and peak rate of force increase during initial responses were examined. Sixteen FMR1 premutation carriers and 20 controls repeated the 2-s version of the task during fMRI at 20% and 60% of their MVC.

Results:

Compared to controls, premutation carriers showed reduced MVCs. During the initial phase in which participants increased their force, premutation carriers showed a reduced rate of force increase compared to controls. When trying to maintain a constant level of force, premutation carriers showed reduced ApEn relative to controls, though there was no difference in force accuracy or force variability between groups. For premutation carriers, greater CGG repeat length was associated with reduced ApEn, increased force variability, and reduced force accuracy. During fMRI, premutation carriers demonstrated increased activation of left superior temporal gyrus (STG) and right superior parietal lobule during force relative to controls at 20% MVC only. At 60% MVC, premutation carriers demonstrated reduced force-related BOLD activation relative to controls in orbitofrontal cortex (fMRI FWE corrected $p < .025$).

Conclusions:

Our findings indicate that aging premutation carriers show deficits of precision sensorimotor behaviors that are associated with greater CGG repeat length. In the context of prior studies showing that greater CGG repeat length is associated with increased risk of FXTAS in aging premutation carriers, these findings suggest that reduced control of precision sensorimotor behaviors may provide important biobehavioral risk markers of disease. During fMRI, premutation carriers demonstrated increased activation in visual and multisensory processing cortical circuits, indicating that sensorimotor deficits may reflect deficits in processing sensory feedback information during behavior. Decreased OFC activation during sensorimotor behavior compared to rest may indicate that premutation carriers show a reduced ability to flexibly shift their behavior during rapid (2 sec) sensorimotor tasks.

226 **146.226** A Comparison of Head Circumference Growth Trajectories in the Context of the CHD8 Regulatory Network

B. M. Boyd[1], *A. B. Arnett*[1], *C. M. Hudac*[1], *K. Hoekzema*[2], *T. Turner*[3], *B. J. O'Roak*[4], *E. E. Eichler*[5] *and R. Bernier*[1], *(1)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (2)Genome Sciences, University of Washington, Seattle, WA, (3)University of Washington, Seattle, WA, (4)Molecular and Medical Genetics, Oregon Health & Science University, Portland, OR, (5)Department of Genome Science, University of Washington, Seattle, WA*

Background: At least 30% of autism spectrum disorder (ASD) diagnoses are attributable to disruptive genetic events (Torre-Ubieta, Won, Stein, & Geschwind, 2016). Although no single genetic event explains the majority of ASD cases, functional genetic networks and shared deficiencies in neural growth pathways have been identified (Huguet, Ey, & Bourgeron, 2013). Research has examined converging regulatory networks, such as genes targeted by *CHD8*, a gene strongly associated with ASD (Cotney et al., 2015). One of the most prominent phenotypes in CHD8 is macrocephaly (Bernier et al., 2014; Barnard, Pomaville, & O'Roak, 2015). Despite the relevance of head size to brain development, growth trajectories have not been examined across functional gene classifications.

Objectives: Compare head circumference growth trajectories across functional genetic and clinical categories among individuals with disruptive genetic events associated with ASD either targeted or not targeted by *CHD8*.

Methods: Seventy-six participants with a disruptive mutation to an ASD-associated gene were included in the analyses (see Table 1). HC measurements were derived from medical record review and medical examination at the research visit. CHD8 target versus non-target functional gene groups were dichotomized based on prior research (Cotney et al., 2015). Participants were characterized as Macrocephalic or Microcephalic if they met criteria at any time point (i.e. +/- 2 population-based z-scores). Random effect, two-level models were tested in Mplus 7.3 with HC and age at the within level, and sex, gene functional category and clinical phenotype at the between level.

Results: Across the full sample, HC increased linearly (B = 2.71, SE = .28, p <.001) and showed quadratic deceleration (B = -.11, SE = .02, p < .001) with age, as shown in Figure 1. Females had smaller mean HC (B = -2.14, SE = .96, p = .026). Both functional gene group and clinical HC characterization moderated growth trajectories. The CHD8 Targets group had steeper linear growth (B = .22, SE = .08, p = .008) than non-Targets. The Macrocephaly group also had greater early linear growth (p < .001) relative to normal and Microcephaly groups. The Microcephaly group did not differ from the Normal group on growth rates (p > .10), indicating small and stable HC. Gene events in the Microcephaly and Macrocephaly groups were largely non-overlapping.

Conclusions: Growth patterns differ significantly within the population of individuals with ASD-associated gene disruptive events, and provide further evidence for discrete macrocephalic and microcephalic groups. Rapid early growth was characteristic of the broader CHD8 Target and Macrocephaly groups, indicating a shared phenotype and post-natal expression of this functional genetic class. In contrast, the Microcephalic group did not show atypical growth post-birth, suggesting related expression of these genes may be constrained to the prenatal period.

Grey matter overgrowth in the first years of life (Courchesne, Campbell, & Solso, 2011) and atypical levels of cerebral fluids (Shen et al., 2013) are common in ASD and may contribute to macro- and microcephalic phenotypes. HC phenotypes associated with genomic subtypes of ASD provide clues to the neurobiological and developmental etiology of neurodevelopmental disorders.

227 **146.227** Altered Striatum Centered Connectivity in SHANK3-Deficient Patients

ABSTRACT WITHDRAWN

Background:
Neuroimaging has been used extensively to dissect the pathophysiology underlying autism spectrum disorder (ASD). However, most studies are

conducted on subjects that etiologies are unknown and expected to be heterogeneous. These may create a challenge for data interpretation and reproducibility. SHANK3 is a master synaptic scaffolding protein enriched at the postsynaptic density (PSD) of excitatory synapses and plays a crucial role for synaptic development and function. Genetic defect of SHANK3 is one of the most frequent causes found in individuals with ASD from recent ASD genomics studies. SHANK3 causing ASD present a unique opportunity to dissect the pathophysiology of ASD by neuroimaging.

Objectives:

To investigate the neuromorphometry and clinical characteristics of Chinese children with *SHANK3* deficiency by neuroimaging and neurobehavioral evaluation.

Methods:

This is a case control study. Subjects were recruited and conducted from Aug 1, 2015 to Aug 31, 2017 in the Neurodevelopment Clinic of Children's Hospital of Fudan University. Among the total of 72 children participating in the study, 14 children have confirmed *SHANK3* genetic mutations, 26 have idiopathic ASD without *SHANK3* and other common genetic defect, and 32 were typically developing children as controls. Genetic tests, comprehensive clinical and neurobehavioral evaluations, as well as brain imaging were conducted for these subjects. Genetic mutations including chromosomal deletions and point mutations of *SHANK3* were identified or confirmed by MLPA, chromosome microarray, WES or Sanger sequencing methods. Comprehensive clinical and neurodevelopment evaluations including diagnostic evaluation of ASD were performed by experienced development pediatrician or certified ADOS and ADI-R administrators. Differences in quantitative grey matter indices were assessed using voxel-based morphometry (VBM) while in white matter were analyzed with tract-based spatial statistics.

Results:

Among 14 subjects with *SHANK3* mutations, 12 have heterozygous deletions including *SHANK3* ranging from 0.1 to 75 Mb size in the chromosome 22q13.3 and two have novel pathogenic point mutations in the *SHANK3* gene. Phenotypically, we described several previously unreported clinical features and manifestations including nostril eversion (100%), sensory stimulus seeking (64%), dental abnormalities (43%), hematological problem (21%) and prominent granulation tissue (7%), as well as common features of *SHANK3*-related ASD and chromosome 22q13.3 deletion (i.e. Phelan-McDermid syndrome, PMS) consisting of hypotonia, global developmental delay, and mild dysmorphic features. For the grey matter, VBM analysis revealed decreased gray matter volume (GMV) in dorsal striatum, amygdala, hippocampus and parahippocampal gyrus ($P < 0.05$, corrected for family-wise error, FWE). For the white matter, tract-based spatial statistics (TBSS) results demonstrated decreased FA in multiple tracts mainly with projection fibers and association fibers, including internal capsule, external capsule, cerebral peduncle, sagittal stratum, and etc. ($P < 0.05$, FWE corrected).

Conclusions:

This was the first major neuroimaging study of *SHANK3* deficiency related ASD. We have found a disrupted striatum centered connectivity associated with *SHANK3* genetic defects. These findings from human are consistent with the reports from the studies of *Shank3*-deficient mouse models. The cross species approach clarify the underlying neuropathological mechanisms of *SHANK3* in the human brain, thus may provide the target areas for the novel therapeutic.

228 **146.228** Characterizing Comorbid Seizures in Rare Genetic Conditions Associated with Autism and Neurodevelopment Disorders in the Simons Searchlight Cohort

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Background:

Simons Searchlight (formerly Simons VIP) is an online registry collecting data on rare genetic conditions associated with autism and other neurodevelopmental disorders and includes over 50 monogenic conditions. Seizures are a frequent comorbidity in these conditions and is of great interest to both families and the research community, but epilepsy has not been well characterized since most have only been described in the last 2-4 years.

Objectives:

To characterize common seizure types, frequency, age of onset, and treatment effectiveness across monogenic conditions associated with seizures in Simons Searchlight.

Methods:

14 of the 16 monogenic conditions with data available in Simons Searchlight are known to have co-occurring seizures in some individuals. 113 participants with a history of seizures and pathogenic or likely pathogenic variants were included in this study. The Medical History Interview (MHI) was administered to families by a licensed genetic counselor and assessed seizure characteristics. An online parent-report seizure was also administered.

Results:

Within the monogenic conditions with seizures as a known comorbidity, 113 (39%) of participants reported one or more seizures. The sample population was evenly divided between females (49%) and males (51%). 35% of the participants have SCN2A mutations. The prevalence of seizures varies from 8% (MED13L) to 63% (SCN2A). The average age at onset across seizure types and gene groups was 22 months, ranging from the neonatal period to 12 years. Average age of seizure onset varied from 7 months (infantile spasms) to 2.8 years (drop attack).

57 participants (50%) reported more than one seizure type. Grand mal seizures were the most frequently reported seizure type (49%), followed by petit mal (42%), complex partial (28%), infantile spasms (24%), and simple partial (22%). Drop attacks were the least common (11%). The mean number of seizure types experienced was 1.8. The highest number of seizure types was reported by SCN2A participants (mean = 2.55).

74% of those participants with simple partial seizures reported achieving seizure control at the time of the most recent medical history interview. In contrast, 95% of those with complex partial seizures had achieved control. In examination of medication treatments, no one medication emerged as most effective in controlling seizures within any one genetic condition.

Conclusions:

Comparisons across rare gene conditions provides insights into seizure phenomenology. Some neurogenetic conditions have higher penetrance of seizures, such as STXBP1, SCN2A, and SYNGAP1. Grand mal seizures are observed in almost all of the groups and is the most frequently reported

seizure type. In contrast, infantile spasms are reported in only 4 genes, and 93% of those with infantile spasms had mutations in SCN2A or STXBP1. This could be evidence of an underlying biological mechanism uniquely predisposing to spasms for certain genes. There also appear to be trends in the age of onset by gene. More data are needed to determine what treatments are most effective for each gene.

229 **146.229** Data Harmonization across Genetic Conditions Associated with Autism

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Background:
Advances in genetic testing have resulted in the discovery of rare variants that increase the risk for autism spectrum disorder (ASD) and related neurodevelopmental disorders. Individuals with these specific mutations have an up to 70% penetrance of ASD. Understanding ASD with a distinct genetic etiology is critical to developing interventions for both syndromic and idiopathic ASD. Families affected by these rare disorders have established Patient Advocacy Groups (PAGs) that have developed and maintained research registries that are crucial to this effort. The registries provide researchers important data, help communicate information to families, and help with participation in research studies. These PAGs have come together to form a consortium to address common issues, including registry-based data, in a group called AGENDA (Alliance for the Genetic Etiologies of Neurodevelopmental Disorders and Autism).

Objectives:

The Autism Science Foundation and the Simons Foundation Variation in Individuals (Simons VIP) project sought to enhance harmonization of data across rare disorder registries and allow for improved access and utilization of these registries to understand commonalities and differences across different forms of autism

Methods:

A total of 8 registries participated in this project and submittedfull data dictionaries. They included data dictionaries from the Autism Treatment Network, Interactive Autism Network, Dup15q Alliance, National Fragile X FORWARD, National Database for Autism Research, Phelan-McDermid Syndrome Foundation, Simons VIP and the Tuberous Sclerosis Alliance. Based on feedback from families, scientists and industry, questions across different domains were organized and categorized. Domains included: demographics, developmental history, pregnancy and birth history, and neurological or seizure history.

Results:

The information was itemized and made publicly available along with data use guidelines for each dataset. The information can be found on a single spreadsheet via the AGENDA website at: https://www.gdaac.org/for-scientists. The comparison highlights questions within each topic that exist in a single registry as well as those that appear similarly in multiples registries. Recommendations for wording and answer coding were made for both existing registries looking to update data formats as well as new registries wishing to design useful data structures at the outset. Within these high priority areas, 90 of the 1277 questions collected were itemized, following a protocol such that additional topic areas can be examined in the future.

Conclusions:

One of the barriers to research across different forms of autism, both syndromic and idiopathic, is the variation in resources and diversity of data collected through research registries. This project sought to decrease these difficulties by highlighting and harmonizing questions within special topics of interest across different registries. Future directions include determining individual governance policies to facilitate a unified data access process. As more rare variants considered causative for autism are identified, ensuring consistent resources to support scientific research is necessary.Increased collaboration between research registries and Patient Advocacy Groups should be encouraged so that standardization of the data can be initiated at earlier stages of clinical research studies, mirroring the approach taken within clinical trial research and the alignment with CDISC (clinical data interchange standards consortium).

230 **146.230** Early Activity Level and Later ASD Symptoms and Attention Problems in Children with FXS

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Background: Fragile X syndrome (FXS) is a genetic disorder resulting in physical, behavioral, and intellectual abnormalities. FXS is the leading known genetic cause of autism spectrum disorder (ASD) and is also commonly comorbid with ADHD and attention problems. Activity level, operationally defined as intensity of bodily vigor, early in development has been linked to later attention problems in typically-developing (TD) children. However, no studies have examined bodily vigor in relation to later attention problems and/or ASD symptoms in FXS.
Objectives: The aim of this study was to examine the relation between activity level in infancy and later ASD symptoms and attention problems in children with FXS, controlling for gross motor abilities.

Methods: This study included 22 children with FXS (18 male) assessed at 12 months of age (T1) (*M* = 12.96 months, *SD* = 0.49 months) and again between 4 and 6 years of age (T2) (*M* = 51.18 months, *SD* = 7.08 months). Measures included a five-minute behavioral observation of free play, the Vineland Adaptive Behavior Scales Gross Motor subscale raw score, the Child Behavior Checklist (CBCL) Attention Problems Subscale *T*-score, and the Autism Diagnostic Observation Schedule – Second Edition (ADOS-2) calibrated severity score. The behavioral observation of free play was coded from video for bodily vigor, a weighted composite score was computed, with higher scores indicating more time spent at higher bodily vigor. Partial correlations between bodily vigor at T1 and ASD and inattention symptoms at T2, controlling for T1 gross motor abilities, were run. Linear regression was then used to examine the relation between bodily vigor at T1 and ASD symptoms and attention problems at T2, controlling for gross motor abilities.

Results: Partial correlations between bodily vigor and the CBCL Attention Problems were non-significant *T*-score, $r = .48$, $p = .072$ when controlling for gross motor abilities, with a slight correlation that suggests significance may arise with a larger sample size. The correlation between bodily vigor and ADOS-2 calibrated severity score was non-significant, $r = .26$, $p = .309$. For CBCL Attention Problems *T*-score, the linear regression model

was non-significant, $F(2,17) = 2.77$, $p = .095$, $R^2 = .27$, but suggestive of a significant correlation with a larger sample. Both bodily vigor ($b = 16.15$, $p = .092$) and gross motor abilities ($b = -.58$, $p = .059$) were non-significant predictors with a possibility of significance in a larger sample. For ADOS calibrated severity score, the model was non-significant, $F(2,21) = 1.30$, $p = .295$, $R^2 = .12$. Neither bodily vigor ($b = 2.46$, $p = .225$) nor gross motor abilities ($b = -.10$, $p = .149$) were significant predictors.

Conclusions: Taken together, these findings show that bodily vigor in infancy and gross motor abilities in infancy both may contribute to later attention problems, but not ASD symptoms. Future studies should take into account other variables of activity level and inattention in infancy in larger groups in order to identify the earliest risk factors of ADHD in FXS.

231 **146.231** Early Development and ASD Risk in Neurofibromatosis Type 1

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Background: Neurofibromatosis Type 1 (NF1) is a monogenic disorder which affects 1 in every 2700 births (Evans et al.,2010), with up to 25% incidence of Autism Spectrum Disorder (ASD;Garg et al.,2013) and up to 45% presenting with ASD symptomatology (Garg et al.,2015). Levels of social impairment remain the main challenge for parents and children with NF1, although very little is understood about their early development. Our initial case series analysis of 10 infants revealed early motor and language delays at 10 months of age (Kolesnik et al.,2017).
Objectives: This project is designed to help identify early behavioural and neurophysiological markers of ASD in NF1, as well as gain a broader understanding of developmental trajectories. It further explores possible common pathways of ASD in children with NF1 and those without genetic disorders to inform construction of individualised intervention protocols.

Methods: We present data from a prospective study of infants with NF1 at 10 (n=10) and 14 (n=10) months. Data collection is ongoing and the final presentation will include data from 30 infants with NF1 recruited into the study. Results from a series of standardised assessments (Mullen,1995; McKinlay et al.,2011) were compared to a cohort of infants with familial risk of ASD including infants with a three-year diagnosis of ASD (HR-ASD:n=34), atypical (HR-Atyp:n=44) and typical development (HR-TD:n=89), as well as low risk controls (LR:n=89), co-varied by age (in days).

Results: Follow-up assessments at 14 months mirrored our initial findings (Fig1), showing reduced motor abilities in NF1 than non-ASD (HR-TD, HR-Atyp, LR) groups [Mullen Gross Motor(GM): ps=.03-.007], but not HR-ASD [p=n.s.]. Fine Motor(FM) and Vineland Adaptive Motor(VAM) scores were significantly lower in NF1 than all other groups [ps<.001]. Additionally, the NF1 group showed significant impairment in *language* ability, including lower Expressive (EL) [p=.033, η^2=.07], Receptive Language(RL) [p=.022, η^2=.044] and Adaptive Communication(VAC) scores [p<.001,η^2=.11], with significant differences between NF1 and LR groups only. Age comparisons (10 vs.14m) revealed age *x* outcome interaction for EL [p=.03, η^2=.023], RL [p=.02, η^2=.024], and VAC[p=.008, η^2=.01] scores, with comparable low scores in NF1 and HR-ASD groups, and lowest overall EL scores in NF1 group [ps ≤.001].

Conclusions: There are notable developmental difficulties in infants with NF1 in motor and language domains, which are similar to infants with later ASD diagnosis. Social skills are reported to be less affected at both time-points, which is unexpected relative to difficulties reported in later life. Based on our findings of pervasive language impairment in NF1 cohort, we will further discuss EEG data from an auditory habituation task (analysis ongoing), which was reported to show sensitivity to early variation in language growth (Kolesnik et al.,in review; Benasich et al.,2002). We hope to explore the relationship between neural markers of auditory processing and language difficulties observed in infants with NF1 and those with a later diagnosis of ASD. Using a prospective design will further help identify the time-window where these early impairments may be addressed.

232 **146.232** Effects of Age, Gender, and Genotype on Auditory Processing in Phelan-Mcdermid Syndrome

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Background: Phelan-McDermid Syndrome (PMS) is a rare genetic condition characterized by deletion or mutation of region 22q13.3, which includes the *SHANK3* gene. Approximately 84% of individuals with PMS have autistic-like traits, which include abnormal reactivity to sensory stimuli.
Objectives: This study uses a standard auditory gating task that measures attenuation of neural activity to repetitive auditory responses in PMS and typically-developing (TD) controls, with a focus on age, genotype, and deletion-size effects in PMS. Auditory gating deficits are commonly associated with abnormal sensory responsiveness and speech processing; understanding variations contributing to auditory gating abnormalities may provide insight into observed variations in clinical phenotype.

Methods: Thirty-seven PMS (age range 46-216 months, 20 females) and 14 TD participants (age range 76-178 months, 6 females) completed 150 trials of a two-stimulus auditory gating task while undergoing dense-array EEG. Gating, amplitude, and latency measures of the P50, N1, and P2 were compared using ANCOVA, examining spatial topography, gender, and genotype (TD, deletion, mutation) for adolescent and adult PMS (n=20 out of 37) matched to TD (n=13 out of 14). Additional analyses included within-PMS comparisons for the full available age range and deletion size.

Results: **Gating.** PMS showed a significantly decreased p50 gating response compared to TD. TD showed stronger gender effects on the N1 gating response than PMS. When variations in topography were examined using global field power, mutations (n=6) could also be differentiated as showing gating deficits intermediate between TD and deletions. Within PMS, an age by deletion size interaction for the N1 gating response indicated there were fewer age differences in gating with small deletion sizes, but as deletion size increased, younger individuals tended toward poorer gating. **Amplitude.** A significant effect of deletion size for PMS indicated that as deletion size increased, P50 and N1 amplitudes decreased.

Latency. Within PMS, there was a gender by deletion size interaction for the P2 response latency to the repeated stimulus. Males and females with small deletion sizes did not differ, but males had longer latencies than females as deletion sizes increased.

Conclusions: Here we demonstrate differences in age, gender and genotype findings between and within PMS and TD. The most notable differences between PMS and TD were in genotype, where PMS showed worse gating than TD for P50. Within PMS, larger deletion sizes were associated with increased auditory processing abnormalities, especially in younger individuals, suggesting the possibility for developmentally-regulated involvement of additional genes in this region. Auditory gating deficits are commonly associated with deficits filtering irrelevant sensory information and can lead to difficulty with sensory responsiveness and speech development. Results suggest that PMS exhibit auditory processing abnormalities that show complex variation by deletion-size, gender and age, which may provide valuable insight into clinical characterization of sensory and speech behaviors in future studies.

233 **146.233** Electrophysiological Biomarkers of Sensory Processing Alterations in Idiopathic and Single-Gene Causes of ASD

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Background: Studying syndromic ASD (sASD) represents a unique opportunity to uncover gene-specific neural response patterns and examine the extent of overlap with idiopathic ASD (iASD). Sensory symptoms are prominent features in patients with both sASD and iASD. Electroencephalography (EEG) represents one method to objectively examine sensory processing, and, more specifically, excitatory (glutamatergic) and inhibitory (GABAergic) neurotransmission.

Objectives: This study aims to characterize neural response patterns in iASD, ADNP syndrome, Phelan-McDermid syndrome (PMS), and FOXP1 syndrome with typically developing (TD) controls. We investigate whether sensory abnormalities observed behaviorally in iASD and sASD are also detectable using electrophysiological (EEG) measures.

Methods: EEG data were obtained from 19 individuals with Phelan-McDermid syndrome, 4 with FOXP1 syndrome, 3 with ADNP syndrome, 69 with iASD, and 26 TD controls between the ages of 4 and 16. Clinical genetic diagnoses were confirmed using chromosomal microarray or targeted sequencing. Transient visual evoked potentials (VEPs) were elicited using a contrast-reversing checkerboard stimulus. VEPs were extracted from ongoing EEG by signal averaging. Amplitudes for P60-N75 (reflecting excitatory activity) and N75-P100 (reflecting inhibitory activity) were calculated by measuring waveforms peak-to-trough. The magnitude squared coherence (MSC) statistic was used to calculate responses in four previously defined frequency bands: alpha (6-10 Hz), beta (12-28 Hz), low gamma (30-36 Hz), mid gamma (38-48 Hz). Auditory evoked potentials (AEP) during a four-tone habituation paradigm were also obtained from a subset of each group.

Results: The iASD group displayed significant attenuation compared to controls at P60-N75 ($p<.001$) and N75-P100 ($p=.01$) with no difference in latencies. The PMS group also displayed significantly attenuated amplitudes compared to controls at P60-N75 ($p<.001$) with no difference in latencies. The iASD group also displayed significant attenuation compared to controls at P60-N75 ($p<.001$) as well as N75-P100 ($p=.01$) with no difference in latencies. The ADNP group showed a similar pattern at P60-N75 ($p=.027$) and N75-P100 ($p=.006$), and significantly delayed latency at P100 ($p=.048$). There was significant individual variability in the FOXP1 group, corresponding to clinical phenotype. In the frequency domain, the iASD and PMS groups displayed significant differences in beta and both gamma bands (p values=.001 to .042 and <.001 to .012, respectively). The ADNP and FOXP1 groups also showed weaker responses in beta ($p=.034$; $p=.032$) and low gamma ($p=.041$; $p=.016$) bands. Preliminary results from AEPs demonstrate group specific differences in magnitude of response to initial tones and degree of habituation of response to subsequent tones.

Conclusions: Time-domain analyses revealed syndrome-specific phenotypes with excitatory deficits observed in iASD, PMS, and ADNP syndrome groups based on deficits in early negative VEP components (P60-N75). Greater variability in response amplitudes was observed in the FOXP1 syndrome group, although on average, longer latencies were observed in both ADNP syndrome and FOXP1 syndrome groups at P100. Frequency-domain analyses demonstrated differences in beta and low-gamma activity present across iASD and sASD groups. Future directions include collecting additional AEP data to determine whether brain-based sensory abnormalities exist across sensory modalities. This information could potentially be used to inform treatment approaches for individuals with both syndromic and idiopathic ASD.

234 **146.234** Evaluating Properties of Electrophysiological Biomarkers in Duplications of Chromosome 15q11.2-13.1(Dup15q syndrome)

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Background:

Dup15q syndrome is highly penetrant for autism, intellectual disability, hypotonia, and epilepsy. The 15q region harbors genes critical for brain development and synaptic function, particularly the UBE3A and $GABA_A$receptor genes. In a recent study we found that individuals with Dup15q syndrome show an electrophysiological biomarker characterized by excessive beta oscillations (12-30Hz) (Frohlich, 2016). This pattern resembles EEG changes induced by allosteric modulation of $GABA_A$Rs, and the frequency at which we see the highest peak in the beta band (peak beta frequency), is modulated by $GABA_A$R kinetics. Given the overexpression of $GABA_A$R genes and UBE3A, which modulates synaptic GABA release, beta power and peak frequency may reflect abnormal GABA neurotransmission in Dup15q syndrome. Therefore, we sought to examine properties of these biomarkers, namely relation to phenotype and stability across states, that might inform its use in future clinical trials of pharmacological agents that modulate GABA neurotransmission.

Objectives:

To determine whether beta power and peak beta frequency 1) correlate with cognition, 2) differ between children with and without epilepsy, and 3) differ between awake and sleep states.

Methods:

Spontaneous resting awake EEG were collected at UCLA and two Dup15q family meetings, from 46 individuals, ages 9months-16years. To analyze

sleep, we accessed clinical overnight EEG from 8 individuals with Dup15q syndrome, ages 2-11 years. Participants under medications known to pharmacologically elicit beta oscillations were excluded. EEG data were processed offline using MATLAB-EEGLAB software. Data were filtered, artifact reduced using both manual and independent component analysis, and physiological artifacts removed. Data were average referenced, and spectral power and peak frequency computed. Clinical measures tested included verbal(VDQ) and nonverbal cognition(NVDQ) based on the Mullen Scales of Early Learning, and adaptive function based on the Vineland Adaptive Behavior Scales. Simple and multiple linear regression models were implemented to model the effects of clinical features.

Results:

Beta power did not correlate with cognition (VDQ: R^2=0.0052, p=0.6756; NVDQ: R^2=0.0002, p=0.9354) and did not significantly differ based on epilepsy status (R^2=0.0003, p=0.9002). Peak beta frequency did not correlate with cognition (VDQ: R^2=0.0489, p=0.1947; NVDQ: R^2=0.0547, p=0.1695). Peak beta frequency was significantly lower in children with epilepsy compared to those without an epilepsy diagnosis at the time of EEG recording (R^2=0.1055, p=0.0383). Analysis of sleep EEG demonstrated persistent beta oscillations in sleep. Additionally, we found evidence of remarkably abnormal sleep characterized by attenuated slow wave sleep, presence of alpha-delta and beta-delta patterns. Particularly in participants with epilepsy, frequent spikes, and reduced spindle density were found.

Conclusions:

Peak beta frequency stratifies children with Dup15q syndrome based on epilepsy status. Sleep EEG revealed presence of excessive beta oscillations. Persistent beta oscillations and other abnormal electrophysiological patterns may compromise healthy sleep physiology and therefore disrupt sleep-dependent cognition. While this needs further investigation, stability of the biomarker across brain states underscores our hypothesis that the Dup15q EEG signature reflects the underlying genetic variation. Such genetically informed brain-based biomarkers can inform and improve clinical trials by serving as measures of target engagement or as outcome measures that precede behavioral responses to pharmacological treatment.

235 **146.235** Exploring Social Profiles of Individuals with 16p11.2 Deletion and Duplication

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Background: Copy number variation (CNV) of the 16p11.2 chromosomal region has been associated with a wide range of neurodevelopmental outcomes. Approximately 19% of pediatric duplication carriers and 26% of pediatric deletion carriers meet criteria for a diagnosis of autism spectrum disorder, and a majority of carriers exhibit some autistic features (Green Snyder et al., 2016; Hanson et al., 2015). Few studies have investigated specific patterns of social strengths and challenges in 16p11.2 CNV carriers. Mouse model studies of 16p11.2 deletion have reported a pattern of intact social approach with atypical social interactions (Yang et al., 2015). Recently, clinical phenotyping of a 16p11.2 duplication cohort has similarly revealed a possible social profile of intact social motivation in the presence of impacted social cognition (Green Snyder et al., 2016). Further investigation of social behaviors in a large cohort of 16p11.2 duplication and deletion carriers may further validate this social profile. Objectives: To explore social profiles of individuals with 16p11.2 deletions and duplications.

Methods: Participant data from 223 children with 16p11.2 deletions and 100 children with 16p11.2 duplications were extracted from the Simons VIP Phase 2 data (Simons VIP Consortium, 2012). A repeated measures ANOVA was used to test whether mean *T*-scores differed on theoretically derived subscales of the Social Responsiveness Scale, Second Edition (SRS-2; Constantino & Gruber, 2012) within the 16p11.2 duplication and deletion groups.

Results: For the 16p11.2 duplication group, results showed a significant main effect of SRS-2 subscale on subscale mean *T*-score, *Greenhouse-Geisser Adjusted* $F(3.25, 321.62) = 28.65$, $p < 0.001$, *partial* $\omega^2 = 0.22$. Follow-up paired *t*-tests among SRS-2 subscales using Dunn-Sidak adjustment revealed that the Social Motivation subscale had a lower mean *T*-score, suggestive of better developed social motivation abilities, compared to Social Awareness ($t(99) = -6.08$, adjusted $p < 0.001$, $d = -0.56$), Social Cognition ($t(99) = -7.21$, adjusted $p < 0.001$, $d = -0.73$), Social Communication ($t(99) = -5.42$, adjusted $p < 0.001$, $d = -0.54$), and Restrict Interests and Repetitive Behaviors (RRB; $t(99) = -8.18$, adjusted $p < 0.001$, $d = -0.82$) subscales. Similarly, for the 16p11.2 deletion group, results showed a significant main effect of SRS-2 subscale on subscale mean *T*-score, *Greenhouse-Geisser Adjusted* $F(3.06, 680.29) = 10.66$, $p < 0.001$, *partial* $\omega^2 = 0.04$. Follow-up paired *t*-tests among SRS-2 subscales using Dunn-Sidak adjustment revealed that the Social Motivation subscale had a lower mean *T*-score compared to Social Cognition ($t(222) = -4.14$, adjusted $p < 0.001$, $d = -0.28$), Social Communication ($t(222) = -6.37$, adjusted $p < 0.001$, $d = -0.43$), and RRB ($t(222) = -2.92$, adjusted $p < 0.05$, $d = -0.23$) subscales.

Conclusions: The social profile of 16p11.2 CNV carriers was quantified in a large sample using standardized caregiver report. Evidence suggests that social motivation represents a relative social strength for both 16p11.2 duplication and deletion carriers. Further investigations should explore social motivation in other standardized measures along with the developmental trajectory of social motivation in individuals with 16p11.2 CNV.

236 **146.236** Genotype-Phenotype Correlations in Phelan-Mcdermid Syndrome

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Background: Phelan-McDermid syndrome (PMS, OMIM# 606232) is characterized by intellectual disability, muscle hypotonia, delayed or absent speech and autism spectrum disorder (ASD). PMS is due to heterozygous chr. 22q13.3 terminal deletions or, more rarely, point mutations involving the SHANK3 gene, crucial to the formation and plasticity of excitatory synapses. Disruption of SHANK3 causes approximately 0.5% of ASD cases, with higher rates reported in ASD co-morbid with ID. Patients with PMS may undergo behavioral regression, with two incidence peaks around 6 years of age and in adolescence.

Objectives: This study aims to assess genotype-phenotype correlations in PMS.

Methods: Fifty PMS patients (2-42 y.o., M:F=1:1) were recruited at the Interdepartmental Program "Autism 0-90" of the "G. Martino" University Hospital (Messina, Italy). All patients underwent medical history collection, neurological examination, behavioral observation, medical work-up and psychodiagnostic testing, including ADOS-2, ADI-R, Leiter-3 or GDMS, VABS-II, VAS, CGI, CBCL, SCQ, SSP, WHOQOL, QOL-A, ABC and RBS-R. Genetic diagnosis was confirmed by array-CGH (400K Kit, Agilent) or by targeted Sanger sequencing in 46 patients, by FISH in 1 case and by

karyotype in 3 cases.

Results: All patients received a DSM-5 diagnosis of Intellectual Disability and/or global development delay; 15/50 (30.0%) also satisfied DSM-5 and ADOS criteria for ASD. Moreover, all patients share deficits in gross and fine motor skills, as well as in alternating movement, visuo-motor and bimanual coordination. Deletion size ranges from 25 Kb to 9 Mb, spanning up to 7 autosomal dominant disease genes (SHANK3, SCO2, PLXNB2, UPK3A, SAMM50, PNPLA3, TCF20). Large deletions (>5 Mb), spanning from SHANK3 to UPK3A and beyond, are significantly associated with: (a) female sex (P<0.05), (b) more severe clinical phenotypes and greater developmental delay (P<0.05 for delay in walking and sphincter control, P<0.01 for deficits in receptive language); (c) presence of multiple brain MRI abnormalities (P<0.01). The largest deletions involving also TCF20 always yield a very severe phenotype with extreme muscle weakness, hypotonia, difficult weaning, reduced spontaneous activity and lack of autonomous walking. On the other hand, deletion sizes >0.42 Mb, spanning from SHANK3 to PLXNB2 and beyond, tend to be associated more frequently with renal malformations, but these are occasionally observed also with smaller deletions. Clinical regression occurred in 12/50 (24.0%) patients and may be more frequent in carriers of small deletions encompassing only SHANK3 (P=0.14). In general, large phenotypic variability is observed among carriers of identical or similar deletions.

Conclusions: Interindividual differences in PMS severity may stem from at least three sources: (a) deletion size involving other functional genes in addition to SHANK3, especially PLXNB2 and TCF20; (b) additional mutations, microdeletions or epigenetic influences in the non-deleted allele; (c) greater penetrance of familial genetic loading for neuro-behavioral disturbances in the presence of a SHANK3 synaptopathy. Larger deletions may be rarely compatible with life in male offspring. The medical work-up for PMS should be broad, structured, and consistent, and should not be driven by deletion size, although dominant and recessive genes located in the deleted segment can point toward specific vulnerabilities.

237 **146.237** Language and Motor Development in Children with Adnp Syndrome

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Background:

Activity-Dependent Neuroprotector Homeobox Protein (*ADNP*) is a transcription factor-encoding gene located on chromosome 20. ADNP Syndrome is a rare neurodevelopmental disorder caused by mutations and deletions in the *ADNP* gene and has been identified as one of the more common single-gene causes of autism spectrum disorder (ASD). ADNP syndrome has also been associated with intellectual disability and global developmental delay encompassing both language and motor domains.

Objectives:

To comprehensively characterize language and motor development in children with ADNP syndrome.

Methods:

Ten children with ADNP syndrome (4 female, ages 3-12 years) were evaluated using standardized assessments including the Mullen Scales of Early Learning, the Expressive Vocabulary Test, Second Edition (EVT-2), the Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4), and the Vineland Adaptive Behavior Scales, Second or Third Edition, Survey Interview Form. Language and motor milestones were collected using the Autism Diagnostic Interview-Revised (ADI-R).

Results:

Language and motor milestones were delayed in all participants. In the language domain, average age of first word and phrase speech were 31 and 60 months, respectively. At the time of evaluation, six participants were nonverbal or minimally verbal, two children used phrase speech, and two children used fluent speech. Seventy-one percent of participants (5/7) who completed the Mullen had higher age equivalents on the receptive language scale (M=22.29, SD=11.66) compared to the expressive language scale (M=19.14, SD=10.24). Of participants able to complete the PPVT-4 and EVT-2 (n=6), 67% scored higher on tasks of receptive language (M=60.57, SD=12.54) compared to tasks of expressive language (M=54, SD=14.25). On the Vineland, 70% of caregivers reported their child's expressive language skills (M=25, SD=14.19) were better developed than receptive language skills (M=22, SD=10.15).

In the motor domain, nine of 10 participants were able to walk unaided. Average age of first crawling and walking was 16 and 25 months, respectively. Of the seven participants who completed the Mullen, 71% (5/7) of participants had higher age equivalents on the Mullen for gross motor (M=25, SD=8.02) than for fine motor development (M=20.86, SD=5.40). Similarly, 71% (5/7) of participants had higher age equivalents on the Vineland for gross motor subdomain (M=26.71, SD=16.77) compared to the fine motor subdomain (M=24.86, SD=16.47).

Conclusions:

Delays in achieving language and motor milestones were reported in all participants. Current scores from standardized clinician-administered assessments indicated better developed receptive language abilities compared to expressive language abilities, despite caregiver report of an opposite profile. Results indicate that children with ADNP syndrome may understand more than they are able to express, which has important implications for behavioral and educational interventions. Both clinician-administered and caregiver interviews revealed better developed gross motor abilities relative to fine motor abilities. Results suggest intensive speech therapy, occupational therapy, and physical therapy are critical for individuals with ADNP syndrome and should be initiated early on.

238 **146.238** Medical Issues in Ehlers-Danlos Syndrome/Hypermobility Spectrum Disorders, Autism Spectrum Disorder, and Unaffected Controls

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Background: Ehlers-Danlos syndrome (EDS)/hypermobility spectrum disorders (HSD) are believed to be largely collagen-related disorders, which are often accompanied by neurodevelopmental and neuropsychiatric conditions (Baeza-Velasco et al., 2015). In particular, a growing body of literature suggests overlap between EDS/HSD and some cases of autism spectrum disorder (ASD), although to date this relationship is poorly delineated (Casanova et al., 2018; Baeza-Velasco et al., 2015). The possibility that a subset of autism cases are in fact connective tissue disorders is intriguing and it is therefore important to determine to what extent connective tissue impairment (clinical or subclinical) occurs within the autism spectrum.
Objectives: To study clinical similarities between adults with EDS/HSD, ASD, and controls across key symptom areas to determine the extent of phenotypic overlap across these groups.

Methods: We surveyed 702 adults aged 25 years or older with or without EDS/HSD and/or ASD diagnoses on a variety of EDS/HSD-related health topics, including immune, autonomic, and endocrine symptomology; diagnostic clustering within affected families; hypermobility and occurrences of dislocations/subluxations of joints; skin abnormalities (e.g., bruising, scarring, bleeding); and chronic pain and fatigue.

Results: Compared to controls, the autism group reported similar though less severe symptomology than the EDS/HSD group, especially in areas of immune, autonomic, and endocrine dysregulation; skin abnormalities; and chronic pain. The ASD group did not significantly differ from controls in reported rates of generalized hypermobility unless already diagnosed with EDS/HSD. Interestingly, EDS/HSD mothers with autistic children reported more immune symptoms than EDS/HSD mothers without (p = 0.0119). The same trend was found in EDS/HSD mothers with EDS/HSD children (p = 0.0145), suggesting the maternal immune system may play an important role in both these conditions' etiologies.

Conclusions: These data suggest that EDS/HSD and autism share some clinical, and perhaps etiological, overlap that should be further studied. This work also indicates that mild connective tissue impairment and chronic pain could be under-recognized issues in ASD that warrant further attention.

239 **146.239** Motor Trajectories and Language Outcomes in a Genetic Model of ASD: Early Development in Fragile X with and without ASD

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Background: Fragile X syndrome (FXS) is the most prevalent genetic subgroup of autism, with a comorbidity rate of 50-70%[1,2]. With substantial phenotypic overlap and high ASD comorbidity, FXS offers a particularly useful ASD model for characterizing the longitudinal implications of early developmental impairments. Motor is one particular area of early impairment in FXS[3] that is more significant in those with comorbid FXS and ASD[4,5]. Motor has been established as an important foundation language development in children with non-syndromic ASD[6]. However, the implications of delayed motor development on language outcomes in FXS and those with FXS and ASD has yet to be examined.
Objectives: To determine whether early foundations and rate of change in fine and gross motor development predict receptive and expressive language outcomes in children with FXS-only and FXS+ASD.

Methods: Participants were from a larger prospective longitudinal study and included 43 children with FXS. According to clinical best estimate procedures 24 of the 43 participants were confirmed to have comorbid ASD (FXS+ASD). Participants were tested at regular intervals between 6 and 60 months old and groups were age-matched across assessments (p=.50; FXS M=23.86; FXS+ASD M=24.78). Study measures included the Mullen Scales of Early Learning[7] the Vineland Adaptive Behavior Scales 2nd Edition[8] at each assessment. MSEL fine and gross motor raw scores were used as predictors and VABS-II receptive and expressive raw scores were used as outcome variables. We used growth models in a multilevel framework to determine level (intercept) and rate of change (slope) in fine and gross motor development over time in each group separately. Intercepts (with age centered at 9-months) and slopes were extracted and then modeled as predictors of receptive and expressive language outcomes at approximately 5-years-old in each group.

Results: Model results indicated that early gross motor (intercept) but not rate of change (slope) predicted receptive language for FXS (b=1.30; p=0.003), and FXS+ASD (b=0.88; p=0.037). This pattern was consistent between gross motor trajectories and expressive language outcomes for FXS (intercept b=5.49; p<.001); however, neither early gross motor nor rate of change predicted expressive outcomes in FXS+ASD. Early fine motor (intercepts) predicted receptive language outcomes for FXS (b=1.85; p<0.001) and FXS+ASD (b=2.54; p=0.02), whereas rate change predicted receptive outcomes only for the FXS (b=25.56; p=0.04). Early fine motor (b=6.26; p<0.001), but not rate of change, predicted expressive outcomes for FXS. Neither early fine motor, nor rate of change in fine motor predicted expressive language outcomes for FXS+ASD.

Conclusions: Study findings suggest that fine and gross motor development plays a significant role in receptive and expressive language outcomes for children with FXS. However, different patterns of influence emerged for children with FXS-only and those with FXS+ASD. Early motor foundations were a more salient predictor of both receptive and expressive outcomes for both groups. Rate of motor skill acquisition only emerged as a salient factor fine motor predicting receptive language in FXS without ASD. Decelerated motor development in FXS+ASD[5] may account for these patterns and collective findings underscore the necessity of targeted motor intervention.

240 **146.240** Neurophysiological Outcomes in a Preclinical Model of Ube3a Overexpression and Dup15q Syndrome

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Background:
Copy number variants (CNV) are among the most common genetic causes of autism spectrum disorders (ASD), with 10-20% of cases resulting from one or more CNVs. Maternally derived duplications or triplications of 15q11.2-q13 (Dup15q syndrome) are the most penetrant CNV observed in ASD, accounting for up to ~3% of ASD cases (Glessner et al., 2009; Pinto et al., 2010). Dup15q syndrome, as a genetically defined subtype of ASD, also shares the core transcriptomic signature observed in idiopathic ASD (Ohta et al., 2015). Characteristic features of Dup15q syndrome are moderate to severe intellectual disability, seizures, hypotonia, speech impairments, anxiety, impaired motor coordination, and ASD (Cook et al., 1997; Bolton et al., 2001; Hogart et al., 2010; Urraca et al., 2013; Conant et al., 2014; Finucane BM et al., 2016). We and others postulate that overexpression of the E3 ubiquitin ligase gene (*UBE3A*), a critical gene in this region, contributes to the Dup15q syndrome phenotype.

Objectives:

To examine neurophysiology by electroencephalographic (EEG) for spiking events in our *Ube3a*overexpression model system.

To investigate EEG characteristics such as epileptiform activity, total spectral power, and spectral power by band width frequency that are translationally relevant and observed in the Dup15q clinical population (e.g., high beta power measured in children with Dup15q).

Methods:

Wildtype and Ube3a overexpression mouse EEG was recorded over a24-48hr acquisition period (N=8-10/per genotype/per sex). EEG data were collected using the DSI telemetry system. Subjects were implanted with F20-EET telemeters bearing two channels to measure EEG and EMG. EEG leads were attached to surgical screws in the skull (anterior to the ICV coordinates), and EMG leads were placed in the trapezius muscles. Relative to bregma, EEG leads were located 1.0mm, 0.5mm for the positive channel and -1.0mm, -0.7mm for the negative counterpart. Animals were given one week to recover from surgery prior to data acquisition. Data were analyzed by DSI Neuroscore software and customized Matlab algorithms.

Results:

Previously, we discovered that neuronal specific overexpression of Ube3a isoform 2 is sufficient to cause seizures, behavioral and anatomical phenotypes (Copping et al., 2017). We extended our initial seizure data herein by reporting subthreshold seizure activity and an approximate 2-3 fold increase in spike train activity (0.5 s minimum duration and a minimum of 4 spiking events). Interestingly, we also observed increased beta spectral power without increased total power.

Conclusions:

Ube3a overexpression mice exhibited higher beta spectral power compared to their WT littermate controls, recapitulating the increased beta power signature seen in the clinical population and highlighting the use of spectral power as a biomarker for therapeutic efficacy. Seizures and epileptiform signatures in EEG can be similarly measured in both rodents and humans, and thus EEG phenotypes, such as those described herein, have realistic translational relevance (Featherstone et al., 2015; Modi and Sahin, 2017; Dickinson et al., 2018).

241 **146.241** Neuropsychiatric Phenotypes in 3q29 Deletion Syndrome and Novel Features of ASD: Results from the 3q29 Registry

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Background: 3q29 deletion syndrome (3q29Del) is a rare (~1:30,000) genomic disorder characterized by a 1.6 Mb heterozygous deletion on chromosome 3. It is associated with a wide range of neurodevelopmental and neuropsychiatric disorders, as well as growth deficits, feeding problems, and congenital heart defects. Notably, the 3q29 deletion confers a 30-fold increased risk for Autism Spectrum Disorder (ASD), a 40-fold increased risk for schizophrenia, and a significantly increased risk for intellectual disability and generalized anxiety disorder.
Objectives: The aim of this study is to describe the spectrum of ASD-related features in the largest 3q29Del patient cohort ever assembled.

Methods: We used Emory University's 3q29Del registry (3q29deletion.org) to obtain self-report data on 3q29Del patients and typically developing controls, including a custom medical and demographic questionnaire (n=94 3q29Del, 58.5% male, mean age=12.7 years; n=64 control, 51.6% male, mean age=10.6 years); Achenbach Behavior Checklists (CBCL/ABCL, n=48 3q29Del, 57 control); Social Responsiveness Scale (SRS, n=48 3q29Del, 59 control); and the Social Communication Questionnaire (SCQ, n=33 3q29Del, 46 control). Statistical testing and data visualization were performed in R.

Results: Self-reported ASD diagnosis in 3q29Del participants was significantly inflated versus the general population (30.7% vs. 1.47%, p<2.2e-16). The male:female ratio of self-reported ASD diagnosis in 3q29Del is 1.8:1, strikingly different from the 4:1 ratio. Additionally, some participants that do not report an ASD diagnosis scored in the clinical range on all self-report scales, and mean scores for all participants were elevated (mean SRS T-score=71.75; mean SCQ score=13.88; mean CBCL/ABCL T-score=62.5), indicating substantial behavioral impairment in the absence of a clinical diagnosis. Finally, 3q29Del individuals showed a novel constellation of ASD features on the SRS, with elevated mean scores on 5 of the 6 subscales (Social Awareness, Social Cognition, Social Communication, Social Communication and Interaction, and Restricted Interests and Repetitive Behaviors). The mean score for Social Motivation, however, was in the mild range (Figure 1), which is dramatically different from the profile observed in idiopathic ASD.

Conclusions: These results showed that the 3q29Del population is significantly enriched for ASD diagnosis and ASD features measured via standardized ASD surveys; however, several individuals scored in the clinical range on all scales, despite reporting no diagnosis of ASD. This implies that either ASD is underdiagnosed or not adequately assessed in 3q29Del patients, or additional psychopathology is present that may be independently elevating scores. Additionally, we find that potential confounders such as self-reported ID diagnosis are not driving the increase in scores for 3q29Del participants, indicating that the 3q29 deletion itself is the major risk factor for this impaired behavioral profile. Moreover, a unique pattern of ASD symptomatology was observed, with social motivation being relatively less impaired than other areas of social functioning; this profile is qualitatively different from what is observed in idiopathic ASD. These findings have implications for standard of care recommendations for individuals diagnosed with 3q29Del; they also suggest that 3q29Del could serve as an investigative inroad to a novel subtype of ASD.

242 **146.242** Predictors of Psychotic Symptoms Among 16p11.2 Copy Number Variant Carriers

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Background: Autism spectrum disorder (ASD) and psychotic disorders such as schizophrenia co-occur more frequently than chance would suggest. This relationship may in some cases be mediated by obsessive-compulsive disorder (OCD)-like symptoms, which are common in ASD and related to psychosis in the general population. However, psychosis in ASD is difficult to diagnosis, with little known about its predictors, correlates and outcomes. 16p11.2 copy number variation (CNV) is a promising model of the relationships between these pathologies. Both 16p11.2 deletion and duplication are associated with ASD, but only the duplication has been reported in schizophrenia. A comparison of psychotic symptoms

among deletion carriers, duplication carriers, and non-carriers could yield insights relevant to the broader ASD population.
Objectives: We sought to identify predictors of psychosis among 16p11.2 CNV carriers and their non-carrier siblings in the Simons Variation in Individuals Project (VIP) cohort, which represents a range of ages (23 ± 17 years). We hypothesized that: 1) psychosis would be most common in duplication carriers followed by deletion carriers and non-carriers, 2) ASD diagnosis would predict psychosis among carriers, and 3) OCD symptoms would predict psychosis among carriers and non-carriers.

Methods: To identify psychotic symptoms, an index was derived from items across existing measures. As psychosis and ASD can both involve social impairment, we focused on items measuring hallucinations, delusions, and disordered thought. The index incorporated Adult/Child Behavior Checklist (ABCL/CBCL) scores and item responses from the Scale of Prodromal Symptoms (SOPS), Diagnostic Interview Schedule for Children (DISC-Youth), and Simons VIP medication questionnaire (which asks about medications taken specifically for psychosis). The index yielded a binary psychosis variable considered positive if both an elevated ABCL/CBCL t-score and a positive DISC, SOPS or medication questionnaire response were present. Logistic regressions were conducted against this variable using carrier status, age, IQ, clinical ASD diagnosis, OCD symptoms (measured by DISC), and gender as *a priori* predictors. Generalized estimating equations were used to control for intra-family correlations.

Results: In the whole cohort (n = 544), psychosis (n = 27) was predicted by duplication carrier status (OR 4.3, 95% CI 1.1 - 16.4, p = 0.03) and OCD symptoms (OR 6.9, 95% CI 2.4 - 19.7, p = 0.0003). Among deletion carriers (n = 130), psychosis (n = 9) was predicted by OCD (OR 11.4, 95% CI 2.2 - 58.3, p = 0.003). Among duplication carriers (n = 108), psychosis (n = 12) had no significant predictors. Among noncarriers (n = 306), psychosis (n = 6) was predicted by OCD (OR 28.9, 95% CI 2.2 - 372, p = .01). No noncarriers with ASD had psychotic symptoms.

Conclusions: Our findings indicate an association between 16p11 duplication and psychosis that is independent of ASD diagnosis or OCD symptoms. In people without the duplication, OCD symptoms and psychosis were robustly associated. The lack of association between ASD and psychosis is surprising in light of previous work suggesting a relationship, albeit in much larger samples. Additional analyses will assess whether ASD symptoms, rather than categorical diagnosis, may show a relationship with psychosis.

243 **146.243** Restricted Repetitive Behaviors of Individuals with Comorbid Tuberous Sclerosis Complex and Autism Spectrum Disorder

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Background: While atypical language development is the most common area of first concern for children with ASD, restricted repetitive behaviors (RRBs) may be some of the first manifestations of ASD, often presenting prior to language development (Wolff et al., 2014). Children with ASD of varying cognitive and adaptive abilities have significantly greater frequency and severity of RRBs compared to typically developing children (Ozonoff et al.,2008; Wolff et al.,2014). In infancy, children with ASD are likely to display repetitive motor movements including rocking, hand flapping, and unusual posturing (Wolff et al.,2014; Harrop et al.,2014; Ozonoff et al.,2008; Richler et al.,2010). By age 3 years, children with ASD also display unusual sensory preoccupations or interests.
There has been increasing interest in examining ASD within genetic disorders (Moss et al.,2012) such as tuberous sclerosis complex (TSC; McDonald et al.,2017; Jeste et al.,2014; Sundberg & Sahin,2015). However, caregivers and clinicians frequently do not recognize the proper diagnosis as being ASD in individuals with TSC (Capal et al.,2017), as RRBs are not well characterized within the TSC population. Better understanding of RRBs in individuals with TSC, as well as those with comorbid TSC and ASD, may inform earlier diagnosis of ASD, promoting optimal outcomes.

Objectives: The current study aims to examine and define the presence of RRBs in individuals with TSC and ASD.

Methods: Participants included 129 children with TSC participating in a multisite longitudinal study through the TSC Autism Center of Excellence Network. Within this sample, 26 individuals received an ASD diagnosis and 103 did not have ASD. Cognitive ability was assessed via the Mullen Scales of Early Learning, adaptive functioning via the Vineland Adaptive Behavior Scales-Second Edition, and RRBs via the Autism Diagnostic Interview-Revised (ADI-R).

Results: Groups did not significantly differ on age or gender($p's>0.05$). The ASD group had significantly lower cognitive ($t(26.5)=-3.14, p<.001$) and adaptive scores ($t(93)=-4.65, p<.001$). Overall, the ASD group had significantly higher scores on ADI-R Total Restricted, Repetitive, and Stereotyped Patterns of Behaviors($p<0.05$). Further, the ASD group showed significantly higher scores on C1-Encompassing Preoccupations or Circumscribed Patterns of Interest, C3-Stereotyped and Repetitive Motor Mannerisms, and C4-Preoccupation with Parts of Objects or Nonfunctional Elements of Materials ($p's<0.05$). At the item level, the ASD group showed significantly higher scores on Unusual Preoccupations, Hand and Finger Mannerisms, Other Complex Mannerisms or Stereotyped Body Movements, Repetitive Use of Objects, and Unusual Sensory Interests ($p's<0.05$). Groups did not differ on Circumscribed Interests, Verbal Rituals, or Compulsions/Rituals.

Conclusions: Results suggest that individuals with TSC and ASD have overall increased amounts and severity of RRBs, specifically increased unusual preoccupations, hand/finger and other complex mannerisms, repetitive use of objects, and unusual sensory interests. This suggests that children with TSC and ASD have a similar RRB profile to children with ASD only at 3 years of age (Wolff et al.,2014; Harrop et al.,2014; Ozonoff et al.,2008; Richler et al.,2010). As such, this profile may aid in detecting individuals with ASD within the TSC population at an earlier age, allowing for better detection of affected individuals.

244 **146.244** The Effectiveness and Feasibility of the PEERS® School-Based Social Skills Intervention in a Transdiagnostic Group of Adolescents

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Background: Social skills difficulties are common in adolescents with a range of neurodevelopmental (NDD) and mental health disorders (MHD). There are few evidence-based social skills interventions for adolescents, and access to these programs is limited. Social skills interventions are generally evaluated in tightly-controlled research settings, which differ substantially from community settings in ways that may limit the generalizability of program effectiveness. For example, social skills programs are generally studied within a single diagnostic group, while in community settings youth with a variety of NDDs/MHDs may be included together. School-based social skills interventions have potential to

overcome barriers to care. Given the limited research on these interventions in school settings, considerations of social validity and feasibility are warranted.

Objectives: The present study evaluated the feasibility, acceptability, and initial effectiveness of the PEERS® social skills intervention for a transdiagnostic group of adolescents with social difficulties in the public high school setting.

Methods: Twenty-four high school students were assigned to the PEERS® intervention or a waitlist control group (WLC). The majority of students (71%) had IEPs. Twenty-nine percent had ASD, 29% had other diagnoses, and 42% had no diagnoses. We assessed variables related to feasibility including attendance, dropout, and scheduling obstacles. We also assessed parents' and adolescents' ratings of program acceptability. We evaluated the impact of the PEERS® program on participants' social skills, ASD symptom severity, social anxiety, and explicit knowledge of social skills, as rated by parents, teachers, and the adolescents themselves. Further, we directly evaluated participants' conversational abilities with the Contextual Assessment of Social Skills (CASS).

Results: Both parents and adolescents rated the intervention acceptable overall. Drop out was low, and the remaining students attended most sessions, although scheduling difficulties arose. Results of ANCOVA indicated adolescents in the intervention group displayed significantly improved social skills knowledge on a measure of skills taught in the program (Cohen's d = 3.26) and overall involvement in conversation on the CASS (Cohen's d = 1.00) compared to adolescents in the WLC. There were small-to-large effect sizes favoring the intervention group for most other intervention outcome measures, although these differences did not reach statistical significance. Reliable change indices revealed that almost half of adolescents (46%) in the intervention group displayed reliable improvement in at least one conversational skill domain that was observable to an independent rater blinded to treatment status and time point, compared to 18% of adolescents in the WLC.

Conclusions: Our findings provide preliminary support for the effectiveness of the PEERS® intervention in transdiagnostic groups. They also highlight the importance of continued research into factors that facilitate implementation of interventions in community-based settings. Future research should evaluate moderators of treatment response to provide guidance for which students are most likely to benefit from the intervention and identify modifications or alternative treatments for those who are less likely to benefit. As this work progresses it is also critical to consider factors that increase the reach and sustainability of interventions, such as training school-based providers and integrating programs into the structure of existing services.

245 **146.245** The Neurocognitive Profile of Individuals with Phelan Mcdermid Syndrome (PMS): Comparison with Autism Spectrum Disorder (ASD) and Individual Differences.

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Background:

Phelan-McDermid Syndrome (PMS) is a rare neurodevelopmental condition caused by a chromosome 22q13.3 deletion. Individuals have mild to profound learning disabilities and 70-80% also have autism spectrum disorder (ASD). Little is known about the shared cognition of PMS and ASD or individual differences within PMS.

Objectives:

To investigate three early processes often disrupted in ASD; spontaneous social attention, biological motion, and visual attention shifting. First, we examined mean group differences and individual variability. Second, we used hierarchical clustering to identify subgroups based on performance profiles across domains. Third, we investigated the relationship between neurocognitive performances, ASD symptoms, and developmental delay.

Methods:

22 PMS (2-19 years), 27 ASD (2-19 years) and 28 typically developing (TD) individuals (1.6-6 years) completed a series of eye-tracking (ET) and behavioural tasks. Spontaneous social attention was measured with a face pop-out ET task and a social orienting behavioural task. Biomotion was measured using a point-light display ET task, and visual attention shifting (disengagement time) with the Gap Overlap (ET) task. Autistic symptoms were assessed in PMS and ASD using the ADOS and ADI-R, and level of adaptive function for all using the Vineland Adaptive Behaviour Scale. Non-verbal mental age (NVMA) was estimated using developmentally appropriate tests. Developmental delay was calculated as chronological age/NVMA.

Results:

Social orienting differed by group ($F_{(2,66)}$ = 7.298, p = .001), with a higher percentage of orienting to social versus object sounds in TD (p = .001) and ASD (p = .001) versus PMS. 59% of PMS participants showed preference for social orienting, 12% for object orienting, 18% had no preference, and 12% did not orient to either stimuli. Social orienting was positively related to social adaptive functioning ($r_{(63)}$ = .438, p < .001) across groups, and negatively to ASD symptom severity in PMS ($r_{(17)}$ = -.620, p = .008). Face pop-out effect (i.e., first look to face in >50% of trials) (45% in PMS, 43% in ASD, and 55% TD) and preference for Biomotion (PMS and ASD 53%, TD 57%) did not differ between groups, but 88% (6/7) of PMS had longer disengagement times than the average ASD or TD individual.

Hierarchical clustering applied to 40 participants with data across all tasks revealed 3 clusters (stability of >.75 after 1,000 bootstraps). Cluster 1 (3 PMS, 3 ASD, and 4 TD) contained the longest disengagement times on average, cluster 2 (1 PMS, 8 ASD, and 5 TD) the highest social attention/orienting preference, and cluster 3 (1 PMS, 2 ASD and 13 TD) the fastest disengagement and lowest social attention. Cluster 1 had on average the lowest NVMA, highest ASD symptom severity and lowest social adaptive functioning. Cluster 2 had the most developmental delay and cluster 3 had the least developmental delay and highest social adaptive functioning.

Conclusions:

PMS individuals performed similarly to ASD on ET tasks of social attention but had lower rates of social orienting relating to ASD symptom severity, and longer disengagement times. No performance profile distinguished ASD and PMS groups as individual performance varied within

both groups.

246 **146.246** Understanding the Landscape of Behavioral Interventions for Individuals with Phelan-Mcdermid Syndrome

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Background: The essence of developmental synaptopathies (DS) such as Phelan-McDermid Syndrome (PMS), PTEN, and Tuberous Sclerosis Complex (TSC) suggest a need for interventions addressing nontraditional treatment targets – namely learning and cognition. The presence of cognitive and physical delays in DS suggests an increased risk for failing to respond to behavioral intervention as a stand-alone treatment, in part due to impairments in learning, motivational, and motor abilities. Developing effective interventions for DS requires paradigms with potential to address complex processes like learning, as well as procedures for enhancing generalization and maintenance of new skills. Any novel behavioral intervention used with this population must be acceptable, compatible, and feasible at a minimum to ensure effectiveness and sustainability. Particularly important is parents' perception that proposed intervention approaches are reasonable, appropriate and relevant for the unique needs of their children.

Objectives: The ultimate aim of this program of work is to identify an acceptable, effective, and safe therapeutic approach to enhance learning processes leading to sustainable improvements in individuals with DS. As a first step in this process, we examined the landscape of behavioral interventions for individuals with Phelan-McDermid Syndrome (PMS) by developing a better understanding of the acceptability of existing behavioral interventions and identifying barriers that may limit the impact and sustainability of these interventions.

Methods: This study used a research-community partnership framework, which emphasizes collaboration with community stakeholders to address a variety of shared goals. An online survey for parents of individuals with PMS was developed to gather quantitative and qualitative about perceptions of and experiences with behavioral interventions. Participants were asked about the nature and acceptability of prior experiences with behavioral intervention. They were also asked to suggest modifications to improve the fit of these programs with the unique needs of their child and family. Descriptive statistics were used to analyze the survey data.

Results: Applied Behavior Analysis (ABA) was the most commonly endorsed behavioral intervention, followed by developmental interventions, and naturalistic developmental behavioral interventions (NDBIs). Parents rated early social communication skills (e.g., turn taking) and expressive language as the most important intervention targets, indicated the importance of delivering behavioral intervention across settings (e.g., home and school), and expressed a desire for a stronger parent/caregiver training component to these services. Suggested modifications to existing models include more flexibility in terms of scheduling appointments and better training for clinicians around the PMS profile and appropriate intervention targets for this population.

Conclusions: There was a wide range of variability in terms of the nature, intensity and acceptability of interventions received by individuals with PMS in the community. Importantly, parents reported many limitations that are consistent with those reported in previous studies of individuals with neurodevelopmental disabilities, including some that appear more PMS-specific. Data from this survey study will be used to inform the next phase of this work seeking to develop and investigate a novel multi-modal therapy utilizing a high quality behavioral intervention plus targeted pharmacotherapy to improve early social learning and communication in individuals with PMS.

247 **146.247** Utilizing the SRS-P to Examine ASD Symptoms in a Sample of High-Risk Toddlers with Neurogenetic Syndromes

T. Halligan*, W. S. Neo, L. R. Hamrick and B. Tonnsen, Psychological Sciences, Purdue University, West Lafayette, IN*

Background: Elevated rates of psychopathology such as autism spectrum disorders (ASD) are common in individuals with neurogenetic syndromes (NGS), including Angelman (AS; 63%), Prader-Willi (PWS; 23%), and Williams (WS; 50%) syndromes. ASD prevalence in these populations is highly elevated compared to 2% in the general population and 20% in siblings of a child with ASD (Baio et al., 2018; Betancur & Coleman, 2013; Ozonoff et al., 2011). Comparing early social responsivity across multiple NGS at increased risk for ASD may elucidate potential pathways of ASD by informing which phenotypic features differentially map on to each NGS, as the genetic mechanisms underlying each NGS are relatively well understood. Some reports suggest differences in social cognition and the underlying processes within NGS (Morel & Demily, 2017), however, very little is known about the early phenotypic profiles of ASD symptomatology in toddlers who are likely most naïve to interventions.

Objectives: To examine differences in early ASD symptomology in toddlers at increased genetic risk for ASD.

Methods: 98 caregivers of toddlers with AS (*n*=23), PWS (*n*=18), WS (*n*=31), and low-risk controls (LRC; *n*=26) completed the *Social Responsiveness Scale Preschool Age, 2nd Edition* (SRS-P) as part of an online, longitudinal study of early development. The 65-item SRS-P is rated from 1 (not true) to 4 (almost always) and identifies social impairment associated with ASD. *T*-scores are generated for Overall Social Deficits and five subscales: social awareness (SA), social cognition (COG), social communication (COM), social motivation (MOT), and restricted interests and repetitive behavior (RRB). We used Kruskal-Wallis tests to test omnibus group differences for SRS scores and Dunn's *post-hoc* procedure with Bonferroni correction to probe pairwise comparisons.

Results: Age (*M*=36.33 months, *SD*=5.11, Kruskal-Wallis $X^2(3)=1.12$, $p=.773$) and sex (47% female, $X^2(3)=4.50$, $p=.212$) did not differ across groups. The distributions of each SRS score significantly differed across groups (*p*s<.01). Post-hoc analyses revealed that relative to LRC, NGS groups demonstrated significantly higher *t*-scores on Overall Social Deficits and SA, COM, and RRB subscales (*p*s<.01), but NGS groups did not differ from one another. However, this pattern differed for COG and MOT subscales. On the COG subscale, AS and WS (medians [*Mdn*s]=64, *p*s<.001) were significantly higher than LRC (*Mdn*=42), but PWS (*Mdn*=51) did not differ from LRC (*p*=.057). Additionally, on the COG subscale, PWS was significantly lower than both AS and WS (*p*s=.007). On the MOT subscale, AS (*Mdn*=51) was significantly higher than LRC (*Mdn*=45, *p*=.023), with no other differences between groups (*p*s>.05).

Conclusions: Results suggest that although toddlers with NGS consistently exhibit atypical social responsiveness symptoms compared to LRC, more nuanced patterns present across NGS groups, particularly in relation to social cognition and social motivation. These findings provide preliminary evidence that although multiple NGS exhibit heightened risk for ASD, the genetic mechanisms and associated profiles related to these

risks may vary. Continuing to probe these differences in an expanded longitudinal cohort may further inform how and why different NGS are more highly impacted by ASD, as well as potential models of differential detection and intervention.

Poster Session
147 - Sensory, Motor, and Repetitive Behaviors and Interests
5:30 PM - 7:00 PM - Room: 710

248 **147.248** Developmental Changes in Neural Responses to an Interoception Task: Implications for Autism Symptoms.

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Background: Given the developmental nature of autism spectrum disorder (ASD), it is important to understand how core features of ASD, like aberrant sensory reactivity, change across the lifespan. While most research has focused on external sensory reactivity, we also receive copious sensory information from within our own bodies, which is invaluable to monitoring body state and interpreting emotions. These internally-generated sensations, known as interoception, may be altered in ASD. Neural networks for interoception include insula, cingulate, and somatomotor cortex.
Objectives: We asked whether neural responses to an interoception task (heartbeat counting, compared to a visual counting control task) differed in ASD relative to a typically developing comparison (TC) group.
Methods: Participants included 46 individuals with ASD (age 8 to 54, mean= 20.84±10.11 years) and 55 individuals in a TC group (age 8 to 53, mean= 19.85±11.14 years). Data were processed using FSL, with age added as a covariate in the model given the wide age-range. Group maps investigated responses in the interoceptive task>visual task. A cluster threshold of z=2.3 and an FWE-corrected p-value=0.05 was used and then randomise was applied for non-parametric permutation testing (5000 iterations).
Results: The ASD group showed unilateral insula and secondary somatosensory (S2) responses, and bilateral response in the visual cortex and cerebellum, while the TC group showed bilateral insula and S2 responses. In this model, there was a positive age association with response in the bilateral insula and S2. Given this significant age finding, we then examined group results in children and adults separately. In children (age 8-17), both groups had significant clusters in the visual cortex, while the TC group also had a small cluster in S2. Additionally, there was a significant positive effect of age in the entire interoceptive network (insula, S2, caudate, putamen, thalamus). In adults, the ASD group had a much more widespread significant clusters in interoceptive regions compared to the TC group. There were no significant age findings in adults. Furthermore, percent signal change in the bilateral subdivisions of the insula all showed an inverted curvilinear relationship to age; neural responses in insula increased with age until they peaked in early adulthood and declined slightly in later adulthood. In adults, percent signal change in the insula was also associated with higher scores on the Social Responsiveness Scale.
Conclusions: This work highlights a potential developmental trajectory in interoception processing that could be relevant for ASD. Interestingly, once neural networks for interoception are refined in adulthood, there is still a wider distribution in ASD, suggesting more heterogenous interoceptive processing. Consistently greater recruitment of visual regions in the ASD relative to the TC group suggests the ASD group may rely more heavily on visual strategies to perform the interoception task. These data suggest that aberrant neural response to sensory cues in ASD is not limited to external cues, but also extends to interoception. Future work will need to understand how and when this developmental interoceptive trajectory may be altered in ASD and what impact it might have on behaviors in ASD.

249 **147.249** Preliminary Results of the Sensory Project in Infant Siblings: Early Sensory Responsiveness Is Linked with Communication Development in Infants at Risk for Autism

N. A. Broderick[1], *C. J. Cascio*[2], *J. I. Feldman*[3], *S. Raj*[3], *A. Augustine*[3], *S. Bowman*[3], *C. M. Daly*[3], *K. Dunham*[3], *A. Golden*[3], *P. Santapuram*[3], *E. Suzman*[4], *A. V. Kirby*[5], *B. Keceli-Kaysili*[6] *and T. Woynaroski*[7], *(1)Pediatrics, Vanderbilt University Medical Center - Treatment and Research Institute for Autism Spectrum Disorder, Nashville, TN, (2)Vanderbilt University School of Medicine, Nashville, TN, (3)Vanderbilt University, Nashville, TN, (4)Vanderbilt University, nashville, TN, (5)University of Utah College of Health, Salt Lake City, UT, (6)Vanderbilt University Medical Center, Nashville, TN, (7)Hearing & Speech Sciences, Vanderbilt University Medical Center, Nashville, TN*

Background:
Children with autism spectrum disorder (ASD) show a broad range of differences in their patterns of responding to sensory stimuli (i.e., sensory responsiveness). It has been proposed that differences in sensory responsiveness, especially in infancy, may produce cascading effects on communication/language development in children with ASD. This theory proves arduous to evaluate given the challenge of reliably diagnosing ASD in infancy and toddlerhood. The **S**ensory **P**roject in **I**nfant **S**iblings (Project SPIS) is prospectively following infants at heightened risk for ASD (infant siblings of children with ASD; Sibs-ASD) to test the "cascading effects" theory.

Objectives:

NIDCD-funded Project SPIS aims to evaluate (a) whether sensory responsiveness differs in Sibs-ASD versus infants at relatively lower, general population-level risk for ASD (infant siblings of typically developing children; Sibs-TD), (b) whether early sensory responsiveness is associated with communication and language skill, and (c) whether associations between sensory responsiveness and communication/language skill vary according to risk group.

Methods:

Preliminary analyses were conducted on 28 infants 11-18 months of age (11 Sibs-ASD, 17 Sibs-TD) for whom Project SPIS data has been collected and scored/coded to date. Sensory responsiveness was measured with two previously developed and validated measures of early sensory responsiveness – the Sensory Experiences Questionnaire (SEQ) and Sensory Processing Assessment (SPA). Parents reported on infants' concurrent

communication and language skill via the Vineland Adaptive Behavior Scales (VABS) and MacArthur-Bates Communicative Development Inventories: Words and Gestures (MCDI) checklist. Infants' prelinguistic skill was additionally assessed using the Communication and Symbolic Behavior Scales (CSBS). A partial interval coding system was utilized to code CSBS samples for presence/absence of communication acts, vocalizations including canonical syllables, and selected consonants. Two metrics of prelinguistic vocal complexity were derived: (a) canonical syllabic communication and (b) consonant inventory.

Results:

Preliminary results indicate that Sibs-ASD do not significantly differ from Sibs-TD in sensory responsiveness between 11-18 months of age: sensory seeking (d = 0.42, *t* = 1.07, *p* = 0.30), hyporesponsiveness (d = 0.11, *t* = 0.28, *p* = 0.78) and hyperresponsiveness (d = −0.34, *t* = 0.88, *p* = 0.39). Effect sizes for between-group differences are small in magnitude. However, individual differences in sensory responsiveness are associated with indices of communication and language ability across risk groups. For example, more hyporesponsive symptoms were associated with decreased communication skill (e.g., zero-order correlation = −0.45), decreased vocabulary size (zero-order correlations with expressive and receptive vocabulary = −0.40 and −0.36, respectively), and decreased canonical syllabic communication and consonant inventory (−0.44 and −0.35, respectively). These associations do not vary according to group. Final analyses, including results from observational measures of sensory responsiveness, will be presented at INSAR.

Conclusions:

Findings suggest that individual differences in early sensory responsiveness are linked with communication and language development across infants at high and low risk for ASD, providing increased support for the cascading effects theory. Infants are being followed longitudinally to assess the extent to which early sensory responsiveness may be useful for predicting future language and communication skill and to evaluate putative mechanisms by which sensory responsiveness may influence development.

250 **147.250** Parent Responsiveness Mediates the Association between Child Hypo-Reactivity and Later Communication

L. R. Watson[1], *R. Grzadzinski*[2], *E. Crais*[1], *G. Baranek*[3], *L. Turner-Brown*[4] *and S. W. Nowell*[5], *(1)Department of Allied Health Sciences, University of North Carolina at Chapel Hill, Chapel Hill, NC, (2)Carolina Institute for Developmental Disabilities, University of North Carolina, Chapel Hill, NC, (3)Chan Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA, (4)UNC TEACCH Autism Program, University of North Carolina at Chapel Hill, Chapel Hill, NC, (5)University of North Carolina - Chapel Hill, Chapel Hill, NC*

Background:

Infants and toddlers who are at high-risk (HR) for developing Autism Spectrum Disorder (ASD) often display hypo-reactivity to sensory stimuli. Research indicates that child hypo-reactivity to sensory stimuli is related to 1) lower child language and communication abilities (Watson et al., 2011; Patten, Ausderau, Watson, & Baranek, 2013) and 2) lower parent responsiveness (Kinard et al., 2017). Studies also suggest that higher parent responsiveness is related to increased child communication and language abilities (Siller & Sigman, 2008; Watson et al., 2017). Many parent-mediated interventions have resulted in increased parent responsiveness over the course of treatment (Green et al., 2015; Siller et al., 2013; Watson et al., 2017). Yet, whether parent responsiveness mediates the relationship between child hypo-reactivity and later communication outcomes remains unexplored.

Objectives:

To evaluate whether parent responsiveness mediates the relationship between child hypo-reactivity to sensory stimuli at one year and child communication at two years.

Methods:

This study includes 83 HR children (56 boys) identified at 12 months based on community screenings with the *First Year Inventory 2.0* (Baranek et al., 2003). Children were seen at 14 months old (+/- 0.77; Time 1) and completed the Sensory Processing Assessment (SPA; Baranek, 1999) while parents completed the Sensory Experiences Questionnaire (SEQ; Baranek, 1999). Children were seen again 9 months later (mean age 23 months +/- 0.90; Time 2); parents completed the Vineland Adaptive Behavior Scales (VABS; Sparrow, Cicchetti, & Balla, 2005) at Time 2. Parent Verbal Responsiveness (PVR) was coded at Time 1 and Time 2 from 10-minute video samples using a coding system adapted from Yoder et al. (2015). An average of PVR (AvgPVR) was calculated [(PVR Time 1 + PVR Time 2)/2]. 50% (n=45) of the children were randomly assigned to an experimental intervention. A series of mediation analyses, controlling for intervention group, were conducted using Process v3.1 (http://www.afhayes.com) in SPSS.

Results:

Mediation analyses revealed that the relationship between SPA Hypo-reactivity at Time 1 and VABS Communication at Time 2 was mediated by AvgPVR (See Figure 1). Additional mediation analyses indicated that, when using SPA, this mediation effect was specific to the VABS Communication domain. Mediation analyses were also conducted using the Hypo-reactivity domain of the SEQ. Consistent with SPA results, the relationship between SEQ Hypo-reactivity at Time 1 and VABS Communication domain at Time 2 was mediated by AvgPVR (See Figure 2). When using the SEQ, AvgPVR also mediated the relationship between Hypo-reactivity and later VABS Social domain.

Conclusions:

Child hypo-reactivity negatively impacts later child language outcomes, though this work suggests that parent verbal responsiveness may attenuate this negative impact. Based on these results, parent-mediated interventions may want to focus on parent responsiveness given the subsequent effect this transactional behavior has on child language development. In addition, this work also indicates that parent responsiveness may have an impact on later child socialization skills.

251 **147.251** A Dynamic Approach to Measuring Temporal Binding Windows in Adults with Autism Spectrum Disorder: Differences with the Commonly Used Synchrony Judgement Task

M. Ferland[1], *M. Segers*[2] *and J. M. Bebko*[2], *(1)York University, Toronto, ON, CANADA, (2)York University, Toronto, ON, Canada*

Background: Being able to integrate information from multiple sensory modalities, such as hearing and sight, is essential for everyday functioning. Individuals with autism spectrum disorder (ASD) have difficulties in audiovisual integration (e.g., Bahrick, 2010; Bebko et al., 2006). These difficulties likely contribute to their social-communicative deficits (Wallace & Stevenson, 2014) and therefore, a better understanding of audiovisual integration in ASD could hold valuable information for interventions.
A way of measuring audiovisual integration is through the temporal binding window (TBW); a window of time in which separate sensory information are perceived as one, synchronous event, despite some degree of asynchrony (Dixon & Spitz, 1980). A common way to measure the TBW is the synchrony judgment (SJ) task (Exner, 1875), where participants decide whether audio and visual components of a stimulus are synchronous or not. The SJ task could be considered *"static"* as it does not enable a *dynamic* manipulation of the TBW size. In the current study a method developed by Segers & Bebko (2013) allowing active manipulation of the auditory timing was used to more precisely measure the audiovisual TBW.

Objectives: To build on previously-presented work at INSAR by Segers & Bebko (2013), by using a more refined version of the new "*dynamic*" method. Specific objectives include: a) how does the TBW of ASD adults compare to non-ASD adults across the new *dynamic* task and the commonly used *static* SJ task, and b) determining what can influence TBW size in ASD.

Methods: Data from 21 TD and 11 ASD adults have been collected and analyzed, with additional ASD participants nearing completion. Participants performed two types of audiovisual integration tasks: a) the dynamic task, where participants manually adjusted the soundtrack of a video by 50ms increments until a point of perceived synchrony with the visual information, and b) the SJ task. Two stimulus types were used: social-linguistic (SL: someone reading a story), and non-social-non-linguistic (NSNL: e.g., a hand playing the piano). Participants also completed questionnaires on sensory information and autism-like traits.

Results: A 2-way-repeated-measures ANOVA yielded significant main effects of task, $F(1,25) = 19.85$, $p < 0.01$, and stimulus type, $F(1,25) = 28.05$, $p < 0.01$. When using the dynamic task, participants produced significantly smaller TBWs (M = 377ms) than when using the SJ task (M =522ms). Furthermore, smaller TBWs were produced for SL stimuli (M =405ms) compare to NSNL stimuli (M = 493ms). In contrast to previous studies, there was no significant difference in the TBW size between ASD and TD participants across the tasks ($p > .10$).

Conclusions: Giving participants the ability to control the soundtrack appears to produce smaller TBWs in both ASD and TD participants and may lead to more precise measurement of the TBWs than more passive, static tasks. It is possible that helping to focus the participants' attention to the task by requesting them to actively manipulate the audio file was sufficient to help ASD participants overcome underlying audiovisual integration issues. This nonverbal dynamic procedure offers considerable promise for research into perceptual systems in ASD.

252 **147.252** A Family Study of Sensory Processing in Autism Spectrum Disorder

J. N. Barstein[1], *S. P. Patel*[2], *K. Nayar*[1], *G. E. Martin*[3], *C. J. Cascio*[4] *and M. Losh*[2], *(1)Feinberg School of Medicine, Department of Psychiatry and Behavioral Sciences, Northwestern University, Evanston, IL, (2)Communication Sciences and Disorders, Northwestern University, Evanston, IL, (3)Communication Sciences and Disorders, St. John's University, Staten Island, NY, (4)Vanderbilt University School of Medicine, Nashville, TN*

Background: Sensory processing atypicalities are now conceptualized as a core symptom of autism spectrum disorder (ASD), with evidence of impairments across individual sensory modalities and in the integration of multiple sensory systems. Recent studies have also documented atypicalities in self-reported behavioral responses to sensory stimuli in first-degree relatives of individuals with ASD. However, no studies have investigated objective measures of sensory processing (including sensory integration) or examined relationships with the broad autism phenotype (BAP; or, subclinical features that correspond to the defining features of ASD). Investigation of traits among unaffected first-degree relatives has been critical in understanding core features linked to genetic liability. Moreover, investigating relationships between sensory processing and clinical-behavioral correlates impacted in ASD and the BAP may lend insight into the causal pathways of co-occurring symptoms of ASD.
Objectives: To examine sensory processing in individuals with ASD and their parents, and explore relationships with clinical behaviors impacted in ASD and the BAP.

Methods: Twenty-four individuals with ASD, 18 proband controls, 50 parents of individuals with ASD, and 29 parent controls completed three measures of sensory processing – a self- and parent-report measure of sensory processing styles, an objective measure of tactile detection, and a measure of visuotactile-proprioceptive integration ("rubber hand illusion"). In the rubber hand illusion task, participants observed a rubber hand being stroked simultaneous to their own hand, which was obscured from their view. Typically, this results in a subjective feeling of embodiment of the rubber hand and estimates of one's real hand as having drifted towards the direction of the rubber hand (i.e., proprioceptive drift). The brushing was administered in two separate three-minute blocks per condition and proprioceptive drift was measured by subtracting the average estimate of hand location at baseline from the average estimate at each block. Participants also completed measures investigating clinical behaviors impacted in ASD and the BAP (e.g., social communication, social cognition).

Results: Individuals with ASD demonstrated atypicalities across all measures of sensory processing, including greater self- and parent-reports of atypical sensory processing styles, a higher tactile detection threshold, as well as a delayed effect of the rubber hand illusion as indicated by an increase in proprioceptive drift following the second block of brushing. On the contrary, parents of individuals with ASD did not differ from controls across objective measures of sensory processing or sensory integration and self-reported few differences in sensory processing styles. In individuals with ASD and their parents, lower proprioceptive drift was related to greater social communication violations.

Conclusions: Findings contribute to a growing body of literature documenting atypical sensory processing and *inefficient*, rather than deficient, integration of visual-tactile-proprioceptive stimuli in ASD. Notably, the lack of differences observed in parents suggest that sensory processing does not to relate to the BAP or genetic liability observed in relatives. While few relationships were observed between measures of sensory processing and clinical features of ASD, findings do suggest that atypicalities in visuotactile-proprioceptive integration in ASD relate to higher-order impairments in social communication.

253 **147.253** Abnormal GABA Concentration in Brain Motor Areas Are Related with Gross Motor Impairments in Individuals with Autism Spectrum Disorder

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Background: Various motor difficulties are commonly observed in individuals with autism spectrum disorder (ASD). Previous studies have demonstrated that impaired motor performance may be explained by a lower concentration of gamma-aminobutyric acid (GABA) in the primary motor area (M1) in individuals with ASD. However, lower GABA concentrations in M1 have been linked to strong neural activity in the corresponding region and strong muscle constriction in neurotypical individuals; thus, it seems paradoxical that many individuals with ASD have motor skill impairments.

Objectives: We investigated the types of motor skill that are associated with GABA levels in brain motor area. Motor skills were evaluated using the clinically accepted Bruininks-Oseretsky Test of motor proficiency, second edition (BOT-2).

Methods: The BOT-2 measures various motor performances which includes both fine and gross motor skills. The fine motor skills assessed include precise bodily control that requires finger and hand movement (1. fine manual control) and bimanual/arm-hand coordination (2. manual coordination). The gross motor skills include sequential and simultaneous bodily coordination (3. body coordination) and strength of trunk, upper and lower body (4. strength and agility). Total score is summation of the scores for four motor skills. GABA concentration in brain motor area were measured using ^{1}H-magnetic resonance spectroscopy (^{1}H-MRS). We measured GABA in left M1 and the supplementary motor area (SMA). In addition, we evaluated degree of the autistic traits by the autism spectrum quotient (AQ) score.

Results: Eight individuals with ASD and ten typically developing (TD) controls participated in the experiments. We found that significant negative correlation between GABA concentration in M1 and total score in the BOT-2 (see figure.1), especially for gross motor skills (3. body coordination, 4. strength and agility) in all participants. ASD participants who had a lower concentration of GABA in SMA tended to exhibit lower levels of motor performance (see figure.2) especially for the skills of whole body coordination (3. body coordination). Furthermore, higher GABA levels in M1 were associated with stronger autistic traits evaluated by the AQ score. M1 receives information from higher-order motor related areas and outputs signals to control muscles via the brainstem and spinal cord. We assumed that excessively high GABA concentration in M1 would suppress strong neural activity, resulting weak neural signal to muscle and degraded muscle contraction necessary for gross motions. Reduced GABA in SMA may induce asynchronized neural oscillations across the left and right hemispheres since GABA is required for synchronising neural oscillations. These atypical conditions of GABA concentration in motor related areas were implied to be an underlying basis of other aspects of autism (e.g., difficulties in social communication).

Conclusions: Abnormal GABA levels in M1 and SMA contributes to motor impairments (i.e., gross motor skills and body coordination, respectively) in ASD. The present findings would contribute to the development of objective evaluations for several motor impairments, and accompanied difficulties derived from autistic features.

254 **147.254** Abnormal Walking Patterns in Children with Autism Spectrum Disorder Associated with Social Impairments

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Background: Children with autism spectrum disorder (ASD) have various degrees of motor impairments. Researchers have been striving to establish the association between their atypical motor patterns (e.g., motor coordination) in early development with their social function, and to use motor deficits as early behavioral markers of ASD. Previous studies have found that ASD children tend to walk with gait abnormalities, but the evidence are inconsistent. For example, retrospective video analyses showed asymmetry in arm movement in infants, but movements of lower limbs measured by motion capture system and force plate failed to identify similar asymmetry. Furthermore, gait abnormality, demonstrated by reduced stride length, increased stride width and reduced range of motion of ankle and knee angles, failed to correlate with social impairments. We postulate that kinematic measures of lower limb movement during walking vary widely across individuals and idiosyncrasy might mask ASD-related changes in gait.

Objectives: We aimed to find gait abnormity and its association with social impairments might be revealed by examining foot pressures during foot-ground contact.

Methods: Twenty-five low-functioning autism (LF, age: 5.28±0.84 yrs, IQ: 84.12±18.41), 33 high-functioning autism (HF, age: 5.50±0.61 yrs, IQ:113.36±12.03) and 29 age- and IQ-matched TD children (age: 5.69±0.62 yrs, IQ: 109.69±10.96, n.s. from HF) were recruited. Children were instructed to walk naturally, self-paced and looking straight ahead, for 5 meters for 10 trials. A high-density, high-frequency pressure mat (RSScan, Inc) was placed in the middle of the walkway to collect the pressure distribution of foot contacts (Fig1). The parents completed Chinese version of the Autism Spectrum Quotient: Children's Version (AQ) and the Social Responsiveness Scale (SRS) before the experiment.

Results: We found no evidence of tendency to toe walk in ASD groups since majority of trials involved heel contact (Table1). The frequency of initial foot-contact in the toe and fore-foot regions were similar between three groups. However, during the foot roll-off, the center of pressure (CoP) started more anteriorly on the foot (initial contact of CoP) and traveled less (distance of CoP), even after removing the individual difference in foot length (Fig1). This indicates that they walk with less foot roll-off. Their stride-to-stride variability was higher as shown by the standard deviation of these two CoP measures. We also found more left-right asymmetry among ASD children, shown by significantly smaller correlation between left and right-foot CoP movements. Examining the force profiles of the metatarsal region, the predominant region for force production during foot contact, revealed a similar reduction in left-right correlation. These converging evidences indicate that ASD children have larger left-right asymmetry in foot function. Importantly, most gait variables were significantly correlated to social function (SRS and AQ scores) but not to IQ. The more abnormal the gait deficit the more severe the social impairment.

Conclusions: In conclusion, we find that foot pressure is a sensitive measurement for quantifying autism-related motor deficits and its correlation with social impairments support the proposition that motor impairments might contribute to the development of core symptoms of ASD.

255 **147.255** Adaptation to the Running Speed of Biological Motion in Autistic Children/Adolescents

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Background:
Adaptation is a ubiquitous property of perception, a form of experience-dependent plasticity in which our current sensory experience is intimately affected by how we viewed the world only moments before. Previous research has demonstrated that autistic individuals often present reduced adaptation to a range of social and non-social sensory stimuli, relative to non-autistic individuals. Here, we examined adaptation to the processing of biological motion – a higher-level visual attribute important for a range of social competences, such as inferring other people's emotions, mood, and intentions.

Objectives:

We sought to compare adaptation to the speed of biological motion in autistic and typical children and adolescents.

Methods:

We tested 19 autistic children and adolescents (6 girls) aged between 8;8 and 19;5 years and 19 typically children of similar age and verbal and non-verbal reasoning abilities. Each participant received a child-friendly dual-task paradigm adapted from an existing study (Arrighi, Orsi & Burr, 2010) and based on point-light-display (PLD) representations of running silhouettes. The paradigm included a primary speed-discrimination task, which provided a measure of precision in the discrimination of running speed and a measure of adaptation to the running speed. We also included a secondary change-detection task, which motivated participants to attend to centre-screen and provided an implicit measure of attention (accuracy in change-detection). Reaction times and eye-movement data were also collected.

Results:

Unexpectedly, analyses showed that autistic and typical participants performed similarly in both tasks – both in terms of their precision in the speed-discrimination task and their adaptation to speed. Autistic and typical participants also showed similar patterns of attention during the task – as indexed by similarly high performance in the change-detection task and the scatter of fixation preferences around a centrally-located fixation point.

A secondary correlational analysis revealed no systematic relationship between the magnitude of adaptation and age, cognitive ability or autistic symptomatology. Interestingly, adaptation was less pronounced in participants (autistic *and* non-autistic) who presented more scattered fixations around the centrally-located fixation point.

Conclusions:

Contrary to our prediction, we found that adaptation to the speed of biological motion was comparable in our autistic and typical children/participants. This finding could not be attributed to group differences in attention or fixation patterns. Our results suggest that limitations in adaptive coding are not pervasive in autistic perception. More nuanced accounts of adaptation in autism are warranted, which would also consider the role of attention and looking preferences.

256 **147.256** Associations between Repetitive Behaviors and Play Diversity in Toddlers with Autism Spectrum Disorder

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Background: Research investigating the relationship between repetitive behaviors and play skills in children with autism spectrum disorder is limited. Restricted and repetitive behaviors (RRBs) are a core symptom of ASD. RRBs encompass a broad range of heterogeneous behaviors, including repetitive motor mannerisms, overriding preoccupations with object parts, preoccupation with restricted patterns of interests, and adherence to nonfunctional routines (Richter et al. 2007). Currently, it is unclear how RRBs relate to other core areas of ASD. For example, children with ASD demonstrate less frequent, diverse, elaborate, and integrated symbolic and non-symbolic functional play than their typically-developing peers (Kasari et al., 2005; Jarrold, Boucher, & Smith, 1996; Williams, Reddy, & Costell, 2001). Research indicates that frequency of play acts is inversely related to the frequency of RRBs (Honey et al., 2006). However, this research relied upon caregiver report through questionnaires. Thus, the purpose of this study is to determine how behaviorally-coded RRBs within the context of a free play session associate with play acts within a standardized assessment of play.
Objectives: This study aims to examine the relationship between the frequency of behaviorally-coded repetitive behaviors during a free play session and the diversity of play acts demonstrated by toddlers with ASD.

Methods: 85 toddlers (69 male: 16 female; mean age = 31 months, SD = 3 months) with a diagnosis of ASD were included in the study. The ADOS-2 and ADI-R were completed by independent research-reliable testers to confirm the diagnoses of ASD. Child RRBs were coded from the 10-minute caregiver-child free play session. Observational coding focusing on lower-order RRBs was based on the coding scheme developed by Harrop et al. (2014). Higher-order RRBs were excluded for the purpose of this study to account for the young population age and time-limited observation. RRBs were coded into four categories: (a) motor/body behaviors, (b) visual behaviors, (c) repetitive object use, and (d) repetitive vocalizations/language. The frequency, type, and level of spontaneous play behaviors were coded from a 15-minute structured play assessment (SPA; Ungerer & Sigman, 1981). Children were presented with a variety of related toy sets to assess play skills.

Results: Two children who didn't display any RRBs during the interaction were excluded from the analysis. On average, toddlers had 10.8 instances of RRBs during the 10-minute interaction (SD = 7.10), and had an average of 17.5 total types of play (SD = 10.4). Repetitive object use constituted the majority of repetitive behavior displayed (55%). There was a significant negative correlation between the number of RRBs and total play diversity (r = -0.26, p-value = 0.02).

Conclusions: These results suggest that the presence of repetitive behaviors is associated with impairments in the diversity of play demonstrated by toddlers with ASD. This highlights the pervasive effects of repetitive behaviors and suggests that the extent of their intrusiveness may preclude a child's ability to play. Our results suggest that improving play within intervention may yield *spillover* effects in reducing the frequency of observed RRBs, emphasizing the need for targeted early interventions that specifically address repetitive behaviors.

257 **147.257** Atypical Auditory Perception in Autism Spectrum Disorder: A Synthetic Approach to Evaluate the Perceptual Patterns and Environmental Causes

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Background: Atypical perception was reported as a potential cause of social difficulties in autism spectrum disorder (ASD). The subjective reports from people with ASD indicated that the atypical perception varies depending on the environmental context. However, it is not easy for everyone to describe their perceptual experiences. Further, the traditional subjective reports are insufficient for quantitative analysis. Therefore, the previous reports could not clarify the detailed patterns of the perception and the influence of environmental factors. In order to solve the problem, a previous study [Nagai et al., 2015] has proposed a synthetic approach to investigate atypical visual perception in ASD. Nevertheless, the understanding of atypical perception in other modalities is still insufficient.

Objectives: According to the previous reports from people with ASD, we assume atypical perception would be affected by environmental stimuli. This study aims at investigating the patterns and environmental causes of atypical auditory perception in ASD. We employed a synthetic approach to lead the participants to systematically report their auditory perception, and then quantitatively analyzed the reports.

Methods: Twenty-two adults with ASD (12 males; age: mean = 30.7, SD = 10.0) were recruited in this study. We presented 30 videos with different scenes and 7 auditory filters (amplify, noise, sine wave, band-reject, echo, flanger, and water effect), which were designed to simulate potential patterns of atypical auditory perception, to the participants. The participant can adjust the strength of the filters to change the sound. The task was using the filters to make the sound similar to his/her auditory perception. We conducted principal component regression on the strength values of the filters and the audiovisual features of the videos.

Results: We found significant regressions on the perception of amplify ($F = 2.892$, $p = 0.002$), echo ($F = 2.298$, $p = 0.012$), and noise ($F = 2.014$, $p = 0.030$). There was a marginally significant regression on the perception of band-reject ($F = 1.841$, $p = 0.051$). We checked the audiovisual features which correspond to the significant principal components. The results showed a negative correlation between the perception of amplify and the intensity of video sound. The perception of echo was positively correlated with the mean and the change of both video sound intensity and object movement in the scene. The perception of noise was positively correlated with the mean and the change of sound intensity. There was no clear correlation between the perception of band-reject and audiovisual features. However, the participants reported that the perception of band-reject has occurred due to the sound of human speech.

Conclusions: This study revealed the patterns and the potential environmental causes of atypical auditory perception in ASD. We found there are similar patterns between our results and the atypical visual perception in the previous study, e.g. visual perception of enhanced brightness and the perception of amplify are both sensory enhancements, and snow-like noise in visual perception may be related to the auditory perception of noise. It implies that there exist common neural mechanisms for the atypical perception of seeing and hearing.

258 **147.258** Auditory Event-Related Spectral Perturbations in Children with and without ASD

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Background:

Sensory atypicalities are well established in ASD and represent core diagnostic criteria (APA, 2013). Although the neurobiological underpinnings of these features are not well defined, there is consensus that they show bidirectional influences on perceptual systems throughout development.

Previous studies have explored the associations between EEG activity and sensory response patterns in ASD. The electrophysiological signatures of sensory processes are observed in both the alpha (8-12Hz) and gamma (30-60Hz) bands. Gamma activity has been reported during a variety of early sensory responses and facilitates sensory processing (Skinner et al., 2000; Singer & Gray, 1995). Increased gamma power in ASD was associated with lower P50 suppression, suggesting ineffective inhibitory control (Orekhova et al., 2008). Alpha activity had been implicated in sensory gating (Klimesh et al., 2007). In High-Risk infants, reversed alpha asymmetry was associated with increased sensory seeking (Damiano-Goodwin et al., 2018).

Objectives:

(1) Examine between group (ASD vs. TYP) differences in EEG event related spectral perturbations (ESRP) during an auditory mismatch negativity paradigm; (2) Explore associations between parent-reported sensory response patterns and ESRP activity in children with ASD.

Methods:

We present findings from 31 children (16 ASD) ages 5-11. A larger sample (N = 60) is anticipated by Spring 2019. Parents completed the Sensory Experiences Questionnaire (Baranek, 2006). Participants watched a silent video while standard and novel sounds (7%) played in the background. EEG was recorded via a 12-channel Electro Cap at 500Hz with Neuroscan and band-pass filtered (0.15Hz – 70HZ) online. Offline EEG processing used EEGLAB (Delorme & Makeig, 2004). ESRP from -200-500ms around novel sounds at electrode Cz was measured, based on previous research (Donkers et al., 2013). We explored the association between SEQ patterns and ESRP in the gamma range and examined other spectral bands.

Results:

Low gamma activity was enhanced from baseline (150-300ms) in ASD compared to controls. Theta activity (4-8Hz) was reduced (0-400ms) in ASD compared to TD controls (Figure 1). There were no associations between ERSP and SEQ patterns, though peak theta and peak *low* gamma were negatively correlated ($r = -.63$, $p = .03$).

Conclusions:

Our preliminary findings suggest that processing of auditory stimuli differ between children with and without ASD. Children with ASD had elevated gamma-related responses, suggesting enhanced sensory processing and gating. Children without ASD showed more evaluative processing (Donkers et al., 2015) with greater theta activity post stimulus. Theta is commonly studied in relation to working memory processing and enhanced theta in TD controls may reflect greater cognitive evaluation to the novel stimulus across the course of the MMN task. Further work is required to characterize the neurophysiological signatures of sensory processing in ASD and relate them to sensory processing atypicalities. Further analysis of gamma and theta power, including the timing of peaks (Isler et al., 2010) could inform about the biological underpinning of sensory atypicalities in ASD.

259 **147.259** Auditory Processing in Autism Spectrum Disorder: Probing Individual Differences with Behavioral, Audiological, and

Neurophysiological Measures

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Background:

Auditory processing differences including hyper- or hyposensitivity to sounds as well as aversions or unusual interests in sounds are commonly reported by individuals with autism spectrum disorder (ASD). Furthermore, past studies of auditory perception have revealed difficulty listening under noisy conditions, reduced responsiveness to speech, impaired prosody and voice emotion perception, and enhanced pitch perception in individuals with ASD. Atypical physiological responses have also been documented, including otoacoustic emissions (OAE), auditory brainstem responses (ABR), as well as cortical event-related potentials. However, the findings reported are variable across studies and are dependent on the stimuli presented and the age of participants. Thus, the etiology of auditory processing differences in ASD is currently not well understood. One likely contributor to these inconsistent past findings is the heterogeneity of ASD itself.

Objectives:

This pilot study investigates individual differences in auditory processing by combining behavioral, audiological, and neurophysiological measures to create Auditory Processing Profiles for each participant. We hypothesize that this assay of auditory function, in contrast to previous measures of a single neurophysiological response, will reveal replicable patterns of neurophysiological differences across individuals with ASD.

Methods:

Twenty-four participants age 21-22 years (ASD n=12; TD n=12) were recruited from a larger longitudinal study conducted at the University of Washington Autism Center and the community. Speech perception, otoacoustic emissions, electrophysiological responses, and standardized assessments of cognition, language, and adaptive function were conducted. The Autism Diagnostic Observation Scale was administered to confirm diagnosis. Speech perception was assessed by estimating target-to-masker ratios at 50% correct for speech targets (0° azimuth) presented with two spatially separated (±45° azimuth) simultaneous speech maskers. The electrophysiological battery used to characterize the transmission and representation of sound included: (1) a click-evoked supra-threshold auditory brainstem response, (2) an envelope following response (EFR) recorded to a 400-ms-long 4 kHz pure tone carrier amplitude modulated at 100 Hz at two modulations depths (0 and -6 dB) and (3) a binaural evoked interaural phase difference (IPD) threshold.

Results:

Preliminary analyses revealed that as a group, ASD participants demonstrated difficulty with speech perception in a multi-talker situation with poorer thresholds than controls. However, individuals with ASD did not show the same deficits on electrophysiological measures. Some individuals with ASD showed reduced EFRs and poorer IPD thresholds while other individuals showed EFRs and IPD thresholds comparable to controls.

Conclusions:

Preliminary analyses suggest that although overall, individuals with ASD in this study showed decreased speech perception under complex conditions, we also found distinct patterns of neurophysiological differences that may underlie this deficit. Some individuals showed differences in temporal representation (i.e., reduced EFRs) or binaural integration (i.e., poor IPD thresholds) while others did not. Together, these measures provide a robust and promising assay of auditory function with the potential to further our understanding of the mechanisms underlying auditory abnormalities in individuals with ASD by leveraging individual differences.

260 **147.260** Autistic Children's Responses in a Multi-Sensory Environment: The Effect of Having Control over Sensory Changes on Behaviour, Mood and Physiological Arousal.

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Background:

Multi-Sensory Environments (MSEs; also called sensory or Snoezelen rooms) are common in special needs schools and contain equipment that change the sensory environment for educational or therapeutic benefit. They are widely used with autistic pupils yet there is little research in this area. Previous work within our lab has found that practitioners who use MSEs with autistic children believe them to be beneficial for improving behaviour. The practitioners also suggested that the child being in control was necessary for maximum benefit. To date, no study has empirically investigated the effect of being in control of sensory changes within the MSE on autistic children's behaviours.

Objectives:

To assess whether having control of the sensory changes in an MSE, versus not having control, influences autistic children's behaviours, mood and physiological arousal.

Methods:

Forty-one autistic children (8 female) aged 4-12 years (*M*=8 years, *SD*=2.05 years), used the MSE twice. In the 'sensory control' condition they changed equipment themselves using an iPad or interactive board. In the 'no sensory control' condition, the equipment changed without their input. The order of conditions was counterbalanced. During each condition the child sequentially engaged with five pieces of MSE equipment including a bubble tube, touch sound and light panel, fibre optic lights, mirror ball, and immersive room lighting. Each piece of equipment was engaged with for three minutes in a randomised order. The sessions were video recorded and behaviours later coded. The outcome measures were selected based on findings from a previous study of practitioner experiences and included: social communication, repetitive motor behaviours (RMBs), sensory behaviours, anxiety, attention, enjoyment, and rapport. Physiological arousal was measured using heart rate variability.

Results:

Behavioural coding achieved good to excellent inter-rater reliability. Findings showed that when the child did not have control of their sensory environment they produced more RMBs and sensory behaviours, and paid less attention. However, there was no difference in social communicative behaviours or levels of enjoyment and anxiety. Rapport with the experimenter was also unaffected by condition. Analyses are ongoing, including the effect of condition on speech and heart rate variability.

Conclusions:

These preliminary findings suggest that having control over sensory changes in the MSE reduces RMBs and sensory behaviours and leads to better levels of attention. This might be because control of the MSE enables an individual's sensory needs to be met. Alternatively, better prediction of the sensory changes may create a less stressful environment. However, it is also notable that having control did not impact on other behaviours, including levels of enjoyment, anxiety or rapport with the experimenter. These finding have implications for how MSEs could be used for maximum benefit in schools.

261 **147.261** Autonomic Orienting and Adaptation Patterns to Repeated Sensory Stimuli in ASD

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Background: Prevalence estimates of sensory processing differences in individuals with autism spectrum disorder (ASD) range as high as 96%. Furthermore, this difficulty perceiving and integrating sensory stimuli is frequently reported by parents and individuals with ASD as one of the largest barriers to functioning in day-to-day life. One method that is used to objectively examine sensory differences in ASD is measuring autonomic reactivity and regulation to sensory stimuli. The Sensory Challenge Protocol (SCP) is a paradigm that measures autonomic reactivity to a series of highly-standardized sensory stimuli from several domains. Results from past SCP studies in ASD have varied, finding both hyperresponsivity and hyporesponsivity to individual stimuli. However, existing studies have not examined within-domain autonomic responses across trials, which would provide important information about orientation and adaptation patterns to sensory stimuli.
Objectives: The current study measured sympathetic and parasympathetic responses to sensory stimuli using the SCP. Analyses specifically focused on reactivity patterns across trials within each sensory modality to better understand how individuals with ASD react to novel and repeated sensory stimuli.

Methods: Twenty-two adolescents with ASD (12-16 yrs) and 24 typically developing adolescents matched on age, gender, and IQ completed this study. Diagnoses were confirmed/ruled out using the Autism Diagnostic Observation Schedule and cognitive abilities were evaluated using the age-appropriate Wechsler assessment. Each participant completed the SCP, where their heart rate, respiration rate, and electrodermal activity were continuously collected during a standardized presentation of the following stimuli: an 84 dB pure tone, strobe light flashed at 10kHz, 80dB siren, wintergreen oil presented under the nose, and feather drawn across the jawline.

Results: Group x trial repeated measures analyses of variance were performed to examine overall cardiac reactivity and orienting responses. There was a significant group x trial interaction when considering all trials (p<.001), suggesting that individuals with ASD are overall less reactive to stimuli across trials. A separate analysis considering only baseline and the first two sensory trials in each domain also revealed a group x trial interaction (p<.001), suggesting a decreased or absent cardiac orienting response to novel stimuli in ASD. *A priori* analyses were repeated within each domain, as is commonly done in the SCP literature. These revealed significant group x trial interactions for responding across all trials on Tone, Wintergreen, and Feather (p's <.05) and for orienting responses to initial stimuli for Tone, Wintergreen, and Siren (p's <.05; Fig 1).

Conclusions: These results support autonomic hyporesponsivity to several sensory modalities in ASD. Specifically, the reduced cardiac orienting response found in the current study suggests that individuals with ASD may attend less readily to neutral sensory stimuli. This may impact information gleaned from their environment and may contribute to both a lower registration of sensory stimuli and, potentially, a defensive response to more aversive sensory stimuli. This study is the first to examine autonomic orienting responses in adolescents with ASD to several, carefully-presented sensory stimuli. The results help to clarify sensory dysregulation and perception in individuals with ASD, including how sensory differences may impact attentional processes.

262 **147.262** Circumscribed Interests and Unusual Preoccupations in Autism Spectrum Disorder: Patterns across Age and Gender

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Background: Circumscribed interests and unusual preoccupations (CIs) are characterized by an intense interest in specific objects or topics (Turner-Brown et al., 2011). CIs are one of the diagnostic criteria for autism spectrum disorder (ASD), and are related to both negative and positive consequences. For example, while CIs may impede social interactions in some situations, individuals on the autism spectrum note that CIs often facilitate social interactions with others with similar interests (Muller et al., 2008). CIs have also been shown to be negatively correlated with depression, and adults on the autism spectrum report using CIs to manage anxiety (Stratis and Lecavalier 2013; Trembath et al. 2012). Better characterizing CIs could improve clinician understanding of how they impact everyday functioning.
Objectives: The aim of this pilot study was to examine the prevalence and types of CIs for children and adolescents on the autism spectrum using a newly developed survey. The following research questions were addressed: What types of CIs do parents most frequently endorse? How many categories of CIs do parents report? What is the impact of CIs on their child's functioning? Are there differences in type of CI across age and gender?

Methods: Parents of children (N=1922, 79.5% male, M *age* = 9.1 years) diagnosed with ASD within the SPARK database completed an online survey regarding their child's CIs. The survey was based on the *Interests Scale* (Bodfish, 2003), but modified to include additional categories and incorporate findings based on recent research (e.g., gender differences). The survey solicited additional information (e.g., age of onset, duration, impact on functioning) and included parent ratings (measured on a Likert scale 1-5) on the uniqueness of the CI and how much it interfered with functioning.

Results: The most commonly reported CIs were in the categories of "television" (81%), "objects" (72%), and "music" (67%). The least commonly reported CIs included "psychology" (3.7%), "politics" (6.2%), and "physics" (6.8%). Age of onset of CI varied across type, with transportation having the youngest age of onset (3 years, 11 months) and politics having the oldest age of onset (10 years, 9 months). Caregivers reported that CIs that interfered the most with functioning were related to collecting, people, things, schedules, television, and objects. The least amount of interference was associated with astronomy, plants, religions, sports, geology, and measurement. Males and females were similarly interested in the majority of the categories. Significant differences emerged in the proportion of males and females interested in "collecting," (χ_2= [1, N=1908] = 4.76 p = 0.029) "people," (χ_2= [1, N=1903] = 4.29 p = 0.038) and "objects." (χ_2= [1, N=1922] = 5.79 p = 0.016)

Conclusions: Participants endorsed CIs across a wide range of categories, though some CI categories were more common than others. The age of onset of CIs varied across categories, as did the impact on daily functioning. Finally, few differences were found in types of interests by gender. The CIs that females were more likely to endorse were three of the six found to have the greatest impact on functioning.

263 **147.263** Does Leading Modality Influence Multisensory Integration in Children with Autism?

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Background: Atypical sensory processing is a key component of Autism Spectrum Disorder (ASD) diagnostic criteria (APA, 2013). The process of multisensory integration (MSI) - the ability to efficiently integrate stimuli from multiple sensory modalities - is necessary to experience the world as a coherent whole. Research suggests that disrupted MSI may partially underlie atypical sensory behaviours in ASD (Wallace and Stevenson, 2014). There has, however, been mixed evidence as to whether MSI is altered in individuals with ASD, especially in stimuli void of social content (e.g. Bao et al., 2017). It has been suggested that MSI, in particular tolerance of asynchrony, is largely influenced by leading stimulus modality in typical adults (Cecere et al., 2016). Although this phenomenon has been studied in relation to autistic traits (Stevenson et al., 2017), this has yet to be explored in individuals with ASD or at different periods of development.
Objectives: Assess the contribution of leading modality on tolerance of asynchrony in children with ASD vs typical children at different periods of development.

Methods: Eighty-six participants were separated into ASD child (n=17; age <12), ASD adolescent (n=13; age > 12), TD child (n=30; age <12) and TD adolescent (n=26; age > 12) groups. Participants evaluated the simultaneity of audiovisual stimulus pairs at seven varying stimulus onset asynchronies (SOAs: 50ms, 100ms, 150ms, 200ms, 250ms, 500ms, 750ms) with 7 SOAs presented audio-leading (A-L), 7 SOAs visual-leading (V-L), and one synced (Powers et al., 2009). Participants were asked to respond whether the auditory stimuli (10ms, 1800 Hz pure tone) and visual stimuli (white annulus subtending 9 visual degrees) were presented at the 'same' or 'different' time.

Results: Proportion of 'same' responses were calculated for each participant. A 3-way mixed ANOVA (4 groups x 2 leading modalities x 7 SOAs) revealed an overall significant effect of leading modality ($p < 0.001$), with V-L trials being indicated as synchronous more often than A-L trials, suggesting a greater tolerance for asynchrony for visual-leading stimulus pairs. No significant overall effect of group was found. However, a significant modality by group interaction was found ($p < 0.001$). This effect is explained by a shift in modality sensitivity across age, mediated by group. Whereas only small changes in proportion of 'same' responses occurred across age for the ASD group (children; $M_{A\text{-}L}$ =62.43 vs $M_{V\text{-}L}$ =68.25 | adolescents; $M_{A\text{-}L}$ =51.65 vs $M_{V\text{-}L}$ =60.71). Meanwhile, a larger difference in audio- vs visual-leading trial performance was found for the TD group (adolescents; $M_{A\text{-}L}$ =53.00 vs $M_{V\text{-}L}$ =67.45 | children; $M_{A\text{-}L}$ =54.68; $M_{V\text{-}L}$ =61.23).

Conclusions: Asynchrony was tolerated to a greater extent in V-L stimuli for all groups. However, performance was mediated by age group, with a larger developmental jump in visual- vs auditory-leading performance in TD groups compared to ASD groups. Our results provide evidence for atypical development of MSI in individuals with ASD, as defined by tolerance to asynchrony, and provide a platform for further investigation of the developmental trajectory of MSI in this population.

264 **147.264** Early Expressive Communication Skills Associated with Development of Lower-Order Rrb in Children with ASD

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Background: Restricted repetitive behaviors (RRBs) are a core symptom criterion for an autism spectrum disorder (ASD) diagnosis. RRBs are heterogeneous, as evidenced by research that has psychometrically parsed this symptom domain. One common distinction is between 'lower-order' RRBs, such as restricted stereotyped behavior (RSB) and self-injurious behavior (SIB), and 'higher-order' RRBs, such as compulsive ritualistic sameness behaviors (CRSB). The validity of this distinction is supported by findings showing differential association with phenotypic characteristics; for example, lower-order RRBs are more common among those with lower IQ. Here, we expand on these findings by examining the interplay between the development of expressive communication skills and the development of subdomains of RRBs.
Objectives: We tested the hypothesis that trajectories of higher-order RRBs are positively related to the development of expressive communication in children with ASD, whereas lower-order RRBs are negatively related.

Methods: The sample consisted of 105 children with an ASD diagnosis enrolled in a longitudinal natural history study. The analyses included data from visits that occurred at approximately 1-year intervals between 3–7 years of age, with a minimum of three visits within this period. Each child's parent/caregiver completed the Repetitive Behavior Scale-Revised (RBS-R) at each visit, as well as the Vineland Adaptive Behavior Scale (VABS, second edition). RBS-R subscores were calculated using the three-factor solution (Mirenda et al., 2010): CRSB, RSB, and SIB. To model expressive language skills, the VABS Expressive Communication Age Equivalent (Exp-AE) at each visit was used. Bivariate latent growth models of RBS-R subscore and Exp-AE were run simultaneously for each RRB subscore.

Results: On average, lower-order RRB scores (e.g., RSB and SIB) did not change across 3-7 years of age. Individually, RSB trajectory was negatively related to the intercept of Exp-AE (β=-3.526, p=0.026), such that children with better expressive language at age 3 exhibited a slower increase in RSB from 3-7 years old. Relatedly, Exp-AE trajectory was negatively related to the intercept of SIB (β=-2.090, p=0.032), such that children with more severe SIB at age 3 exhibited a slower increase in Exp-AE between the ages of 3-7 years.

CRSB (the higher-order behaviors) also showed a stable trajectory on average. Neither the intercepts nor slopes of CRSB were significantly related to the intercept or slope of Exp-AE. However, a trend for a positive correlation between Exp-AE and CRSB intercepts was observed (p=.066), such that children with higher expressive language at age 3 had more severe CRSB scores.

Conclusions: Consistent with the literature, the mean trajectory of RRB subscores remained stable from 3-7 years old in this sample of children with ASD. At the individual level, a marginally significant positive correlation was observed between early higher-order RRBs and early expressive language. However, early expressive language skills were negatively related to the slope of RSM development, and early SIB were negatively related to the slope of expressive language development. While consistent with reports that lower-order RRBs are associated with lower cognitive ability, the present findings suggest that the nature of this relationship may vary across lower-order subdomains.

265 **147.265** Eating Behavior Is ASD Child According to Mothers Narratives.

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Background: Several studies indicated that individuals with ASD are resistant to change and have a narrow range of interests that may affect even the food they eat. The most common problems found in those studies were: limited food intake; refusal to eat certain foods or selectivity related to the texture, smell and taste of food; inflexibility regarding the use of utensils, brands and packaging; and behavioral and nutritional problems All the above-mentioned studies dealt with eating problems in patients with ASD from the perspective of the healthcare professional/ physician, with no information on the perceptions and concerns of parents in relation to the eating habits of individuals with ASD.
Objectives: This study aims to investigate the eating behavior of autism spectrum disorder (ASD) individuals through their mothers' narratives.

Methods: The chosen methodological approach was the study of narratives, as we sought the reporting of narrator's experiences. Data on the eating habits of individuals with autism spectrum disorder were collected during semi-structured interviews held individually with the parents/guardians. The interviews were recorded, transcribed and codified using the NVivo software program.

Results: Eighteen mothers of boys with ASD participated in the study. Analysis of the interviews yielded three major categories: eating patterns, the family's attitudes in relation to the child's eating habits, and food-related behavior. The results show that factors related to autism spectrum disorder may affect the child's food choices. Environmental factors, particularly the parents' behavior, may also play a decisive role, both in reinforcing the child's food choices and in encouraging a healthier and more diversified diet.

Conclusions: Professionals should be attentive and instruct parents regarding their decisive role in reinforcing or discouraging inappropriate mealtime behavior in children with autism spectrum disorder.

266 **147.266** Effects of Coloured Lighting on Behaviour of Children with and without Autism Spectrum Disorder

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Background: "Visual stress," an adverse reaction to bright lighting and high-contrast visual patterns, is common in ASD (e.g. Robertson & Simmons, 2015; Ludlow & Wilkins, 2016). An established, if controversial, treatment is to use individually chosen coloured filters, lenses or lighting, thought to reduce neural hyper-responsivity (Wilkins, 1995; 2003), a concomitant of sensory hyper-responsivity (Takarae and Sweeney, 2017).
Objectives: To determine whether coloured lighting influences the observed behaviour of children with ASD.

Methods: A cross-over, double-masked, placebo-controlled study involved 11 children with ASD and 11 controls (aged 6-14 years) matched on verbal (BPVS) and non-verbal (Ravens) IQ measures. An optimal coloured light was individually selected for each child using the "Intuitive Colorimeter" process (Wilkins et al, 2002). A placebo colour was selected using an algorithm so as to differ by 0.091 in CIE UCS chromaticity. The lighting was matched for illuminance. One month after colorimetry all children were videoed performing the "Description of a picture" tasks from the ADOS, under both test and placebo lighting. The videos were rendered in monochrome and behavioural observation coding was used to assess social interaction and autism-like behaviours in the two different lighting conditions. The two raters were both ADOS trained and blind to both diagnosis and lighting condition. They rated eye-contact, social conversation, non-verbal communication, joint attention, atypical social conversation, autistic features (e.g. hand flapping, covering eyes) and other notable behaviours. They also each scored the child's behaviour on an ADOS-like questionnaire and gave their "general impression" of whether the child was autistic on a scale from 0-100.

Results: Observable autistic features decreased significantly under optimal coloured lighting relative to placebo (β= -0.887; SE=0.225, z= -4.34, p=0.001). Post-hoc pairwise comparisons on the significant condition-by-group interaction, (β=1.538; SE=0.419, z=2.756, p=0.006) revealed a significant difference between conditions only in the ASD group (Z = -3.23, p = 0.007). Thus, under optimal coloured lighting, observable autistic features decreased to a greater extent in autistic children than in controls. Both groups of children were rated as significantly less likely to be autistic in the optimal colour condition (WTS(1) = 7.765; p = 0.016). However, there was no evidence that the optimized lighting altered conversational engagement, non-verbal communication, eye contact or joint attention in the ASD group.

Conclusions: Results suggest overall positive effects of optimal coloured lighting both for autistic and typical children and particularly on the non-social signs of ASD. Together with recent related data showing improvements in other areas of difficulty faced by autistic children (Ludlow et al, 2018), they encourage future research on the potential of coloured lighting and lenses as a beneficial adaptation of the sensory environment.

267 **147.267** Examining the Relationship between Early Sensory Reactivity and Later Autism Severity

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Background: Infants at high-risk (HR) for developing Autism Spectrum Disorder (ASD) often display atypical patterns of sensory reactivity, including hypo-reactivity, hyper-reactivity, and sensory seeking behaviors. Sensory seeking behaviors often increase over the second year of life in children later diagnosed with ASD (Baranek et al., 2018) and hypo-reactivity to sensory stimuli at 24 months has also been linked to later ASD diagnoses (Germani et al., 2014). Extending this work to younger samples and evaluating how sensory reactivity changes over the first years of life has implications for early identification and treatment planning.
Objectives: To examine the relationship between sensory reactivity at 12 and 24 months and later ASD severity.

Methods: This study includes 87 HR children (60 boys) identified at 12 months based on community screenings with the *First Year Inventory 2.0* (Baranek et al., 2003). Children completed the Sensory Processing Assessment (SPA; Baranek, 1999) at 14 months (+/- 0.77; Time 1) and 23 months (n=83; +/- 0.86; Time 2). 50% (n=45) of the children were randomly assigned to an intervention trial. A subsample (n=45) returned between ages 3 and 5 years (mean= 4.5 years +/- 0.92; Time 3) for follow-up diagnostic assessments and received the Autism Diagnostic Observation Schedule

(ADOS-2; Lord, Luyster, Gotham, & Guthrie), yielding calibrated severity scores: overall score (CSS), CSS social affect (CSS SA), and CSS restricted, repetitive behaviors (CSS RRB). To account for missing data, multiple imputation was carried out using Multivariate Imputation by Chained Equations (see MICE package in R). Linear regression models were fit to the imputed datasets with each SPA score at Time 1 and the change in each SPA score from Time 1 to Time 2 (covariates: treatment group and age at Time 3). Effect sizes were calculated (the parameter estimate divided by the standard error).

Results: SPA hypo-reactivity at Time 1 was significantly related to CSS [95% CI (0.35, 3.43); effect size = 2.49] and CSS SA [95% CI (0.33, 3.32); effect size = 2.48]. Increases in SPA Hypo-reactivity from Time 1 to Time 2 was significantly related to CSS [95% CI (0.41, 2.78); effect size = 2.73], CSS SA [95% CI (0.30, 2.61); effect size = 2.57], and CSS RRB [95% CI (0.05, 3.03); effect size = 2.11]. Increases in SPA Hyper-reactivity from Time 1 to Time 2 was significantly related to CSS [95% CI (0.45, 4.79); effect size = 2.46], but not CSS SA or CSS RRB. Sensory Seeking behaviors at Time 1 and changes from Time 1 to T2 were not significantly related to later ASD severity.

Conclusions: Child hypo-reactivity at 12 months may be particularly helpful in predicting ASD severity during the preschool years. In addition, increases in hypo- and hyper-reactivity from 12 to 24 months may provide new information about the emergence of ASD symptoms prior to a diagnosis. These results indicate that early sensory reactivity may be a useful precursor to an ASD diagnosis and may provide a new target for early interventions.

268 **147.268** Exploring the Relationship between Sensory Reactivity and Mental Health: A Comparison of ASD and Neurotypical Youths.

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Background: Research shows that sensory reactivity symptoms are often present in individuals with a diagnosis of an autism spectrum condition (ASC), irrespective of level of functioning. The literature also asserts that autistic individuals are at a significantly higher risk of developing mental health conditions than their neurotypical peers. Whilst some research has investigated individual sensory reactivity constructs within specific diagnoses, particularly with hyper-responsivity/sensory sensitivity and anxiety, little research has been conducted more broadly into the relationship between other sensory reactivity constructs (poor registration/hyporesponsivity and sensation seeking) and the development of other mental health disorders. The current study explores the correlational relationship between sensory reactivity and mental health constructs across a sample of ASC and neurotypical youths.

Objectives: To examine whether there are relationships between sensory reactivity and mental health, and explore any differences in sensory processing and mental health across groups of ASC and neurotypical youths.

Methods: This study analysed standardised parent-report measures of sensory difficulties and mental health. Measures were completed for 29 children diagnosed with ASC (ages 7 to 11) and 43 children without a diagnosis (ages 8 to 12). The Sensory Profile - Parent (SP) was used as the measure of sensory reactivity, and the Child Symptom Inventory (CSI) for mental health constructs. The SP provided symptom scores for auditory, visual, vestibular, touch, multisensory and oral processing, and total scores for sensory seeking, poor registration and sensory sensitivity. The CSI provided symptom scores for inattention, hyperactivity, Attention Deficit Hyperactivity Disorder (ADHD), Oppositional Defiant Disorder (ODD), Conduct Disorder (CD), Generalized Anxiety Disorder (GAD), specific phobia, obsessions, compulsions, Post-Traumatic Stress Disorder (PTSD), depression, social phobia and separation anxiety. Cross-tabulation analyses were used to understand sensory reactivity symptoms across groups, and bivariate correlational analyses were used to assess sensory reactivity and mental health.

Results: Cross-tabulation analysis found that autistic participants had greater sensory processing difficulties compared with their neurotypical peers ($p < .01$), and that autistic participants had higher scores on poor registration than sensory seeking or sensory sensitivity ($p < .01$). Significant correlations were also found between sensory sensitivity constructs and mental health in autistic participants, including in sensory seeking and hyperactivity ($r = -.67$, $p < .01$) and generalised anxiety ($r = -.60$, $p < .01$), and in total sensory processing and generalised anxiety ($r = -.59$, $p < .01$) and depression ($r = -.56$, $p < .01$). Significant correlations were also found for individual sensory modalities and mental health in autistic participants ($p < .05$).

Conclusions: Our results suggest that there is a relationship between sensory reactivity and mental health, both at a total construct level and at an individual modality level. The results also suggest that there may be a potential for diagnosis-specific profiles of sensory reactivity and mental health. Further, poor registration may be an under-assessed variable. Future directions include understanding the causal relationship between sensory reactivity and mental health, and developing a more robust understanding of across-group profiles.

269 **147.269** Exploring the Relationship between Stereotypy, Sensory-Driven Behaviors, and Self-Injury in Children with Autism Spectrum Disorder

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Background: The DSM-V categorizes stereotyped movements and hyper- or hypo-reactivity to sensory input as subtypes of restricted and repetitive behaviors (RRBs), a defining characteristic of Autism Spectrum Disorder (ASD) (American Psychiatric Association, 2013). Self-injurious behaviors (SIBs) are also seen at high rates in this population and can cause significant impairment (Minshawi et al., 2014). SIBs have been theorized by some to be an extreme form of RRBs (Eynat, Dyck, & Passmore, 2009; Mace et al., 1994). While there is research examining factors that influence SIBs, no study has examined the relationship between stereotypy and sensory-driven behaviors and SIBs in the ASD population. Objectives: The study aims were to 1) examine the relationship between stereotypy and SIBs, 2) examine the relationship between sensory-driven behaviors and SIBs, and 3) determine predictors of SIBs.

Methods: Data from 220 children with ASD ages 2.5–16.9 years enrolled in a previous research through Boston Children's Hospital and the Boston Autism Consortium was used. All children met diagnostic cutoff on the Autism Diagnostic Observation Schedule (ADOS, Lord et al., 2003). The Behavior and Sensory Interest Questionnaire (BSIQ, Hanson et al., 2016) measures type and severity of 74 RRBs with codes ranging from 0-3. Using the averages of BSIQ questions related to stereotypy and sensory RRBs, four groups were developed: 1) stereotyped movements (SM) (Items B1.a-B4.f), 2) unusual sensory interests (SI) (Items B5.a-k), 3) sensory aversions (SA) (Items B6.a-d), and 4) SIBs (Items E1.a-g). The first three groups

were then divided into three levels of severity: Low severity=scores below the 25th percentile, Moderate severity=scores ranging from the 25th to 75th percentile, and High severity=scores above the 75th percentile. Analysis was conducted by first using Spearman rank order correlations to identify relationships between SM, SI, SA and SIBs. Next, a Kruskal-Wallis test was used to determine if there was a significant difference in SIBs for low, moderate, and high levels of SM, SI, and SA. Lastly, a linear regression model was run to determine any predictors of SIBs controlling for nonverbal IQ (NVIQ), age, and gender.

Results: All groups were positively correlated with SIBs (SM, SI, SA; p<.001). There was also a significant difference in SIBs between the different severity groups. Post hoc testing showed that SM high (p=.002), SI high (p<.001) and SA high (p=.029) were significantly correlated with SIBs. There was no significance for SM, SI, SA moderate or low severity and SIBs. SA was the only significant predictor of increased SIBs (r =.102, p<.001).

Conclusions: The results indicate that high severity levels of increased stereotypy, sensory-seeking behavior, and sensory aversion are all associated with SIBs. This could support the hypothesis by Eynat et al., 2009 that these behaviors are related. In addition, SA was a predictor of SIBs. Individuals who experience distress and aversions to specific sensory stimuli (BSIQ Items B6.a-d), could potentially show this by engaging in SIBs. In the future, more research will be critical to understand the causes and relationships of these behaviors and how best to design intervention approaches.

270 **147.270** Family Experiences of Auditory Hypersensitivity in ASD

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Background: Auditory hypersensitivity is a common sensory issue for individuals with autism spectrum disorder (ASD). Previous research suggests that auditory sensitivity negatively impacts family life and limits participation in everyday activities.
Objectives: To provide insight into the experiences and behaviors of individuals with ASD and auditory sensitivity, and better understand their needs and concerns and those of their families.

Methods: Parents of individuals with ASD (n=90) were recruited to participate in a 54-item survey, adapted from the Auditory Sensitivity and Child Safety Questionnaire (Law et al., 2016). The survey probed the individual's past and current levels of auditory sensitivity and how this issue affects the individual's behavior and family life. A follow-up focus group interview was conducted with a subset of parents (n=7). The focus group discussed the nature of challenging sounds and situations, behaviors, negative effects on family activities and loss of opportunities, safety issues and effectiveness of current solutions.

Results: Child characteristics: Gender (77% male); Ethnicity (63% white; 14% Asian; 23% other/mixed ethnicity); Age (Median = 10.5 years, Range: 3-30 Years).

86% of the respondents reported that their child experienced negative reactions during the last 6 months. 51% of parents reported that their child reacts negatively to both very specific and general sounds; 40% indicated that their child reacts only to specific sounds; 6% of parents reported that their child reacts only to general noises; 3% of parents were unsure. When asked to indicate all of the types of problematic sounds, 83% of parents indicated loud noises, 61% indicated sudden noises, and 53% indicated high-pitched noises.

Commonly reported emotional states in response to aversive sounds included stressed (80%), irritable (62%) and scared (51%). Common responses included ear covering (86%), screaming (50%), and trying to stop the sound (34%). When the sound sensitivity was at its worst point, many respondents reported a negative reaction daily/multiple times a day (68%), or weekly/several times a month (18%). When asked whether sound sensitivity has an impact on daily life and social opportunities, the most common response was that sound sensitivity *at least sometimes* limits participation in family (67%), school (69%), and community (70%) activities. Several parents (39%) considered auditory sensitivity moderately or extremely difficult to manage in their child; 43% of parents found that it led to unsafe behavior in their children.

The focus group provided valuable and nuanced insights into changes and variability in sound sensitivity for individuals over time and across contexts. Data is being analyzed using content analysis. Parents indicated that emotional states and motivation to participate in activities often had an important effect on their child's tolerance to aversive sounds. They indicated some success with existing therapies and technologies, but also expressed a need for further improvements that could more effectively address the complexity of sound sensitivity issues.

Conclusions: Sound sensitivity is an important and still poorly understood aspect of the ASD profile. It is an issue that affects the lives of individuals and families, and warrants greater focus in the areas of research and development.

271 **147.271** Food Addictive and Selective Eating Traits in Autism and Their Health and Behavioral Consequences

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Background:
Obesity is a prevalent issue in those with Autism Spectrum Disorder ([ASD]; Curtin et al., 2014). People with ASD are more likely to develop high blood pressure, diabetes, cardiovascular disease/stroke, etc. when compared to the general population (Croen et al., 2015). The mechanisms driving these adverse health outcomes are unclear. There is some evidence for increased overeating in individuals with ASD (Hess, Matson, & Dixon, 2010); however, this evidence is limited. Food addiction [FA] is a set of traits used to explain the drive to eat due to the rewarding nature of food, despite the potential accompanying negative health consequences. To date, neither FA traits, nor their health-related correlates have been examined in individuals with ASD. Furthermore, the overlap between FA traits and food selectivity has yet to be examined and may be associated with further negative health outcomes.

Objectives:

Characterize food addictive and selective eating traits in children with ASD and their associations with body mass index [BMI].

Methods:

Participants consisted of parents of children with ASD (n=153;M age=8.9,109 males) and parents of typically developing [TD] children (n=78;M age=8.3,36 males) who completed psychometrically sound and well-established questionnaires assessing FA traits and picky eating behavior. FA was assessed using The Yale Food Addiction Scale for Children (Gearhardt et al., 2013; Burrows et al., 2017). Food selectivity (i.e., picky eating) was

assessed using a portion of the Eating Habits Survey (Wilde et al., 2012). Lastly, parents were asked to report their child's biological sex, chronological age, height, and weight in order to calculate BMI and categorize overweight/obesity status using Center for Disease Control norms.

Results:

Children with ASD were more likely to be rated as picky eaters than TD children(ASD:55.6%,TD:29.5%;$\chi 2$ =14.1,p<.001). Additionally, parents rated children with ASD as having more FA traits than TD children(t=4.15,p<.001), and significantly more children with ASD than TD children surpassed the threshold for elevated FA traits(ASD:23.8%,TD:8.5%;$\chi 2$=7.40,p<.01). Of the children with ASD surpassing the threshold for elevated FA traits, 68.6% were also rated as being picky in their eating, which was significantly higher than among the non-picky eaters(50.9%,p<.05). Finally, among the children with ASD, BMI was found to be lower for picky eaters compared to non-picky eaters(t=3.84,p<.001), but positively correlated with FA traits(r=.20,p<.05). Furthermore, those who have elevated FA traits alone and those who exhibit both elevated FA traits and picky eating have higher BMI than those who are picky eaters only(F=18.05,p<.001).

Conclusions:

This study indicates that not only food avoidant behaviors, but also FA traits, are overrepresented in children with ASD. Moreover, there appears to be an overlap between selective eating and FA traits in ASD, suggestive of a 'selective overeating' phenotype. Finally, picky eating (lower) and FA (higher) exert opposing influences on BMI in the context of ASD. This study informs our understanding of appetitive traits and eating behaviors in ASD that could serve as behavioral risk factors for overweight/obesity. In turn, these behaviors might represent viable intervention targets, around which to design effective treatments to optimize health outcomes in individuals with ASD.

272 **147.272** Functional Brain Mechanisms of Sensorimotor Deficits in Individuals with Autism Spectrum Disorder

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Background: Abnormalities in sensorimotor behavior are present in the majority of individuals with ASD and are associated with core symptoms. Cortico-cerebellar networks that control sensorimotor behavior have been implicated in ASD, but little is known about their function during sensorimotor actions.

Objectives: The purpose of this fMRI study was to examine cortical-cerebellar function during feedback-guided motor behavior in ASD.

Methods: Individuals with ASD (11-30 years; N = 18) and age-matched controls (N = 15) completed a visuomotor task of feedback-guided precision gripping during fMRI. Participants pressed with their right thumb and forefinger on a force transducer while viewing a green FORCE bar on a screen that moved upwards with increased force toward a fixed white TARGET bar. Individuals were instructed to maintain the FORCE bar at the level of the TARGET bar for 24 seconds. Target force levels were set at 20% and 60% of each participant's maximum voluntary contraction (MVC). Force variability was characterized as the coefficient of variation (i.e., standard deviation of the force time series / mean force output; CoV).

Results: Mean force did not differ between groups indicating participants were able to follow task demands. Participants with ASD showed increased force variability ($F_{(1,30)}$= 5.214, p= 0.03) at both 20% (d= .45) and 60% (d= .77) MVC compared to controls. Compared to controls, individuals with ASD showed decreased activation in left angular gyrus during the visuomotor task compared to rest (AG; maximum t= 4.31). Individuals with ASD also showed greater visuomotor activation compared to controls in ipsilateral ventral M1, extending anteriorly into posterior ventral pre-motor cortex (PMv; maximum t= -4.06, cluster size = 38 voxels). This difference reflected the finding that control participants showed a selective deactivation of ipsilateral M1/PMv during visuomotor behavior, whereas individuals with ASD did not show this pattern. A significant group x force interaction was observed for contralateral Crus I activation (maximum t= -2.42) that was driven by an increase in activity during 60% compared to 20% MVC in control participants, while individuals with ASD showed no significant change in Crus I activation between force levels.

Conclusions: Increased force variability in individuals with ASD suggests impaired processing of sensory feedback to guide precision motor behaviors. Individuals with ASD did not show deactivation of right motor cortex during visuomotor behavior relative to rest, suggesting reduced ability to selectively modulate motor cortical output. Reduced activation in left AG may reflect an inability to integrate visual, haptic, and proprioceptive inputs to reactively adjust ongoing motor output. Failure to show force-dependent scaling of Crus I in ASD suggests lateral cerebellar circuits do not adapt sensory prediction and error processes to maintain precision motor output during more demanding conditions. Together, our results demonstrate multiple cortical-cerebellar mechanisms associated with sensorimotor imprecision in ASD.

273 **147.273** Gender Differences in Parent-Reported Restricted Interests in Children with and without ASD

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Background: Restricted interests (RIs), a diagnostic criterion of ASD, are pursuits that are circumscribed and intense, causing interference in daily activities (Lord et al., 1993). Clinician assessments of RIs indicate a greater prevalence in boys than in age- and IQ-matched girls both with and without ASD (Anthony et al., 2013). However, the assessment of RIs may be biased towards identification in boys, particularly as the topic of girls' interests may appear 'typical', despite causing significant impairment in everyday contexts (Duvekot et al., 2017; Hiller et al., 2014).

Objectives: The objectives of the current study were to: (1) identify the number of parent-reported RIs in a sample of IQ-matched children with and without ASD and (2) examine group and gender differences in interest topics and whether they cause interference in the child's life.

Methods: A total of 125 age- and IQ-matched children (age 6-12, IQ>80) and their caregivers participated in this study (55 ASD, 41 boys; 70 typically developing [TD], 43 boys). Children were administered the Wechsler Abbreviated Scales of Intelligence 2nd Edition (Wechsler, 2011) while their parents completed the Yale Special Interests Survey (Klin & Volkmar, 1996), a qualitative questionnaire eliciting information on the presence of intense interests and activities relating to the interest. Interference of interest was assessed as a sum of questions on a 4-point scale reporting the percentage of time spent engaging in the interest within contexts of daily living (i.e., alone, with family, with peers).

Results: Seventy-seven children were identified as possessing RIs (ASD: 34 boys, 11 girls; TD: 22 boys, 11 girls). A majority of youth with ASD were identified as having a RI (83% of boys, 79% of girls) compared to 51% and 41% of TD boys and girls, respectively. Independent samples t-tests identified that IQ was not significantly different between diagnostic groups (t(123)=1.64, p=.09) or between those with and without RIs (t(123)= -.561,

p=.58). Eight of 11 ASD girls shared a similar interest to ASD boys, primarily video games and Pokémon (50%); 73% of all girls shared similar interests (animals, cartoon characters, drawing, and reading). However, despite similarities in content, the RI of girls with ASD caused significantly more interference in daily living compared to TD girls (*t*(19)= -2.71, *p*=.01, *d*=1.17). 58% of all boys shared similar interests; however, 43% were an obsessive interest in video games. Parent ratings of interference did not significantly differ between boys and girls with ASD (*t*(42)= -.78, *p*=.44).

Conclusions: Consistent with previous research, our results indicate that the RI topics of girls with ASD were similar to those of TD girls. However, parent-ratings of interference were significantly higher in ASD girls than TD girls, while not significantly different from those of boys with ASD. These findings suggest that interference in daily activities may be a key distinguishing feature of RI between children with and without ASD more so than the topic of interest itself. Assessment of the interference parents attribute to a RI may be a possible avenue to improving diagnostic accuracy in ASD, particularly among girls.

274 **147.274** Gross Motor Features during Balance Training Distinguish Youth with Autism Spectrum Disorder Compared to Youth with Typical Development

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Background: Motor challenges are commonly reported in individuals with ASD (Fournier et al., 2013), and fine motor skills during tablet play were shown to reliably distinguish between children with autism spectrum disorder (ASD) and children with typical development (Anzulewicz et al., 2016). However, it is unclear whether gross motor movements would similarly distinguish youth with ASD and youth with typical development. Understanding markers of gross motor function that are more common in ASD would help clarify the nature of motor challenges in this population.

Objectives: (1) Use machine learning to determine whether whole body movement and postural stability during balance tasks can reliably distinguish between youth with ASD and youth with typical development. (2) Investigate whether the results of our machine learning classification corresponded to performance on a standardized motor task. (3) Explore which features of whole-body movement are most informative in the classification algorithm.

Methods: Kinematic and postural sway data were collected in 46 youth with ASD and 18 age-matched youth with TD (ages 7.0-17.9 years), as part of a biofeedback-based videogame training to enhance balance in youth with ASD (Travers et al., 2018). Kinematic data from one-hour sessions were recorded with a Microsoft Kinect Camera, and postural sway data were recorded with a Wii Balance Board. Given the heterogeneity within the ASD profile, a 3:1 ratio of ASD to TD was selected, to allow the motor data to be representative of the diversity within the autism spectrum. Training sessions 2-4 (of 18) were used in these analyses to characterize motor skills before the majority of the training (sessions 5-18) but after the initial intake assessment (session 1). These data were cleaned, informative features were extracted, and an ensemble of random forests were trained. The intake session included confirmation of an ASD diagnosis (providing training labels) and a standardized measure of overall motor function (Bruininks & Bruininks, 2005).

Results: The machine learning algorithm demonstrated average sensitivity of .90, average precision of .84, and average F1 score of .86, using 5-fold cross-validation. The machine learning results were highly correlated with the standardized motor scores, $r = -.50$, $p < .001$, suggesting that the machine learning results aligned with an outside measure of motor ability. Postural sway movement was the feature that most robustly distinguished between the two groups, followed by movement in the right shoulder, left foot, right hand, right foot, left hand, right wrist, neck, and right elbow.

Conclusions: Gross motor features during a balance-training task were able to distinguish between the youth with ASD and the youth with typical development with a high degree of sensitivity and precision. Further, the metrics rendered from the machine learning were highly related to overall motor skill, suggesting that our data and machine learning results were representative of participant motor function (and not other potential sources of noise in the data). The results further suggest postural sway data (both left-to-right and forward-to-back movement) may be a distinctive feature for individuals with ASD and a key skill to target in therapy.

275 **147.275** How Do Adults with ASD Respond to Volatile Stimuli? Behavioral and Neural Evidence

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Background: Adults with autism spectrum disorder overestimate the volatility of their sensory environment (Lawson et al., 2017), which should theoretically correspond to longer reaction times and reduced accuracy in discrimination tasks. The neural mechanism underlying this overestimation may be grounded in brain areas known to preferentially encode features (e.g., quality) and sensitive to repeated exposures (Li et al., 2008).

Objectives: We investigated these hypotheses in a sample of adults with autism (ASD group, n=20, 8F) and neurotypical controls (TD group, n=14, 8F) by presenting olfactory stimuli which are naturally volatile and dynamic, and whose perception is generally not consciously rehearsed.

Methods: Participants were presented with subjective ratings during a behavioral olfactory discrimination task and a cross-adaptation task performed during fMRI. Four odorants followed a 2x2 design of two qualities (minty vs. floral) and two chemical groups (ketone vs. alcohol); for instance, one odor had a minty quality which came from a molecule containing either a ketone or an alcohol group. Participants sniffed twice in succession and smelled pairs of odorants that could share perceptual quality (e.g., they were both minty) or the chemical group (e.g., they were both ketones). Participants smelled 40 pairs of odorants (cued by the words 'sniff now') in a pseudo-randomized order 4.25s apart with trials separated by 24s of clean air to minimize sensory habituation. Participants had to decide whether the two odorants were the same or different.

Results: For the odor-quality (i.e., minty vs floral) discrimination task, the ASD group does not show the same reaction time benefit for “same” odor pairs as the TD group, and the interaction of condition (same vs. different odor) and group (ASD vs TD) is statistically significant. The same interaction pattern is significant for accuracy rates. Subjective ratings of familiarity changed significantly in the ASD group over the course of the task, increasing from 42/100 to 58/100 on the visual analog scale; the TD group started at the same level where the ASD group ended (60/100) and did not change with time. In the TD group, the “mintiness” rating seems to be is driven by the ketone odor, whereas the “floralness” rating is

driven by the alcohol odor; in the ASD group, ratings of odor quality were not tied to chemical group. Analyses of fMRI data are ongoing. Preliminary data suggest suppression of activity following the presentation of two stimuli sharing one feature in the TD but not in the ASD group (Rosen et al., 1998) and the same pattern (TD not ASD) of odor-evoked activity in posterior piriform cortex (PPC) which significantly decreased (cross-adapted) in response to qualitatively similar, but not to chemically similar, odorant pairs.

Conclusions: In line with the hypothesis of overestimated volatility, the ASD group takes longer, with decreased accuracy, to discriminate pairs of odorants even for perceptually-similar olfactory stimuli. We discuss implications for treatment of uncertainty and anxiety and in everyday life.

276 **147.276** Identifying Interests Related to Literacy in Preschool Autistic Children: Results of the New Autism Toddler Strengths and Interests Questionnaire

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Background: Klin, Danovitch, Merz and Volkmar (2007) showed that 75% of young autistic children (age 2 to 6) with typical intelligence present intense interests. However, few studies and instruments have documented intense interests in autistic children at age of diagnosis. Moreover, diagnostic instruments give little information on the nature of autistic interests, despite documenting their restriction and intensity. In contrast, an abundant literature based on questionnaires or interviews indicates that intense interests are valued by parents of typical children and may be used for motivational and learning ends (Hume, Lonigan et McQueen, 2015).
Objectives: To compare parental reports of young autistic children's interests to those of typical children using the recently developed Autism Toddler Strengths and Interests Questionnaire (ATSIQ).

Methods: The ATSIQ, is composed of 19 close- and open-ended questions, documenting the child's interests and how the parents perceive these interests. 20 parents of autistic children (mean age = 60.75 months SD= 8.27) and 20 parents of typical children (mean age = 53.40 months SD= 15.17; p=.067) participated in a semi-structured phone interview using the ATSIQ. Non-parametric tests (U Mann-Whitney) were performed to compare groups on 1-the frequency of each topic of interest and 2- the parental perception of the child's interests.

Results: Four topics of interest were significantly more frequent in autistic children: Letters, Numbers, Electronics (computers/tablets /smartphones) (all *p*'s<.05) and Logos (*p*<.01). These were also considered more intense by the parents (*p*<.05) compared to interests in typical children. Seven topics of interest were significantly more frequent in the typical group: Play with friends (*p*<.001), Stuffed animals (*p*<.01), Books, Symbolic play, Legos, Cars, and Insects (all *p*'s<.05). Parents' perception of their child's interests was less favorable in the autistic group (*p*<.001).

Conclusions: The present study indicates a higher frequency of interests related to literacy in preschool autistic children compared to typical children. Literacy skills emergence in young autistic children is associated to the strength profile seen in this population's development trajectory (Ostrolenk et al. 2017; Westerveld et al. 2016; Mottron et al. 2013). However, the results suggest a less favorable parental perception of interests in autism. The next step of the present study is to perform a qualitative analysis that will provide more information about the nature of the child's principal interest and its context of emergence. Since parental attitude toward their child's interests tends to favor learning in typical development (Lukie, Skwarchuk, LeFevre et Sowinski, 2014), the ATSIQ could be useful in informing parents about the nature and value of their child's interests.

277 **147.277** Impaired Olfactory Detection and Identification in Children and Young Adults with ASD

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Background: Individuals with autism spectrum disorder (ASD) often experience significant sensory processing differences, including atypical chemosensory (i.e., taste and smell) functioning. Carefully characterizing olfactory differences in ASD is important given the functional impact they may have on the significant feeding challenges in this population, as well as shared neural circuitry between olfactory and social regions. Extant olfactory findings in ASD have varied, with some studies finding lower detection and/or identification in individuals with ASD and others finding no differences. Further research is needed to reconcile these findings, including controlling for other factors affecting performance, and to examine whether olfactory differences are specific to ASD or present in the broader phenotype.
Objectives: This study aimed to clarify and extend the ASD olfaction literature by examining detection and identification abilities in a large, well-characterized sample of children and young adults with ASD, while also assessing other factors that might influence performance (e.g., exposure, receptive language). To examine shared genetic and environmental factors, participants with ASD were compared to both unaffected siblings and typically developing (TD) controls.

Methods: Participants were 85 children and young adults with well-characterized ASD, 49 unaffected siblings of the participants with ASD, and 66 unrelated TD controls. Ages ranged from 10-24 years, and groups did not differ by age. IQs were > 70. Receptive language was also measured with the PPVT-4, which has a similar response format to the identification task.

Olfactory detection thresholds were determined using the Smell Threshold Test, in which varying concentrations of phenyl ethyl alcohol were presented bilaterally in a two-interval forced-choice adaptive paradigm. Odor identification was assessed using the University of Pennsylvania Smell Identification Test (UPSIT), in which participants identified a target odor amongst four choices (presented with photographs in this study to decrease verbal demands). Finally, each participant's prior exposure to UPSIT target odors was assessed via parent-report questionnaire.

Results: Kruskal-Wallis analysis of variance (ANOVA) revealed an overall group difference in olfactory detection, X^2 (2)=19.65, *p*<.001. Follow-up comparisons indicated that individuals with ASD had higher (worse) thresholds than siblings (*p*<.001) and TD controls (*p*=.001), who did not differ. Olfactory identification, analyzed via ANOVA, also revealed an overall group difference, *F*(2,195)=16.65, *p*<.001. The ASD group showed worse identification compared to siblings (*p*<.001) and controls (*p*<.001), who did not differ. To account for differences in exposure, we calculated adjusted scores based only on target odors each participant had previously experienced. After adjusting for exposure history, the ASD group remained significantly worse than both siblings (p<.001) and controls (p=.02). A similar pattern of results emerged after controlling for age, gender, receptive language, and olfactory detection abilities.

Conclusions: These results support reduced olfactory detection and identification abilities in children and young adults with ASD, even after

controlling for other factors influencing task performance. Furthermore, unaffected siblings demonstrated intact olfactory abilities, which were statistically comparable to TD controls, suggesting a unique olfactory phenotype in individuals with ASD, which does not extend to full siblings without the diagnosis.

278 **147.278** Inhibitory Control of Prepotent Eye Movements in ASD

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Background: Impairments in inhibitory control (IC), or the ability to suppress a dominant behavioral response, are common in individuals with autism spectrum disorder (ASD). Multiple psychological and neurophysiological processes contribute to successful IC, though the extent to which these distinct processes are affected in ASD is not known. We previously have documented that individuals with ASD show a reduced ability to proactively delay response onset during a manual motor stop-signal task which contributes to failures inhibiting contextually inappropriate responses. Relative to manual motor behaviors, eye movements are highly automated, more difficult to inhibit, and more closely linked to discrete neurophysiological processes. Characterizing IC of eye movements in ASD may provide key insights into spared and affected psychological and neurophysiological processes.

Objectives: To characterize oculomotor inhibitory control impairments in individuals with ASD.

Methods: Sixty individuals with ASD aged 5-29 years and 65 age- and gender-matched typically developing controls completed an oculomotor stop-signal task (i.e., countermanding). During this task, the majority of trials were GO trials, on which participants made rapid eye movements (i.e., saccades) toward peripheral targets (12 degrees to the left or right of center). The remaining trials were STOP trials, on which a stop signal appeared at variable intervals following the peripheral target (i.e., stop signal delays) to cue the participant to inhibit the saccade. Stopping accuracy (i.e., the percent of STOP trials successfully inhibited), estimated reaction time of the stopping process (SSRT), and reaction time slowing on GO trials (RT slowing) compared to a baseline RT task were examined.

Results: Individuals with ASD exhibited reduced stopping accuracy compared to controls, especially for rightward targets. Compared to controls, individuals with ASD also showed reduced RT slowing that was more severe for rightward targets. SSRT did not differ between groups. Across both groups, increased age was associated with higher stopping accuracy and RT slowing, and these effects did not differ as a function of group membership.

Conclusions: The results indicate that inhibitory control deficits in ASD reflect a reduced ability to strategically delay behavioral responses as evidenced by reduced RT slowing. These findings suggest that fronto-striatal pathways necessary for top-down proactive inhibitory control are compromised in ASD. Additionally, these impairments were found to be more severe when inhibiting rightward eye movements. Because rightward eye movements are controlled primarily by the left hemisphere, our findings suggest a lateralized deficit in communication between higher-level cognitive systems and motor control processes in individuals with ASD. Alternatively, as prior brain activation findings indicate that inhibitory control processes are right hemisphere dominant, our findings also may indicate inter-hemispheric communication impairments in ASD.

279 **147.279** Kinematic Performance during a Human-Robot Imitative Gesturing Task Differentiates Autism Spectrum Disorder (ASD) from Typical Development and Correlates with Clinical Assessments of Motor Skills

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Background: Individuals with Autism Spectrum Disorder (ASD) may have difficulty imitating social-communicative gestures, perhaps in part due to significant challenges in areas of motor control including postural stability and coordination. Currently, assessment of a person's ability to appropriately use gestures relies on subjective observation and parent-report. While useful clinically, these approaches do not identify kinematic signatures of ASD and typical development (TD) that may enhance our understanding of the underlying mechanisms driving imitative gesturing differences. Technologies such as motion-capture and robotics may help to quantify motor problems in ASD.

Objectives: We aimed to quantify differences in imitative gesturing between ASD and TD using motion capture during human-robot interaction. We also aimed to determine whether scores on common clinical measures of motor function and symptom severity capture the full scope of imitation difficulties in ASD.

Methods: Thirty-two participants with ASD (n = 18) and TD (n = 14) imitated unilateral and bilateral social gestures of an interactive robot (e.g., wave). Participants and the robot were instrumented with reflective markers on corresponding head and body locations. Body position during imitation was tracked by an infrared motion-capture system. We used Dynamic Time Warping (DTW) to quantify the degree to which the participant's and robot's movement were aligned across the movement cycle. Participants also completed a battery of social, motor, cognitive, and behavioral assessments.

Results: We used repeated-measures ANOVA to test main and interaction effects of gesture type (fist bump, give, hug, wave, ask, celebrate) and group (ASD, TD) on imitation accuracy (DTW cost), including age as a covariate in the model. The main effect of gesture type was significant (F(5, 145) = 37.92, p < .001) with all gestures differing significantly from one another (ps < 0.005) except for "celebrate" and "wave". The main effect of the covariate, age, was significant (F(1, 29) = 5.27, p = 0.29,η_p^2 = 0.15), but its interaction with gesture was not (p > 0.05). The main effect of group was nonsignificant (F(1, 29) = 2.11, p = 0.16), with low observed power (0.29). The interaction of gesture and group was significant (F(5, 145)= 2.56, p = 0.03, η_p^2 = 0.08), with the ASD group demonstrating significantly lower accuracy for the "fist bump" and "celebrate" gesture types than the TD group. Imitation accuracy was correlated with MABC-2 aiming & catching, balance, and total scores for both the "fist bump" and "celebrate" gestures (ps < 0.05), but not ADOS-2 scores.

Conclusions: Preliminary results revealed kinematic differences between ASD and TD in imitative accuracy, which related to clinical motor assessments. Future analyses will include examination of positional matching for specific joint angles (e.g., elbow flexion/extension), as well as correlational analyses for additional clinical tests. Imitative gesturing is a building block to later development of social-communication skills; difficulty with reproduction and functional use of gestures may negatively impact social engagement, and in turn, learning opportunities. It is

important to understand the underlying motor control and sensorimotor integration mechanisms that support imitative gesturing in ASD in order to identify appropriate intervention targets.

280 **147.280** The Relation between Preference for Predictability and Autistic Traits

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Background: A common idea about individuals with autism spectrum disorder (ASD) is that they have an above average preference for predictability and sameness. In fact, this idea is central to recent predictive coding accounts of ASD, that propose that a deficit in dealing with unexpected information could be the single impairment accounting for all ASD symptoms. However, the precise mechanisms underlying these preferences received surprisingly little attention in research.
Objectives: In the current study, we investigated whether we could observe this common symptom of ASD under controlled experimental conditions using three different paradigms. We used a dimensional approach in order to estimate the correlation between autistic traits and preference for predictability.

Methods: A large sample of participants (*n* = 164) was presented with three tasks that each measured preference for predictability in a different way, including both explicit and implicit measures. The first task assessed aesthetic preferences for sequences of tones that varied in their predictability. In the second task, we measured preference for perceptual fluency. The third task consisted of choosing between decks of cards with reward outcomes varying in predictability. Autistic traits were measured by using the Autism Spectrum Quotient (AQ) and Social Responsiveness Scale (SRS).

Results: We observed a significant positive correlation between autistic traits and preferences for both predictable sequences of tones and perceptual fluency. However, there was no correlation between behavior in the cards task and autistic traits.

Conclusions: These results show that there is a relation between autistic traits and preference for predictability in a standardized lab environment, but that this is restricted to specific situations. Our findings might indicate that the correlation is only apparent when preferences are explicitly measured as compared to implicitly investigated, and that transferring preferences from one context to another might be disturbed in ASD. However, as these studies are only a first step towards a better understanding of insistence on sameness, more research is necessary. Overall, we hope that these studies might inspire future systematic investigations into this key symptom of ASD.

281 **147.281** Problems with Sensory Information Processing in Sexual Offenders with an Autism Spectrum Disorder Who Are Treated in a Forensic Psychiatric Clinic. a Qualitative, Exploratory Study.

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Background:
In recent years abnormalities in sensory functioning have been increasingly regarded as an important, even a central characteristic of autism spectrum disorder (ASD). Yet these abnormalities are still a neglected area in the forensic diagnosis and treatment of offenders with an ASD.

The current study was conducted in a (medium risk) forensic psychiatric clinic and out- patient clinic in the Netherlands, specialized in the treatment of (high functioning) sexual offenders with an ASD.

Research shows that the diagnosis ASD, on a group level, does not imply an increased risk for sexual offending. With regard to people with ASD who did commit sexual crimes, theorists have hypothesized that almost every characteristic of the autistic phenotype could potentially contribute to the likelihood of committing such an the offence. Abnormal sensory information processing however, is a neglected area in this respect.

Objectives:

The objective of this study was to explore the role of abnormal sensory information processing in the lives of forensic ASD patients who committed sexual offences. The research questions were:

- Do these patients in effect experience abnormalities in their processing of sensory stimuli?

- Do these abnormalities pose problems for them in their everyday lives and, if so, how do they cope with these difficulties?

- Do they perceive a relationship between these problems and their criminal sexual behaviour?

Methods:

Eight adult male patients participated after informed consent. Research design: 'thematic analysis', a qualitative method for identification and analysis of patterns in a qualitative dataset. Specialized software (Atlas.ti) was used to facilitate analysis. The data were acquired with a semi-structured interview. The interviews were taped and transcribed. A set of codes covering all aspects of the phenomena under investigation was carefully constructed. The interviews were subsequently coded and the analysis was conducted on the resulting data.

Results:

All respondents experienced several types of abnormal sensory information processing. Visual, tactile and auditory oversensitivity were the most prevalent. Five patients had problems with the filtering of multiple sensory stimuli or with the integration thereof. Seven out of the eight respondents experienced severe problems as a result of their abnormal sensory processing. Problems that affected their social relationships in a negative way were most mentioned. Coping strategies that patients used were overwhelmingly the avoidance of situations involving problematic sensory stimuli. In the majority of cases this resulted in social isolation. Four out of eight patients described a relation between these sensory problems and their sexual offences.

Conclusions:

Although this exploratory study has its limitations, the results indicate that abnormal sensory processing may pose real problems for many forensic patients with ASD who committed sexual offences and may be a risk factor for offending. Careful assessment of, and attendance to, these

problems may improve treatment quality and contribute to the reduction of recidivism.

Poster Session
148 - Social Cognition and Social Behavior
5:30 PM - 7:00 PM - Room: 710

282 **148.282** Conjoint Effects of ASD Status and ADHD Symptom Severity on Inflated Social Self-Perception in Youth

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Background:
Inflated self-perception, or positive illusory bias (PIB) is a common phenomenon in youth (Barry, 2011), particularly among those with ADHD (Owens et al., 2007; Emeh et al., 2014). PIB is associated with negative outcomes in individuals with ADHD including aggressive behavior, poor social functioning, and poor treatment response (Hoza et al., 2010; Mikami et al., 2010). Recent research suggests that PIB may also be evident in individuals with ASD (Lerner et al., 2012). Crucially, ADHD is highly comorbid with ASD, with up to 80% of individuals with ASD meeting criteria for ADHD (Rommelse et al., 2010). Due to the high rate of comorbidity, it is plausible that PIB in individuals with ASD is an artifact of their ADHD symptoms, rather than a unique phenomenon in ASD, or that ASD and ADHD confer additive influences. To date, no study has investigated this conjoint influence in PIB.

Objectives:

To investigate the relative contributions of ASD status and ADHD symptom severity on PIB in a large sample of youth with and without ASD.

Methods:

Parents completed a developmental history questionnaire on 142 youth (102 male) ages 7-17 (M_{age} = 12.51, SD_{age} = 2.46) which included information on diagnoses. Adolescents and their parents completed the Social Skills Improvement System (SSIS; Gresham & Elliot, 2008), a measure of social skills. ADHD symptom severity was measured using the parent-reported ADHD Combined-type severity score from the Child & Adolescent Symptom Inventory (CASI-5; Gadow & Sprafkin, 2013; Table 1). Effects were also examined for Hyperactive- and Inattentive-type ADHD. PIB was measured using difference scores on the SSIS (see Table 1). Hierarchical multiple regression was used to predict PIB based on ASD status (to ascertain the relationship of ASD diagnosis to PIB), ADHD severity (to determine its relative influence on PIB), and their interaction (to determine if any ADHD severity effect is unique to those with ASD), controlling for ADHD status (to isolate symptom severity and clinical diagnosis effects).

Results:

ASD status predicted PIB (Table 2). After controlling for ASD status, ADHD severity predicted PIB, and ASD status no longer predicted PIB (Table 2). This effect held after controlling for ADHD status and the ASD status x ADHD severity interaction. Effects did not differ by ADHD symptom type.

Conclusions:

This is the first study to examine the conjoint effect of ASD status and ADHD symptom severity on PIB. While ASD status predicted PIB, this effect was reduced when ADHD severity (itself a predictor of PIB) was modeled. This was neither attributable to ADHD diagnosis, nor specific to youth with ASD. Thus, results suggest that, in a sample of youth with and without ASD and ADHD, while ASD does confer elevated PIB, this effect is partially accounted for by ADHD symptom severity regardless of ASD status. This suggests the presence of shared additive (but not multiplicative) influence of ASD status and ADHD symptom severity on social self-perception. Given the high rate of ADHD symptoms in ASD populations, this helps explain how and when PIB manifests in youth with ASD.

283 **148.283** Coordinating Attention to Faces Relates to Response to Joint Attention in the First Year of Life

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Background:
Responding to joint attention (RJA), or the ability to share attention to an object with another, emerges in the first year of life and is a pivotal skill, foundational for later language and social development. The relative roles of social understanding and features of objects in the environment for early RJA have long been debated (Moore & Dunham, 1995), and are central to understanding the emergence and developmental significance of RJA, and RJA-related deficits in autism spectrum disorder (ASD).

Bakeman and Adamson' (1984) characterized two interactive infant-caregiver play states. During *passive joint engagement*, infants focus primarily on a shared object in the presence of another. *Coordinated joint engagement* involves infants' active coordination of attention between another person and an object, increases from 6 to 18 months, predicts language outcomes, and exhibits deficits in toddlers with ASD (Adamson et al., 2009).

Objectives:

This study takes a micro-analytic approach to quantifying passive and coordinated joint engagement states in the context of RJA. This study examined whether where infants look directly after responding to an RJA bid was associated with response sophistication. We hypothesized that the amount of social gaze directly after RJA would increase with age, and positively relate to RJA sophistication, while the amount of non-social gaze directly following RJA would decrease with age and not relate to RJA sophistication.

Methods:

We measured RJA using the Dimensional Joint Attention Assessment (*DJAA;* Elison et al., 2013). This measure characterizes individual differences in infants' RJA abilities using 4 series of hierarchically ordered joint attention bids varying in cue redundancy. Higher DJAA scores (range 0-4) reflect the ability to respond to subtler, less redundant bids (i.e., gaze shift and head turn cues, vs. gaze shift, head turn, *and* verbal cue) for joint attention. The DJAA was administered during naturalistic play at 125 assessments of 90 typically developing infants aged 8 to 16 months

(mean=11.4).

The targets of infants' gaze directly after responding to each RJA bid were coded offline and categorized as *social* (i.e., looking to the face of the experimenter or caregiver) or *non-social* (i.e., looking to a toy, object, or anywhere). The proportion of infants' social and non-social post-RJA looks were calculated for each DJAA assessment. Analyses employed linear mixed models with sex as a covariate.

Results:

Results indicate that age did not predict the proportion of social (t(95)=0.14, p=0.89) or non-social looks (t(121)= 1.52, p=0.13) directly following RJA. However, over and above age-related increases in mean DJAA scores (t(56)=5.43, p<0.01), the proportion of social looking directly after RJA positively predicted mean DJAA scores (t(56)=2.16, p=0.034). Conversely, the proportion of such non-social looks did not predict mean DJAA scores (t(64)=0.96, p=0.34).

Conclusions:

Findings suggest that infants of all ages who reference those around them after responding to an RJA bid exhibit more sophisticated abilities to respond to others' joint attention cues. Despite the central role of objects in joint attention contexts, the ability to coordinate attention with others after following gaze may play an important role in the emergence of RJA sophistication early in life.

284 **148.284** Diagnosis or Not: Dimensional Autism Symptoms Are Related to Adaptive Social Skills across Adults with and without an Autism Diagnosis

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Background: Adaptive social functioning is often impaired in individuals with Autism Spectrum Disorder (ASD) relative to their typically developing peers and is a well-established measure of functional outcomes for these individuals. This discrepancy cannot be explained entirely by intellectual functioning and seems to widen over the lifespan, as research suggests an increase in adaptive functioning deficits in ASD with age. However, less is known about the relationship between subclinical ASD symptoms (i.e., in those individuals who do not meet for a diagnosis but present with symptoms of ASD) and adaptive social skills, which may reveal important, unique needs of individuals who do not currently qualify for services by diagnostic standards. The current study seeks to fill this gap. We hypothesized that dimensional autism symptoms would explain variance in adaptive social skills, above and beyond an individual's intellectual functioning, age, and ASD diagnosis, particularly for adults.

Objectives: To explore the relationship between a dimensional report of autism symptoms and adaptive social skills across individuals with and without autism, controlling for diagnosis.

Methods: A total of 74 participants with and without ASD were included in this study. This included 35 adults (40% Male; 60% ASD) and 39 children (85% Male; 64% ASD) who completed the Adaptive Behavior Assessment System, Second or Third Edition (ABAS) and Autism Spectrum Quotient (AQ). Analyses of adults and children were conducted separately to account for differences in raters and assessment versions. A series of hierarchical regressions were conducted for each age group with ABAS Social Domain standard score as the dependent variable. We first controlled for IQ, age, and ASD diagnosis, and then added the AQ total raw score in the subsequent model. Results of the model comparisons are reported.

Results: For adults, the covariates of IQ, age, and ASD diagnosis accounted for 30.6% of variance in adaptive social skills, although diagnosis was not statistically significant. Autism symptoms on the AQ accounted for an additional 14.7% of variance in adaptive social skills ($\Delta F_{1,30} = 8.06$, associated $p < 0.01$), indicating that greater ASD symptoms were associated with lower adaptive skills. There was no significant relationship between ABAS Social score and AQ total for children. See Table 1 for complete regression results.

Conclusions: This study suggests an association between dimensional autism symptoms and adaptive social skills for adults with and without ASD, even after controlling for ASD diagnosis. We did not find similar results for children, which may be a factor of age-related increases in adaptive skill deficits often seen in ASD. Our study is, however, limited by a small sample size. Future work should evaluate similar relationships with a focus on individuals without an ASD diagnosis, or below the "clinical cutoff" on the AQ, to confirm whether similar results are found within a purely sub-clinical population. In conclusion, this study sets the stage for future research to identify individuals who do not meet for a diagnosis of ASD but nonetheless display adaptive social skill deficits in their daily lives and may benefit from access to similar interventions.

285 **148.285** Differing Anxiety Levels in Youth with Autism Spectrum Disorder, Attention-Deficit Hyperactivity Disorder, and Both Diagnoses

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Background: Attention-Deficit/Hyperactivity Disorder (ADHD) is a common co-occurring neurodevelopmental disorder among youth with autism spectrum disorder (ASD; Lanes et al. 2016). Both children with ADHD or ASD individually, and those with comorbid ADHD and ASD, experience higher rates of total anxiety compared to typically developing (TD) peers (Bauermeister et al. 2007; White et al 2009; Wood & Gadow 2010), which impacts treatment response (Antshel et al., 2011; March et al., 2000). ASD youth often experience separation anxiety (van Steensel et al., 2011), social anxiety and generalized anxiety symptoms, while ADHD youth typically report heightened separation and generalized anxiety (Tsang et al., 2012). Therefore, there is reason to believe that ADHD and ASD may confer differential and conjoint risk for specific anxiety symptoms in youth. No study to date has examined the relative impact of having comorbid ASD and ADHD on specific anxiety symptoms in youth.

Objectives: This study investigates relationships between anxiety, ADHD, and ASD in order to determine if this co-morbidity can affect the presentation of anxiety. It was hypothesized that youth with comorbid ADHD and ASD would experience higher levels of overall anxiety, specifically separation, generalized, and social anxiety symptoms, compared to TD youth and youth with only one of the two disorders.

Methods: 86 participants (M_{age} = 13.71, SD_{age} = 1.83, 63 male) were divided into one of four diagnostic groups (Table 1). The ASD group met the criteria on the ADOS-2 (Lord et al., 2012). Youth who met criteria for ADHD exceeded the ADHD combined-type clinical cutoff on the parent-reported CASI-5 (Gadow & Sprafkin, 2013). Participants and their parents completed a measure of anxiety (MASC-2; March, 2013). One-way ANOVA was used to compare mean anxiety across groups.

Results: ASD+ADHD (*M*=60.13) and ASD only (*M*=59.17) groups had higher total parent-reported overall anxiety than the TD group (*M*=51.41; *p*=.050; see Figure 1). Both the ASD (*M*=58.70) and ADHD (*M*=66.50) groups self-reported greater overall anxiety than the TD group (*M*=51.66; *p*=.04). Regarding specific anxiety symptoms, parent-reported separation anxiety was higher in the ASD+ADHD group (*M*=60.04) than the ASD (*M*=53.03) and TD (*M*=51.31) groups, and in the ADHD group (*M*=64.50) than the TD group (*p*=.03). Self-reported separation anxiety was higher in the ADHD group (*M*=73.00) than the ASD+ADHD (*M*=59.22) and ASD groups (*M*=57.90), all of which were higher than TD (*M*=50.45) youth (*p*<.001). Neither parent- nor self-reported generalized anxiety or social anxiety symptoms differed significantly between groups (all *p*>.15).

Conclusions: Parents reported higher separation anxiety symptoms in the ASD+ADHD group relative to all other groups, while youth with ADHD reported themselves to experience higher levels of separation anxiety in comparison to other groups. When comparing individuals with ASD and ADHD separately, ADHD was particularly associated with co-occurring separation anxiety. Overall, ASD and ADHD both confer risk for anxiety in youth, but those with ADHD may be more likely to develop separation anxiety over other types of anxiety. Our results have implications for the nosology, taxonomy, and etiopathology of these common complex comorbidities in youth.

286 **148.286** Discrepancies between Parent- and Self-Reported Social Skills in Autism Spectrum Disorder: Magnitude and Treatment Effects

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Background:

While most people usually rate themselves as "above average" on objective measures of performance (e.g., test performance; Kreuger & Dunning, 1999), for certain populations the discrepancy between self- and other-report ratings is particularly pronounced (i.e., the positive illusory bias; Hoza et al., 2000; Gresham et. al., 2000). This bias is particularly pronounced among those with developmental disorders. For instance, youth with ADHD persistently over-estimate their own skills relative to others' reports of their skills (Owens et al., 2007). A growing body of literature suggests that youth with autism spectrum disorder (ASD) exhibit a similar – perhaps even greater – discrepancy (Lerner et. al., 2012; Vickerstaff et. al., 2007; Kalyva, 2010). While social skills interventions have been shown to affect parent- and self-reported social skills independently (Gates et. al., 2017; Lerner et. al., 2011), the impact they may have on this informant discrepancy remains unknown. Similarly, it is unclear what role common treatment moderators (e.g., age, sex, comorbidity) may play in this relationship.

Objectives:

To investigate the impact of a social skills intervention program on the discrepancy between parent- and child-rated social skills in adolescents with ASD.

Methods:

Adolescents and their parents (Table 1) completed the Social Skills Rating System (Gresham & Elliot, 1990) before and after participating in an empirically-supported intervention (McMahon et al., 2013) known to increase both self- and parent-reported social skills for youth with ASD (Lerner, Mikami, & Levine, 2011). These activities provided the participants with additional opportunities to practice social skills in an engaging and reinforcing group environment (Lerner, Mikami, & Levine, 2011).

Results:

Adolescents rated their own social skills higher than their parents rated them both pre-intervention ($t(44) = 7.84$, $p < .001$) and post-intervention ($t(44) = 6.53$, $p < .001$). However, the discrepancy between child- and parent-reports was significantly smaller post-intervention than pre-intervention ($t(44) = 2.16$, $p = .04$); this effect was driven by an increase in parent-reported scores rather than a reduction in child reported scores. Hierarchical multiple regression analyses revealed that older adolescents experienced a relatively greater reduction in discrepancy than their younger peers (Table 2).

Conclusions:

This is the first study to assess the impact of a social skills intervention program on the discrepancy between parent- and child-rated social skills for adolescents with ASD. Results indicated that while adolescents with ASD overestimate their abilities relative to parent-report even after undergoing social skills treatment, the magnitude of discrepancy reduces following a social skills intervention program. This indicates two potential explanations for our findings: either the adolescents are showing real improvements and their ratings that reflect increased skill and awareness of the skills, or we are observing parents' tendency to report changes due to expectancy effects that are common within intervention research (Jones et al., 2017). In order to tease this apart and discover the cause of the discrepancy decrease, further research should employ the use of peer-report and observational data of social skills. This will help us to understand if social skills interventions are truly increasing social skills and/or self-awareness.

287 **148.287** Effect of Diagnostic Disclosure on First Impressions of Autistic Adults Made By Autistic and Neurotypical Observers

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Background: Although adults on the autism spectrum (ASD) receive unfavorable first impressions from typically-developing (TD) adults, impressions improve when TD adults are made aware of their diagnosis (Sasson & Morrison, 2017). It is unclear, however, whether these patterns extend to autistic adults evaluating other autistic adults. Some work suggests autistic adults evaluate other autistic adults similarly to TD controls (Grossman et al., 2018), yet other evidence indicates autistic adults perceive autistic adults differently than TD peers (Milton, 2012).
Objectives: This study compared the first impressions of ASD and TD adults made by ASD and TD raters and examined how diagnostic disclosure affected those impressions.

Methods: ASD (*n* = 32) and TD raters (*n* = 62) adults served as rater participants. Each viewed 10 second videos of ASD (n =20) and TD (n = 20) stimulus participants introducing themselves (Sasson et al., 2017). Each video was presented with either an accurate diagnostic label (e.g. ASD adults as "this person has autism" and TD adults as "this person has no diagnosis"), or no label. Raters were then asked to give their first impression of the stimulus participant, rating six traits (e.g., awkwardness) and four behavioral intentions (e.g., desire to live near; Sasson et al.,

2017).

Results: TD stimulus participants were rated more favorably than ASD stimulus participants on awkwardness, attractiveness, and dominance, and received stronger interest in hanging out with, sitting near, and having a conversation with from all raters (*p*s<.002). Compared to ASD raters, TD raters evaluated stimulus participants as less attractive but were more willing to hang out with them (*p*s<.02). ASD raters were more willing than TD raters to live near TD and ASD stimulus participants (*p*s<.03), but TD raters were more comfortable sitting near TD stimulus participants than they were ASD raters (*p*=.03).

Including an accurate diagnostic label was related to more favorable ratings on likeability and trustworthiness, and greater willingness to hang out with and start a conversation with stimulus participants (*p*s<.02), relative to when a diagnosis was withheld.

TD raters gave more favorable ratings to ASD stimulus participants when an accurate diagnostic label was provided compared to no label on awkwardness, likeability, comfort living near, and willingness to start a conversation with (*p*s<.01). In contrast, these patterns did not extend to ASD raters, whose ratings for ASD stimulus participants did not improve with a diagnostic label, and actually worsened for awkwardness ratings (*p*=.04).

Conclusions: Results suggest similarities and differences in how autistic adults are evaluated by TD and ASD adults. Overall, ASD participants were rated less favorably than TD participants by both groups. ASD raters expressed lower interest in hanging out with participants regardless of their diagnosis, and reduced comfort sitting next to TD participants. Further, only TD raters improved their ratings of ASD participants when a diagnosis was provided. ASD raters even evaluated ASD participants as *more* awkward when their diagnosis was known. Diagnostic disclosure therefore appears to improve first impressions of autistic adults made by TD but not by ASD raters.

288 **148.288** Effect of Intranasal Oxytocin on Visual Processing and Salience of Human Faces

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Background: There is still no pharmacological treatment available for improving the core symptoms of autism. Promise has emerged from studies showing that treatment with the neuropeptide oxytocin promotes attention to social cues, and alleviates autism symptoms in patients. However, the underlying mechanisms of oxytocin's actions remain undetermined. Social salience hypothesis suggest that oxytocin increases the salience of social cues, which in turn can modulate the influence of context and inter-individual factors on social behavior. Salience of cues can be manipulated through binocular rivalry, a visual phenomenon that has been extensively used to study visual perception. In a binocular rivalry paradigm the eyes are presented with two discordant images, that compete for visual awareness – i.e. each eye is continuously exposed to only one of two images, but the image that the viewer subjectively perceives is one or the other ("dominant" percept), or a mix of the two ("piecemeal" percept).

Objectives: This study investigates if oxytocin treatment may affect binocular rivalry, a measure of visual perception and interplay of excitation and inhibition in the cortex. Binocular rivalry has been previously shown to be deficient in individuals with autism.

Methods: We recruited 50 male volunteers, and carried out a randomized, double-blinded, cross-over study of the effects of intranasal oxytocin on binocular rivalry. The participants viewed images of social stimuli (faces with different emotional expressions) and non-social stimuli (houses and Gabor patches) as salience of social cues was quantified using duration of dominance for social and non-social stimuli.

Results: We demonstrate a robust effect that intranasal oxytocin increases the salience of human faces in binocular rivalry, such that dominance durations of faces are longer – this effect is not modulated by the facial expression. We tentatively also show that oxytocin treatment increases dominance durations for non-social stimuli.

Conclusions: Our results lend support to the social salience hypothesis of oxytocin, and in addition offer provisional support for the role of oxytocin in influencing excitation-inhibition balance in the brain.

289 **148.289** Efficacy Study of a Social-Communication and Self-Regulation Intervention for School-Aged Children with Autism Spectrum Disorder: A Randomized Controlled Trial

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Background:

The Growing, Learning, and Living with Autism (GoriLLA) group intervention is a blend of two widely used approaches: Structured TEACCHing (Klinger et al., 2006) and Social Thinking (Hendrix et al., 2013; Winner & Crooke, 2009). This intervention is designed to increase social-communication and self-regulation skills in children with ASD, and is parent-assisted to promote generalization of skills. Components of Social Thinking are commonly used for children with ASD, but lack an established evidence-base. In fact, very few RCTs have been conducted with this type of social-cognitive intervention package for young children and even fewer examining the role of parents.

Objectives:

This study aimed to examine the initial efficacy of the GoriLLA group intervention

Methods:

Participants were 17 1st and 2nd grade children with ASD (ages 6 to 9 years), and their parents. A randomized delayed treatment control group (DT) design was used with pre- and post-intervention assessments of parent and child intervention strategy knowledge and generalization of strategies as observed during a parent-child play interaction. Fidelity was monitored at each session. Two follow-up assessments were completed at 3 and 6 months post-intervention, corresponding to pretreatment and posttreatment assessments for the DT group.

Measures

The Child Observation Protocol (COP) is a semi-structured observational measure of child knowledge learned in the intervention. Internal consistency of the COP was fair to good (Cronbach's alpha at pretest = .76; at posttest = .81). ICC for the total score was .97.

The Parent Report of Group Outcomes (PROGO) consists of 12 multiple choice questions tapping parent knowledge related to intervention

concepts. Cronbach's alpha at Time 1= .55, Time 2= .66.

The 3 Box Task (Brady-Smith et al., 1999; NICHD, 1999; Vandell, 1979) is a semi-structured parent-child play observation of social interaction skills. This task served as a measure of the generalization of strategies practiced in the groups to parent-child interactions.

Results:

Intervention fidelity was strong based on measures of attendance, adherence, clinician quality, and behavior management. Repeated measures ANOVAs revealed significant overall time by group effects for the PROGO, $F(1,15) = 7.06$, $p \leq .02$, $\eta 2 = .32$ and COP, $F(1,15) = 6.90$, $p \leq .02$, $\eta 2 = .32$, favoring the intervention group over the DT group. The effects of the intervention did not extend to parent-child interactions. All effect sizes were promising despite the small sample size (see Table 1). ANOVAs from the 3 to the 6 month follow-up assessments showed significant gains in the intervention group $F(1,6) = 10.46$, $p < .02$, but not the DT group $F(1, 8) = 4.10$, $p < .10$, although there was a trend toward replication of the effects of the GoriLLA Group intervention on the COP for the DT group (see Figure 1).

Conclusions:

Overall, the results of this study indicate that the GoriLLA Group intervention package is effective in teaching social-communication and self-regulation concept knowledge to children with ASD and their parents. Both parents and children demonstrated an increase in social-communication and self-regulation knowledge after participating in the intervention as compared to a control group.

290 **148.290** Emotion Dysregulation and Empathic Behavior Among Adolescents with ASD: A Pilot Study

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Background: Empathy is a key component of socio-emotional interaction. Empathy research suggests that individuals with ASD have specific impairments in cognitive empathy (seeking and interpreting socio-emotional cues) whereas their affective empathy (emotional contagion) is intact. However, findings are contradictory, and there may be a gap between the abilities individuals with ASD display in mentalizing tasks and the use of these abilities in real-life situations, due to higher complexity of the latter, thus calling for a use of more ecologically valid paradigms.
Objectives: To explore the mechanisms underlying empathy deficits among adolescents with ASD, using a behavioral paradigm and eye tracking.

Methods: Six adolescent males with ASD (clinically diagnosed and verified using ADOS-2) with no intellectual impairment, and eight typically developing (TD) male controls, matched on age and cognitive abilities, were video-recorded while undertaking the Prosocial Empathic Behavioral Assessment (PEBA) - an ecological paradigm that involves 3 minutes of a friendly interaction with an unfamiliar peer, one minute of a response to the peer's sudden distress (following a disturbing text message), and one minute of a return to friendly interaction. Participants wore eye tracking glasses (SMI model 2WA). Socio-emotional behaviors during the last three minutes of the interaction (friendly-distress-back to friendly, each one minute long) were coded minute by minute by trained blind raters.

Results: Behaviorally, in the *friendly* phase the groups displayed similar levels of appropriate affect, whereas in the *distress* phase adolescents with ASD displayed lower levels of appropriate affect, compared to the TD group. This difference persisted in the *return to friendly* phase. Levels of vocal synchrony differed between groups significantly only in the *distress* phase, due to a decrease in the ASD group. In contrast, levels of facial expression synchrony were significantly lower in the ASD group compared to controls in the *friendly* and *return to friendly* phases only. Eye tracking has shown that whereas in the *friendly* phase fixation time on the peer's upper face was similar in both groups, in the *distress* phase adolescents with ASD fixated less than controls on the upper face, a trend that persisted in the *return to friendly* phase.

Conclusions: These preliminary results demonstrate an altered empathic response in adolescents with ASD, which was characterized by a reduced display of appropriate affect and vocal synchrony and diminished eye gaze to the peer's eye region. The latter may reflect an attempt of participants with ASD to down-regulate their own arousal.

The inappropriate affect and diverted eye gaze persisted when the peer allegedly overcame her distress and restored friendly interaction. Furthermore, when the peer *returned to a friendly* conversation, TD adolescents regained facial expression synchrony, while adolescents with ASD did not. These findings may indicate a difficulty among adolescents with ASD to regulate their own emotions and to adjust them to the partner's changing mental state. Future research could include psychophysiological measurement in order to further clarify the role of emotion regulation in adolescents' empathic behavior.

291 **148.291** Emotion Regulation Skills Predicts Friendship Quality in Children with Autism

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Background: Emotion regulation is associated with a host of positive outcomes in children with and without autism, including increased mental health, academic achievement, and the deduction of problematic behavior. Less is known regarding whether, and how, emotion regulation and dysregulation relate to social outcomes, such as friendship quality and feelings of loneliness.
Objectives: To examine the impact of emotion regulation and symptoms related to emotion dysregulation (externalizing and internalizing behavior) on friendship and loneliness in school-age children with ASD.

Methods: Across four sites, parents and teachers of 106 children with autism aged 5–12 (*M* = 8 years, *SD* =1.5 years) reported on children's emotional regulation skills as well as externalizing and internalizing symptoms, based on the frequency of these behaviors in home and school environments. Four-to-five months later, children reported on the quality of their friendship with their best friend (companionship, conflict, helpfulness, sense of relationship security, closeness) and their feelings of loneliness. Linear regression models were run to examine longitudinal emotion-regulation related predictors of friendship quality and loneliness in the children.

Results: Across time, fewer reported behavior problems and less emotion dysregulation predicted stronger companionship, increased aggressive behavior predicted more conflict, and more frequent externalizing and depressive symptoms predicted greater feelings of loneliness. Girls with autism had stronger companionship, security, and closeness with their best friend and rated their best friend as more helpful than did boys with

autism. Autism symptoms, IQ, and age were not associated with any aspects of friendship quality or loneliness (Table 1).

Conclusions: Results highlight the importance of targeting emotion regulation and mental health in interventions for school-aged children with ASD to help support friendship development and prevent loneliness. Findings also suggest that interventions targeting autism symptoms and IQ may not facilitate friendship development directly and confirm that girls have a protective advantage in friendship development.

292 **148.292** Examining Associations between Self-Report Measures of the Broader Autism Phenotype and Observed Theory of Mind, Auditory Processing and Effectiveness Communicating during a Collaborative Game

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Background:

Autism is increasingly conceptualized as the extreme end of a distribution of autistic traits that extends into the general population, known as the Broader Autism Phenotype (BAP; Sucksmith et al., 2011). Although difficulties with perspective taking are commonly observed early in development in autism (Baron-Cohen et al., 1985), evidence that reduced ToM is an aspect of the BAP in adulthood remains conflicted (Yang & Baillargeon, 2013; Sasson et al., 2013). However, strong evidence supports sensory differences as a core aspect of the BAP (Mayer, 2017; Robertson & Simmons, 2013). The current research investigates associations between self-report measures of the BAP and observed ToM, sensory differences (specifically auditory processing), and *in situ* communication among non-autistic college students.

Objectives:

1. Investigate associations between autistic traits, ToM and auditory processing

2. Evaluate if autistic traits, ToM and/or auditory processing contribute to success playing a collaborative language-based game

Methods:

College students without autism (*N* = 103; Age range = 18-28, 65 females) completed BAP assessments (the BAPQ and communication subscale of the AQ-Adult), ToM (Reading the Mind in the Eyes [RMET] test, The Awareness of Social Inference Test [TASIT]), an advanced test of ToM assessing sarcasm and lie detection using audiovisual stimuli), measures of speech and non-speech pitch sensitivity, and interactive computer-based games (the Columbia Games) requiring verbal communication to reach a joint goal of matching an object to a location described by one's partner (we focus here on accuracy and efficiency).

Results:

After conducting a square root transformation to correct skew in AQ communication, we ran correlations (Table 1). AQ communication and the pragmatic language subscale of the BAPQ were associated with each other and with RMET. The full BAPQ was *not* associated with RMET. The TASIT was only associated with RMET but demonstrated limited reliability; its subscales were not correlated. Heightened communication difficulties on the AQ were associated with *reduced* speech pitch detection while heightened pragmatic language difficulties on the BAPQ were associated with *greater* ability to detect pitch in non-speech stimuli. Only pragmatic language was associated with communicative success playing the game.

Conclusions:

Findings align with prior research conducted with family members of autistic people indicating that different aspects of the BAP represent separable phenotypes (Losh et al., 2008). By highlighting a specific relationship between the pragmatic language aspect of the BAPQ and ToM that was *not* apparent when relating ToM to the *entire* BAPQ, findings suggest that conflicted findings concerning associations between the BAP and ToM among adults may arise because of differences in the BAP and ToM measures used. Although each BAP communication subscale was associated with a different measure of pitch, the pattern of findings suggests that longitudinal research examining if early detection of non-speech relative to speech pitch leads to later communicative difficulties associated with the BAP might be fruitful. Given that the pragmatic language subscale of the BAPQ was the *only* predictor of successful in-person communication, ecologically valid strategies for promoting effective pragmatic language skills may be beneficial for college students with and without heightened autistic traits.

293 **148.293** Explaining Variance in Social Competence in School-Aged Children with Autism Spectrum Disorder

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Background: Social competence likely depends on multiple social-cognitive and social-affective processes, yet few studies have assessed the relative importance of a range of constructs across these domains, and fewer still have done so in children with autism spectrum disorder (ASD). Deficits in theory of mind (ToM) are often hypothesized to substantially impair social functioning, yet evidence for this link is mixed. Empathy is also considered essential for social competence, and an important distinction may exist between cognitive empathy (recognizing or understanding others' emotions) and affective empathy (experiencing others' emotions in oneself).

Objectives: The present study is the first to our knowledge to directly compare relations between social competence and a range of social factors potentially affected in ASD: ToM, empathy, biological motion perception (BMP), social reward, and social anxiety.

Methods: In school-aged children with ASD (n=51, mean age: 11.48 ± 2.11 years, range: 7.11-14.87), we administered standard ToM tasks (Strange Stories and Reading the Mind in the Eyes), a BMP task featuring walking point-light figures embedded in noise, and the Social Reward Questionnaire (SRQ), from which we selected two subscales for the current analysis: Admiration and Prosocial Interactions. Parents reported on their children's ToM abilities (Theory of Mind Inventory (ToMI): Early, Basic, and Advanced subscales), empathy (Griffith Empathy Measure: cognitive and affective subscales), and social anxiety (Screen for Child Anxiety Related Disorders). Social competence was assessed using the Social Affect domain of the Autism Diagnostic Observation Schedule (ADOS).

Due to high collinearity between the ToMI subscales and between cognitive empathy and ToMI Early, we created a composite of these measures representing parent-reported ToM. Similarly, we created a composite of the two highly correlated SRQ subscales. Predictors also included verbal IQ, nonverbal IQ, and age.

To determine the subset of variables that best explain social competence, we performed Bayesian model selection, which quantified evidence (Bayes Factors; BF) for adding each predictor to the null (intercept-only) model. Then, to determine the relative importance of each predictor, we performed a dominance analysis, which calculates the change in R^2 when each variable is added to the model.

Results: Model selection indicated moderate evidence in favor of affective empathy predicting social competence (BF=3.6) but inconclusive evidence for the other predictors. The dominance analysis provided converging evidence, as affective empathy explained the most variance in social competence (11%), followed by verbal IQ (6%) and BMP (4%). The remaining predictors each accounted for 1% or less of the variance.

Conclusions: These findings suggest that for some individuals with ASD, social deficits are partly explained by a lack of emotional resonance with one's social partner. Our results do not support the hypothesized link between ToM and social functioning in ASD. However, we do not conclude that ToM and the other social domains represented in this study have no relevance for social functioning in ASD. Instead, our results could indicate the limitations of several commonly used behavioral measures, which may not capture the cognitive and affective processes most relevant to real-world social functioning.

294 **148.294** Exploring the Relationship between Visual Evoked Potentials and Visual Search in ASD: Results from the ABC-CT Interim Analysis

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Background: Visual Evoked Potentials (VEP) are electrophysiological signals extracted from the visual cortex that are activated when visual pattern changes occur quickly (Odom et al., 2009). Research suggest that adolescent and adults with Autism Spectrum Disorder (ASD) exhibit lower P100 amplitudes in their VEPs compared to the Typically Developing (TD) individuals (Kovarski et al., 2016). It remains unknown how, or if these differences in brain activity are associated with corresponding higher order mechanisms of visual sampling. Visual pathways carry information to areas of the brainstem that organize and effect eye movements. Thus, the timing and organization of early sensory response may affect the planning and organization of eye-movements at a more cognitive level. Consequently, atypical low-level visual processing may be reflected in atypical Visual Search (VS) behavior, as exemplified by eye-tracking literature that has shown less exploratory eye scanning in children with ASD (Sasson et al., 2008).

Objectives: To explore the relationship between low level perceptual visual processing as measured by VEP and potentially higher-level visual search behavior as measured by the proportion of time spent in fixations in a VS paradigm in children with and without ASD.

Methods: 6-11 year olds with ASD (*n*=126) and TD (*n*=55) watched videos of flickering checkerboards (VEP) and viewed static image arrays, with each array composed of five social and nonsocial images (VS). Low-level visual processing was measured through P100 amplitudes during VEP. Higher-level visual processing was measured by fixation ratios (total fixation duration/valid looking time). Fixations were calculated by Li et al. (2016) with 1° spatial threshold and 100ms minimum fixation time. Correlations and ANCOVAS examined the relationships between the variables.

Results: TD showed higher VS fixation ratios (p=.009), suggesting that TD children spent more time extracting information from the scene than the ASD group, and controlling for IQ did not alter this relationship. Consistently, in the ASD group, higher VS fixation ratios were associated with less social impairment (higher ADOS Social Affect severity scores) (r=.19, p=.037). There were no between-group differences in P100 amplitude (p>.05), but within the TD group lower P100 amplitudes were associated with greater social impairment (r=-.15, p=.046). There were no relationships between P100 amplitude and fixation ratios within any of the groups or when the groups were combined even when controlling for age, ADOS, and/or IQ scores.

Conclusions: P100 amplitudes and eye tracking fixation measures were not found to be related in this study. However the VS results suggest that higher-order visual information processing may be impaired in ASD, with reduced visual sampling being associated with more autism symptomatology. The VEP results suggest that, while between-group differences were not observed, it is capturing some aspect of the continuum of social function across the TD population. The lack of relationship between the VEP and VS variables might be due to task differences between the EEG and ET paradigms, but could also signal a fundamental disconnect between neural and neurobehavioral markers. Lower-level visual perception may not prominently influence the higher-order visual exploratory deficits evident in children with ASD.

295 **148.295** Factors That Affect Performance in Children with ASD on the VEP Task: Results from the ABC-CT Interim Analysis

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Background: Autism Biomarkers Consortium for Clinical Trials (ABC-CT) aims to identify biomarkers to reliably measure treatment effects in autism spectrum disorder (ASD). This study focuses on analyses of Visual Evoked Potential (VEP) data collected during the EEG at two time points (baseline and 6 weeks). In the protocol, T2 visits were to occur 28-56 days after the T1 visit. Given that test retest reliability of the VEP (using ICC and presented at INSAR 2018) was .80 for the NT group and .68 for the ASD group, we examined the time between visits as a potential moderator of T1 and T2 response.

Objectives: To evaluate factors that impact data acquisition and the effect of the time of day and days between visits of T1 and T2 visits on the VEP EEG biomarker in participants with ASD.

Methods: Participants were 225 6- to 12-years-old children (TD: *n*=64; ASD: *n*=161) at 5 different sites who viewed videos of flickering checkerboards with central red fixation point while EEG was collected. Some of the outcome variables included total number of good trials, and P1 and N1 amplitude at Occipital Midline ROI.

Results: 79.5% children with ASD and 86% in the NT group provided valid data at T1 (χ^2= 1.249, p = .26). At T2, 83.9% children with ASD and 86% NT children provided data (χ^2= 3.883, p = .05). Time of day was coded as 1: A.M/2: P.M and was similar across both groups points (T1: χ^2=.579, p=.447; T2: χ^2 =3.33, p =.19).

Time between T1 and T2 visits and in whether the participant with ASD has valid T2 data collected (p=0.69) was not statistically significant. 10% children were excluded at T1 when tested at A.M, compared to 19% excluded at P.M, χ^2 = 3.732, p = .053. At T2, 7.8% children were excluded when tested at A.M; compared to 12.2% excluded P.M (χ^2 = .831, p = .36). Mean time between T1 and T2 did not differ for those children with and without T2 data. (p = .14)

Regression analysis showed that T2 performance was significantly predicted by both P1 and N1 amplitude in the ASD group at T1 (F=99.8, p < .001; F=135, p<.001). No effect of time between T1 and T2 or P1 variability was noted in T2 performance (t=-.041, p =.97); however, number of trials viewed at T2 did explain additional variability in the N1 amplitude (t=-1.921, p=.06).

Conclusions: Data loss was similar at T1 for both groups, however more ASD children provided data at T2, suggesting exposure to the protocol improved acquisition in ASD children. Testing time of visit time did not impact acquisition success consistently; however, T1 performance significantly predicted T2 performance in P1 and N1 amplitude. Overall, these analyses provide guidance on use of VEP in longitudinal clinical trials, specifically that children with ASD may perform better (higher acquisition rates) when given multiple times to attempt the EEG experiment; but that the distance between time-points (within a specified time frame) did not alter performance.

296 **148.296** From Bias to Behavior: Predicting Prejudice Towards Autistic Individuals

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Background:

An increasing number of young people with an Autism Spectrum Disorder (ASD) diagnosis are entering the university population, but little research has examined bias that these individuals may experience in the university setting. The existing literature on bias towards individuals with ASD has typically focused on children and offers mixed results. Also, no study has attempted to investigate the connection between bias and behavior in the context of a peer interaction.

Objectives:

This study assessed bias against ASD individuals, by examining whether interacting with an individual they believed to be autistic would influence university students' judgments of and behaviors toward the individual. We also measured both explicit and implicit bias, as well as the relationship between bias and interaction behavior.

Methods:

The participants were 112 undergraduate students from a medium-sized Southeastern university. In Part 1 of the study, participants completed the Societal Attitudes Towards Autism Scale (SATA), an explicit measure of attitudes towards individuals with ASD. Next, participants completed an implicit association test (IAT) to measure implicit biases against individuals with ASD. During Part 2 of the study, participants completed an interaction task in which they spent 3 minutes discussing a neutral prompt with a trained confederate who displayed behaviors consistent with or inconsistent with ASD. A 2 x 2 factorial design was employed, in which the confederate portrayed either an ASD or neurotypical individual, and the participant was led to believe that the confederate belonged to a fictitious ASD Club, or not (non-ASD Club). Non-verbal behavior indicating implicit discomfort in the interaction was subsequently coded by research assistants.

Results:

A total of 56 participants completed all testing sessions and were included in the final data analyses (24 male; M_{age} = 19.00, *SD* = 1.11). Scores on the IAT were significantly higher than 0, p < .001, suggesting an overall implicit bias against ASD individuals. The mean score on the SATA, however, suggested an overall positive explicit attitude towards ASD individuals. Regression analyses revealed a significant IAT x Club interaction, β = .44, p = .015. For the ASD Club condition, there was a significant negative relationship between IAT and non-verbal behavior such that greater implicit bias was associated with more positive non-verbal behavior. For the non-ASD Club condition, there was a significant positive relationship between the two variables such that greater bias was associated with more negative non-verbal behavior. Finally, SATA was associated with more positive non-verbal behavior.

Conclusions:

We found an overall negative implicit bias against ASD individuals but overall positive explicit attitudes towards ASD individuals. Furthermore, more positive attitudes were associated with more positive non-verbal behavior. Implicit attitudes were also associated with non-verbal behavior, but this relationship differed as a function of whether participants thought they were interacting with an ASD individual or not. This work has implications for the experience of college students on the Autism Spectrum. Future research could help establish whether this is a product of social desirability bias.

297 **148.297** Gendered Play Behaviours in Children with and without Autism: A Population-Based Cohort Study

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Background:

Observation that males are more vulnerable than females to autism has led to several theories regarding the relationship between sex, gender and autism. One such theory is the fetal testosterone hypothesis, which proposes commonalities between a typical male cognitive trait profile and autism. This theory suggests that autism represents The Extreme Male Brain (EMB). However, opposing ideas exist, including Gender Identity

Defiance (GID) theory. This proposes that autism is characterised not by a typical male profile, but rather by a presentation that is at variance with sex/gender-typical characteristics.

Objectives:

To test contrasting predictions of the Extreme Male Brain and Gender Identity Defiance theories, via examining gendered play of autistic and non-autistic children.

Methods:

In a longitudinal population-based cohort (N = 10,750) we compared gendered play behaviours in children with and without autism on 3 occasions in early childhood. Gendered play behaviours were ascertained using the Pre-School Activities Inventory administered to parents at ages 2.5, 3.5, and 4.75 years. The Child Activities Inventory was also administered to children at age 8 years. Children with a diagnosis of autism were identified using multiple sources.

Results:

There was no evidence of a difference in gendered play behaviours between children with or without autism at ages 2.5 or 3.5 years. At age 4.75, the play of autistic boys appeared less masculine than that of non-autistic boys (β=-2.5, 95% CI -5.0 to -0.1). The play of autistic girls appeared less feminine as they became older, although these estimates suffered low statistical power (β =+3.4, 95% CI -1.7 to +8.5). Differences in self-reported play at age 8 were broadly consistent with earlier parent-reported differences, continuing the pattern of greater gender typicality for non-autistic children than for autistic children.

Conclusions:

Our results do not support the EMB theory, and are more consistent with GID theory: autism is characterised by sex/gender-variant play, not male-typical play. Importantly, differences appeared to arise through a lack of typical gender development in children with autism. Our findings highlight the importance of examining these differences in a developmental context.

298 **148.298** Hot and Cool Executive Function Have Different Mediating Effects on Theory of Mind in High-Functioning Children with Autism Spectrum Disorder

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Background:

Children with autism spectrum disorder (ASD) often show difficulties in executive function (EF) and theory of mind (ToM). The relationship between EF and ToM has been greatly debated due to their developmental coexistence. Previous studies have mainly focused on the association between the cognitive aspect of EF (i.e., cool EF) and ToM in children with ASD, so understanding of the influence of the affective aspect of EF (i.e., hot EF) on ToM is limited, not to mention the separate influences of cool and hot EF on ToM. Separating EF into cool and hot aspects to understand the linkage between EF and ToM could extend current understanding of the cognitive difficulties of children with ASD and be useful in assessment and intervention in clinical practice.

Objectives:

This study examined the mediating effects of cool and hot EF on ToM to elaborate the link between EF and ToM in high-functioning children with ASD.

Methods:

Children with high-functioning ASD aged from 4 to 12 years old were recruited from hospitals, clinics, and developmental centers in Taiwan between January 2015 and June 2018. Children's ToM, cool EF, and hot EF were respectively measured with the Theory of Mind Task Battery, computerized Dimensional Change Card Sort (DCCS) task, and Children's Gambling Task. The DCCS generates four cool EF variables. Mediation analysis was applied to assess whether cool/hot EF mediated the effect of hot/cool EF on ToM. A complete mediator would have an insignificant direct effect (X→Y) and a significant indirect effect (X→M→Y); a partial mediator would have both a significant direct effect and an indirect effect.

Results:

A total of 118 high-functioning children with ASD (104 boys) participated in this study. On average, they had severe ASD symptoms and average verbal comprehension respectively, as determined by the Social Responsiveness Scale, Second Edition (mean = 78.9, SD = 10.2) and the Verbal Comprehension Index (mean = 106.9, SD = 16.4). The mediation analysis showed that cool EF was a complete mediator of the effect of hot EF on ToM (indirect effect: 0.01 [95%CI: 0.00–0.04] and direct effect: 0.05 [95%CI: -0.00–0.11]), whereas hot EF was a partial mediator of the effect of cool EF on ToM (indirect effect: 0.99 [95%CI: 0.05–2.55] and direct effect: 4.87 [95%CI: 0.48–9.26]).

Conclusions:

Both cool and hot EF were correlated with ToM in high-functioning children with ASD. Interestingly, the influence of hot EF on ToM could occur simply through cool EF, while the influence of cool EF on ToM could happen partially through hot EF. Our findings highlight the necessity of considering the distinction of hot and cool EF in clinical assessment and intervention for children with high-functioning ASD.

299 **148.299** I Just Want to be Loved: Autistic People's Experience of Relationships

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Background:

Autistic peoples' sexuality and functioning in intimate romantic relationships has often been characterised by discourses of asexuality, deficits, need for sexual education, and reifying the purported difference in sexuality (Bertilsdotter Rosqvist, 2013). Although autistic people have difficulties with typical expressions of social-emotional reciprocity, it should not be assumed that they don't have the same need for belonging,

social connection and desire for intimate romantic relationships as neurotypical people, or that they have different, but reasonable needs for these qualities.

Objectives:

The current study is situated within the broader literature of sexual education, while aiming to prioritise the voices of autistic people in sharing their perspectives and experiences of sexuality and intimate romantic relationships. The study is qualitative and exploratory, posing no initial hypotheses. The interpersonal process model of intimacy (IPMI; Reis & Patrick, 1996; Reis & Shaver, 1988) was used to frame research questions, and both autistic and neurotypical individuals were recruited to observe differences and consistencies in experience.

Methods:

Twenty-eight autistic adults and 22 neurotypical adults completed an online qualitative survey. Thematic analysis was employed to identify themes within the data (Braun & Clarke, 2006). The researchers employed a descriptive phenomenological approach within the analysis, focusing on what was explicitly said by participants, prioritising meaning and experience.

Results:

Autistic people described intimacy with romantic partners as a process of mutual support, sharing and the ability to be vulnerable. In terms of maintaining relationships, key themes identified related to emotion regulation and open, direct communication in talking through problems with a partner. Physical intimacy was perceived as an expression of emotional intimacy and important maintaining factor in closeness, however notions of its meaning were variable. Barriers in initiating and maintaining romantic relationships included difficulty expressing needs or emotions, reading and projecting subtle signals (flirting and differentiating between friends and love interests), and feelings of mistrust and negative self-perception.

Likewise, neurotypical people emphasized the importance of open communication and sharing within intimacy. Neurotypical people emphasized the importance of physical intimacy more strongly and maintaining factors in relationships involved learning from the past, intuiting partners' needs, maintaining independence and spending time with friends and others to support oneself through challenges. Both groups demonstrated an understanding of trust as a process that develops over time through an individual's demonstration of character.

Conclusions:

Although autistic people have difficulty with typical expressions of social-emotional communication, the current study demonstrated that mutual support, physical intimacy and open communication are considered important factors in maintaining intimate romantic relationships by most people. Subtle aspects of intimacy, such as interpreting flirting and signs of interest may be a focus for future sexual education for autistic people interested in finding partners.

300 **148.300** Increasing Parent-Child Social Interactions in Preschoolers with and without ASD through Song Books

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Background: Providing natural opportunities that scaffold interpersonal engagement is important for supporting social interactions for children with ASD. Shared musical activities may be an effective way to foster such interactions. For example, children with ASD showed increased eye gaze and turn-taking with a therapist when engaged in music therapy versus play therapy (Kim et al., 2008). However, less is known about whether musical contexts support parent-child interactions. Beyond focusing only on children, musical activities may be helpful in supporting parents' behavior during parent-child interactions because music is a natural, familiar, and predictable activity. We use a dyadic book sharing activity to examine the impact of music and song on parents' and children's interpersonal engagement.

Objectives: Examine interpersonal engagement (visual attention and movement coordination) in parent-child dyads during picture book versus song book interactions.

Methods: Nine children with ASD (7 male, M=3.56 years) and twelve typically developing (TD) children (8 male, M=2.92 years) were video recorded during a 5-minute picture book and a 5-minute song book activity with their parents. Parents' and children's visual attention were manually coded using a five-second partial interval coding schema (Klimenko, 2007) that assessed attention to the book and/or gaze toward the partner. Wilcoxon paired sign-rank tests compared child and parent mean visual attention scores during the picture book and song book activities. Movement profiles were extracted from one-minute video clips of the same activities using a frame-difference-method. Granger causality analyses were used to examine interpersonal coordination.

Results: Across all dyads, children demonstrated greater sustained attention to the song books than to the picture books (W=27, p=0.007). Children with ASD showed marginally greater sustained attention during the song books (W=5, p=.08), while TD children demonstrated significantly greater sustained attention to song books (W=9, p=0.037), though the magnitude of the effect was small. Overall, parents showed greater gaze toward their child during the song books than during the picture books (W=12, p=0.0001), which was also evident in parents of only the TD children (W=5, p=0.005) and ASD children (W=2, p=.02). Movement analyses indicated that children Granger-caused parent movement activity more during the song books than the picture books (p<.05), suggesting greater parent responsiveness during the song books.

Conclusions: Song books, as compared to picture books, appeared to create a context that scaffolded parent-child engagement. Children increased sustained attention to the books and parents increased eye gaze toward their children during song book versus picture book activities. The parents' increased gaze to their child during the song book activity may have impacted their movement coordination with their child, as parents' movements were more responsive to their children's movements in this context. Song activities may be an accessible activity that support parent-child engagement due to their familiarity and predictability. Further analyses with an expanded sample size will compare behavior before and after participation in a ten-week parent-child music class involving music-based parent training for social engagement.

301 **148.301** Individuals with Higher Levels of Autistic Traits Are Less Susceptible to Social Conformity on a Perceptual Decision-Making Task

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Background:
Previous research on social influence processes in typically developing individuals has suggested that subjective social norms can influence individuals' perceptual judgments, with group influence exerting an effect on judgments. The opinions of others seem to change an individual's perceptual judgment, which is thought to be an effect of conformity.

Key diagnostic criteria of autism spectrum disorder (ASD) include social impairment, such as reduced sharing of interests, emotions, or affect. Individuals with ASD also often have difficulty with theory of mind, including the ability to take on another's perspective. Consequently, individuals with ASD may be expected to conform less than typically developing individuals due to the social difficulties inherent to ASD.

Objectives:

The current study seeks to examine susceptibility to social influence (i.e., conformity) in the context of a perceptual decision-making task in adults with high and low levels of autistic traits.

Methods:

Participants included 40 undergraduate students with normal or corrected-to-normal vision. Participants were asked to indicate the dominant color of squares consisting of 128 x 128 orange and blue pixels. Stimuli ranged from 40 percent to 60 percent orange pixels (e.g., 40% orange/60% blue to 60% orange/40% blue).

Participants first completed 40 trials in which they responded with no social pressure (Block 1). Participants then completed 102 trials (Block 2) in which the alleged responses of other participants were presented before stimulus onset on each trial. Responses were presented consecutively and separated by random delays between 1000 and 2000 ms. The responses of other participants were manipulated such that the majority response was correct for 80 percent of trials to induce social pressure.

Participants completed the Autism-Spectrum Quotient (AQ) following the computer task.

Results:

Overall accuracy was higher in Block 2 compared to Block 1, suggesting that the manipulation of social pressure was effective. For Block 2, preliminary analyses indicate a significant negative correlation between Total AQ scores and accuracy on hard-to-detect trials (with an orange/blue contrast of 49% / 51%) such that individuals with higher AQ scores (i.e., higher levels of autistic traits) performed less accurately (r = -.368, p= .019). There were no correlations between AQ scores and accuracy on easy-to-detect trials, when perhaps relying on either social information or perceptual abilities alone may have led to accurate responses.

Conclusions:

These results suggest that adults with higher levels of autistic traits utilize social information to a lesser extent and are perhaps less susceptible to social conformity, resulting in lower accuracy on very difficult trials of a visual perception task. Future work will explore this relationship in individuals on the autism spectrum in a similar experimental task.

302 **148.302** Interpersonal Movement Coordination in Adults with Autism Spectrum Disorder (ASD): A Potential Tool for Addressing 'Female Camouflage'?

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Background: When individuals engage in social interactions, they coordinate their nonverbal movements such as facial expressions and gestures. This movement coordination is associated with increased rapport and social connection between partners (Miles et al., 2009). Emerging research in ASD has suggested atypical movement coordination in the population (Zampella & Bennetto, 2018), but individual differences are yet to be examined. Interestingly, recent work demonstrates that females with ASD present more typical socio-communicative behaviours (e.g., gestures) relative to males. This strength in females with ASD may 'camouflage' other diagnostic features, resulting in under-diagnosis (Rynkiewicz et al., 2016). Here, we used a novel movement analysis method to explore whether interpersonal movement coordination, a hallmark of successful communication, may differ between males and females with ASD.
Objectives: 1) To utilize a novel, optic-flow methodology to determine whether movement coordination during interaction differs between males and females with ASD, and 2) evaluate how this compares to potential sex differences in movement coordination in neurotypical (NT) adults

Methods: Thirteen adults (3 females; Age: 18-24 years) with ASD without intellectual disability participated. Twenty-six participants will be recruited as NT controls. Participants completed the ADOS-2, Module 4 with a research-reliable administrator while being video-recorded. Semi-structured interview sections of the ADOS (e.g., questions about social interactions difficulties) were selected for analysis. The control sample will be asked the same semi-structured interview questions. Movement coordination was analyzed using Correlation Map Analysis (CMA; Barbosa et al., 2012). CMA uses a standardized optical flow method to assess movement within regions based on changes in pixels across video frames. A moving-window is used to calculate instantaneous correlation between regions. A higher correlation value corresponds to greater coordination. Whole-body regions were identified around the participant and the experimenter to assess movement coordination.

Results: Females with ASD demonstrated greater movement coordination within a much smaller range (Range=.75-.82) than the males (Range=.35-.84; Figure 1). This difference is striking because males and females were similar with respect to age, verbal and non-verbal IQ. Moreover, females exhibited greater coordination despite having higher symptom severity than males (ADOS median calibrated severity score female=9, male=7; Figure 2). Movement coordination between the ASD group and the NT group will be compared. Based on previous work (e.g., Zampella & Bennetto, 2018), we expect that ASD participants will present lower movement coordination compared to NT participants. We also predict a main effect of gender, based on prior results using other methodologies (Hermans et al., 2009). Given that females with ASD present more typical socio-communicative behaviour, we expect a GenderXGroup interaction, such that the difference in coordination between ASD and NT males will be greater than the difference between ASD and NT females.

Conclusions: These preliminary results suggest that there may be intriguing differences in interpersonal movement coordination between males and females with ASD, which need to be investigated in larger samples. Given that females with ASD often 'camouflage' other diagnostic features with their relatively typical socio-communicative behaviours, investigating movement coordination during interaction may provide a tool for better understanding gender differences in ASD.

303 **148.303** Judging Intentionality of Ambiguous Action in an Adult ASD Sample

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Background: Discerning intentional from unintentional actions is a key aspect of social cognition. Mental state attribution literature has consistently shown that people with autism spectrum conditions tend to be less accurate in discerning an agent's intention when there is clearly a right answer. However, little is known about how autistic people attribute intentions when making judgements about ambiguous actions. Understanding 'intention attribution style' in this population will help us gain an insight into everyday mental state processing whereby intentions may be frequently ambiguous.

Objectives: The aim of this study was to determine whether individuals on the autism spectrum differ in their interpretation of ambiguous actions compared to neurotypical controls.

Methods: Participants included 20 adults with a diagnosis of an autism spectrum condition (7 females) and 20 neurotypical controls (11 females). Verbal and perceptual reasoning ability was measured using the Wechsler Abbreviated Scale of Intelligence II. All participants were asked to complete a modified version of Rosset's (2008) Ambiguous Sentences paradigm which measures the proportion of intentional versus unintentional judgements of ambiguous actions.

Results: There were no significant differences in verbal ability or perceptual reasoning ability between groups. The Strange Stories Film task (SSFt; Murray et al., 2017) which measures advanced theory of mind (ToM) revealed a significant difference in ToM abilities between the autistic group and controls. One statistically significant outlier in the ASD group was excluded from analysis of the Ambiguous Sentence paradigm scores. Participants with autism showed a higher intentionality endorsement percentage for ambiguous sentences (M=18.42.91, SD=13.18) than controls (M=13.18, SD=8.59; t(37)=2.04, p=.048). ToM scores did not correlate with intentionality endorsement percentage scores in either group therefore group differences could not be explained by ToM ability.

Conclusions: Our results suggest that high functioning adults with an autism spectrum condition are more likely to perceive ambiguous behavior to be intentional rather than accidental compared to neurotypical controls. This is a noteworthy result in a small sample and suggests group differences in intention attribution style. Over-attributing intentions when interpreting ambiguous behaviour may be a contributing factor to the social difficulties experienced by autistic individuals. As ToM deficits could not explain the increased tendency to perceive ambiguous but prototypically accidental behavior to be intentional, a follow-up study investigating the relation between executive functioning skills and intention attribution style in autism is planned.

304 **148.304** Metacognitive Executive Functioning and Its Relationship to Social Functioning in Children with Autism Spectrum Disorder

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Background:

Previous research indicates there is a negative relationship between both executive function and social communication skills (Joseph & Tager-Flusberg, 2004), as they relate to autism spectrum disorder (ASD) symptoms. As such, understanding the relationship among executive function and social communication processes may provide important information for informing intervention strategies in ASD. However, there is limited research examining the relationship between specific processes of executive function (i.e., metacognition, behavioral/emotional regulation) and other social skills.

There is recent interest in this topic. One study found that both difficulties in behavioral regulation and metacognitive executive functioning predicted deficits in social communication in children with ASD while only the relationship between behavioral regulation and social communication was significant in typically developing children. This suggests that there may be a unique link between metacognitive processes and social functioning in children with ASD (Leung, Vogan, Powell, Anagnostou, & Taylor, 2016). Another study compared metacognition to behavior regulation and found that metacognitive processes were the more important factor in accounting for social function in children with ASD (Torske, Nærland, Øie, Stenberg, & Andreassen, 2018).

This previous research on the relationships among executive functioning skills and social functioning has centered on the use of the Social Responsiveness Scale, 2nd Edition (SRS-2), a commonly used screening tool that identifies social communication difficulties relevant to autism symptomology. There is little research exploring this relationship with more comprehensive measures of social functioning, especially ones that are indicative of every day social skills. To address this, the social skills improvement system-rating scale (SSIS-RS) was selected for this study as it gathers a more global assessment of social functioning with the addition of providing guidance for intervention.

Objectives:

The aim of this study was to explore the relationship between social functioning as measured by the Social Skills Improvement System Rating Scales (SSIS-RS) and executive functioning as measured by the Behavior Rating Inventory of Executive Functioning (BRIEF). We predict that, based on emerging research, metacognition will have a stronger relationship with social skills than behavioral regulation.

Methods:

Fifty-three children with ASD, ages 6-12, with full scale IQ scores above 50, were assessed on parent reported measures of executive functioning (BRIEF) and social skills (SSIS-RS). A linear regression was conducted to examine the relationship between the Metacognitive and Behavioral Regulation Indexes of the BRIEF and the social skills index of the SSIS-RS.

Results:

Consistent with our hypothesis, metacognition predicted social skills (β = -0.32, p = 0.03), with greater difficulties in metacognition indicating lower social abilities. The relationship between behavior regulation and social skills was not significant (β = -0.22, p = 0.15, *ns*).

Conclusions:

Results support previous research suggesting that metacognition plays a larger predictive role in every day social functioning than behavioral regulation. Metacognition involves skills such as working memory, activity initiation, planning/organization, and self-monitoring, which may be improved through direct teaching. These results have implications for developing metacognitive-based interventions that could assist in the

development or improvement of every day social skills in children with ASD.

305 **148.305** Modelling the Percentage Looking Time to Social Scenes – Results from a Large Cohort with Autism Spectrum Disorder

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Background: The social motivation account of Autism Spectrum Disorder (ASD) stresses the role of decreased social interest as an antecedent of socio-cognitive abnormalities in ASD (Chevallier, Kohls, Troiani et al., 2012). One strong candidate to possibly explain this account is reduced spontaneous social attention (e.g. to the human face and social-communicative cues). A number of studies report reduced attention to faces in children and adults with ASD, but others fail to replicate (Frazier, Strauss, Klingemier et al., 2017). Nonetheless, very few studies utilise large samples and a broad age range, and therefore unable to investigate socialattention at particular developmental stages, or the effects of varying degrees of social content in the stimulus.

Objectives: We report on the developmental profile of social attention and its sensitivity to context from childhood to adulthood in a large European cohort of individuals with ASD and controls.

Methods: We used eye-tracking data from the The EU-AIMS Longitudinal European Autism Project (Loth et al., 2017), which included 366 participants with ASD; 268 with TD; age range 6-30. Participants with ASD had an average IQ of 98.69 (SD = 19.48). Participants watched 6 static photographs depicting social interactions (Figure 1c). Trials with a percentage looking time (PLT) to the screen < 25% were excluded from analysis. Group differences in PLT were explored through 3 linear mixed models including the interaction between Areas of Interest (AOIs) 1) head, body and background people 2) face and hair 3) upper and lower face, group (ASD, TD), and age class (child, adolescent, adult), varying intercept per participant, and IQ as a covariate. We tested the linear contrasts of interest by subtracting the estimate of the TD group from the estimate of the ASD group within each age class.

Results: The groups significantly differed in terms of PLT to the head (difference = -2%, p = .01, d = 0.27) and to the face (difference = -2%, p = .01, d = 0.22) in the adolescent age class, and to the head (difference = -4%, p < .001, d = 0.57), the body (difference = 2%, p = .03, d = 0.26), the face (difference = -5%, p < .001, d = 0.55), and the upper face (difference = -4%, p < .001, d = 0.34) in the adult class - with participants with ASD looking on average less to the head/face and more to the body (Figure 1a). Examination of individual stimuli indicated differential sensitivity to group differences (Figure 1b). Analysis of temporal profiles of attention is ongoing.

Conclusions: We observed a tendency in the TD group to increased social attention with age. The ASD group, in contrast, maintained a flat profile. This suggests that reduced social attention is not an invariable feature of the ASD phenotype in childhood. On the other hand, social attention clearly deviates from typical development at later stages of development: the characterization of social attention indexed in this data may represent the consequences of living a life with ASD, with important consequences for intervention.

306 **148.306** Not so Automatic Imitation: Expectation of Incongruence Reduces Interference in Both Autism Spectrum Disorder and Typical Development

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Background:

Individuals with autism spectrum disorder (ASD) exhibit deficits in social functioning. One prominent view is that such impairments are the result of a diminished capacity for imitation; however the underlying mechanisms remain unclear. One recent theory suggests that ASD may be characterized by an aberrant mirror neuron system (MNS), the neural system underlying imitation. Imitative response tendencies can be probed in the laboratory through automatic imitation (AI)–the degree to which observed actions modulate action execution. However, the largest study to date found evidence that AI is intact in ASD, challenging this hypothesis (Sowden et al., 2016). An alternative account suggests that social deficits may instead stem from differences in the ability to exert top-down control of imitation in those with ASD versus those with typical development (TD). Although previous research has suggested that AI is not affected by top-down control in TD (Hogeveen & Obhi, 2013), no research has examined this process in ASD.

Objectives:

To provide further evidence for or against the MNS hypothesis by examining potential differences between ASD and TD in the degree of AI (H^1), and for the control of imitation theory by examining participants' ability to exert top-down control of imitation (H^2).

Methods:

Participants completed two blocks of a paradigm that included both AI and non-imitative control trials (effector priming, EP). Across blocks the congruent/incongruent trial ratio was manipulated such that one block consisted of mostly congruent trials (MC) while the other was mostly incongruent trials (MI). The dependent variables (DVs) were accuracy, reaction times (RT), and drift rate (v) – a combination of accuracy and RT quantifying participants' rate of information processing. Data collection is ongoing for the current study, and at present we examined the control of imitation in ASD (N=27) and an FSIQ case-controlled TD sample (N=27).

Results:

Scores for our three DV's were collapsed across block and submitted to a 2 (stimulus type: imitation vs. effector) x 2 (congruence: congruent vs. incongruent) x 2 (diagnosis group: TD vs. ASD) ANOVA (fig.1). In contrast to the theory of a broken MNS, the degree of AI was equivalent between groups for all three variables (all Fs < 1, BF_{01} > 2), consistent with the notion that the MNS is intact in ASD. Turning to our second hypothesis, interference scores were calculated for each DV and submitted to a 2 (stimulus type: imitation vs. effector) x 2 (block: MC vs. MI) x 2 (diagnosis group: TD vs. ASD) ANOVA (fig.2). For both groups, AI and EP interference effects decreased when the ratio of incongruent-to-congruent trials

increased (MI < MC; *F*s > 13, BF_{10} > 13). The top-down control of imitation was also matched between groups across all variables (*F*s < 1, BF_{01} > 8).

Conclusions:

In agreement with previous work our results demonstrate that AI is unimpaired in ASD and cast further doubt upon the broken MNS theory. Furthermore, we demonstrated that control over AI is similarly unimpaired in ASD, suggesting that for both groups AI is not as automatic as previously theorized.

307 **148.307** Overall Health, Social Functioning, and Motor Functioning of Individuals with High Functioning and Low Functioning Autism Spectrum Disorder

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Background: Individuals with autism spectrum disorder (ASD) experience a myriad of challenges. For example, it has been documented that individuals with ASD have compromised health, social, and motor impairments. Multiple risk factors play a role in their challenges experienced, as well as the severity of these challenges. One of the main risk factors is the level of functioning of individuals. However, there is a lack of research comparing the differences in overall health, social, and motor impairments individuals with low functioning (LF) and high functioning (HF) ASD experience.
Objectives: For this reason, the current study compared overall health, social functioning, and motor functioning among individuals diagnosed with ASD through the analysis of the interRAI Child and Youth Mental Health – Developmental Disabilities (ChYMH-DD) and the interRAI Child and Youth Mental Health (ChYMH) assessments.

Methods: Participants were divided into two groups, high functioning (HF) and low functioning (LF). Two hundred and seventy-two were HF (IQ<70) (60 females, 212 males) with a mean age of 12.77 years (SD=3.16). One hundred and six were LF individuals (IQ>70) (25 females, 81 males) with a mean age of 11.8 years (SD=3.29). Within both groups, more than half of the individuals were 12 years or older. Chi-square tests were conducted to detect differences between groups.

Results: The findings revealed minimal differences between LF and HF individuals with regards to their overall health and motor functioning. However, significant differences pertaining to social functioning were revealed. In addition to discussing the differences pertaining to the social functioning of HF and LF individuals, the study highlights implications arising from this research as well as opportunities for future research.

Conclusions: ASD is a highly variable disorder, in that children with the diagnosis exhibit many different characteristics and deficits. As such, it is important research continues to identify differences across LF and HF individuals allowing for the development of effective spectrum specific interventions and in turn improve quality of life among individuals with ASD. It is anticipated reducing the challenges experienced by individuals with ASD, will in turn reduce stress on their caregivers and family members.

308 **148.308** Parental Responsiveness during Musical and Non-Musical Play for Preschoolers with ASD

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Background: Although a growing body of research is examining connections between music and social development in children with autism spectrum disorder (ASD), there is limited research investigating musical play in parent-child interactions. Parent-child play interactions offer an important avenue for supporting children's social development. Shared engagement and parent responsiveness to children's focus during play are associated with children's social and language development (Gulsrud et al., 2016). Musical play may support interactions because it is familiar, reinforcing, and predictable, which may help children attend to activities and provide parents with an accessible way to be responsive (Lense & Camarata, 2018). However, musical play may also impede interactions due to its sensory and repetitive components.
Objectives: Examine whether use of musical play/toys during parent-child play is related to children's attention and parental responsiveness.

Methods: 8 parent-child dyads of preschoolers with ASD were video recorded for ten minute play sessions that included both musical and non-musical toys (5 male children; M=35.88 months). Videos were coded using a 5-second partial interval schema for engagement in musical play, as well as use of musical toys apart from musical play (e.g., building with drums). Additionally, children's attentional leads and corresponding parental physical toy play or verbal responses were identified. Wilcoxon Signed Rank tests compared differences between children's leads and parental responsiveness during musical and non-musical activities.

Results: Children with ASD spent 35.8%±12% of time engaged in musical play and an additional 22.1%±11% of time engaged with musical toys apart from musical play. Children provided similar numbers of attentional leads when engaged with musical play/toys and non-musical play/toys (W= 9, p = 0.25). Parents showed somewhat greater responsiveness to children's musical play/toy leads (62.1%±16.2%) versus non-musical leads (46.8%±17.0%) (W=5, p = 0.078) but this differed depending on type of responses. Parents provided significantly more physical play responses to musical vs. non-musical leads (p=0.039) but there was no difference in verbal responsiveness (p=0.15). Follow-up analyses restricted only to children's active musical play leads (e.g., playing xylophone, singing) suggested continued parent physical play responsiveness but somewhat reduced parental verbal responsiveness during active music making (p=.078) vs. non-musical play.

Conclusions: While there are substantial individual differences in ASD children's use of musical toys and play during a parent-child free play, engagement with musical play/toys impacted parental responsiveness. Parents provided more physical play responses when their child engaged with musical play/toys potentially due to the familiarity and accessibility of musical activities. Parental verbal responses was not impacted by use

of musical toys alone but may be reduced during active musical play perhaps due to the competing auditory stimuli. Results have implications for incorporation of music into therapy including using musical activities to support parents in following their children's leads and providing responsive input. Follow-up analyses with an expanded sample size will further address different types of play leads and responses.

309 **148.309** Personality Traits Mediate the Relationship between SRS-2 and BASC Composites in Children with HFASD

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Background: Meta-analytic findings indicate that lower levels of Big Five personality traits are associated with ASD and ASD characteristics (Lodi-Smith et al., in press). These traits are related to both internalizing and externalizing behaviors in children with ASD (De Pauw et al., 2011; Schriber et al., 2014) and mediate the relationship between ASD characteristics and positive outcomes in a community sample (Rodgers et al., 2018). These studies suggest that higher Big Five personality traits may be adaptive in ASD, just as they are in individuals with non-ASD diagnoses and the general population.

Objectives: The current analyses replicate and extend this work by testing the relationship among Big Five personality traits, ASD symptoms, and behavioral outcomes with the hypothesis that Big Five personality traits will mediate the relationship between ASD symptoms and behavioral outcomes.

Methods: The relationship among personality traits, ASD symptoms, and behavioral outcomes is tested in 46 children with high-functioning ASD recruited for a larger intervention studies targeted at training social skills (see, Lopata et al., 2012; Thomeer et al., 2012 for inclusion criteria and screening procedures). At intake, parents and children reported on child Big Five personality traits using the Big Five Inventory-2 (BFI-2; Soto & John, 2017). Parents also completed the Social Responsiveness Scale – Second Edition (SRS-2; Constantino & Gruber, 2012) and the Behavior Assessment System for Children (BASC-2, Reynolds & Kamphaus, 2004; BASC-3, Reynolds & Kamphaus, 2015). Children were an average of 9.14 years (*SD* = 1.82, range = 6 – 12), were primarily male (*n* = 46, 95.8%), and White and not of Hispanic or Latino descent (*n* = 40, 83.3%). All analyses were conducted in *R* and *SPSS*.

Results: Parent reports of child conscientiousness, agreeableness, emotional stability, and extraversion were negatively associated with SRS-2 total scores, social communication scores, and restricted and repetitive behavior scores as well as BASC scores of internalizing and externalizing problems, and behavioral symptoms. Parent reports on each of these traits were also positively correlated with BASC adaptive skills. The only significant correlations for child reports were negative correlations between emotional stability and BASC externalizing problems and behavioral symptoms. Neither parent or child reports of openness to experience were significantly correlated with SRS-2 or BASC scores. Multiple mediation analyses indicate that parent reports of conscientiousness, agreeableness, and emotional stability mediate the relationship between SRS-2 and BASC scores.

Conclusions: Effects for parent reports replicate meta-analytic findings on the relationship of personality traits to ASD and extend this work to the domain of ASD symptoms. Further, these results replicate prior work suggesting that higher levels of certain personality traits may be a buffer against behavioral challenges within ASD and in children with non-ASD mental health diagnoses. Paired with the robust evidence that personality traits can and do change across the lifespan and are predictive of positive outcomes across multiple domains in clinical and non-clinical populations, these findings add to the growing body of literature that suggests personality traits may be a productive potential target for future interventions in this population.

310 **148.310** Predictive Gaze Shifts during the Observation of Actions in Toddlers and Preschoolers with and without Autism Spectrum Disorders

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Background:

The large variety in autism phenotypes complicates the search for understanding underlying mechanisms. A few years ago a new theory was proposed, which suggests that a broad range of autistic symptoms may be manifestations of an underlying impairment in predictive abilities (Van de Cruys et al., 2014; Pellicano & Burr, 2012; Sinha et al., 2014). While there is some initial empirical support for this theory, exactly how impairments in prediction are linked to autism severity and the onset of autism spectrum disorders (ASD) remain unclear. An important ability in social situations is to predict what someone else is going to do, which can be assessed by measuring predictive gaze shifts, eye movements towards the outcome of an observed action before the action is completed.

Objectives:

The current study aimed to compare predictive gaze shifts in typically developing (TD) young children and young children with ASD prior to the onset of goal-directed actions. The second aim was to explore whether the ability to predict others' actions is related to the severity of autism symptoms.

Methods:

Data has been processed for 18 TD children (ages 25-59 months; M = 44.6, SD = 2.5) and 14 children with ASD (ages 27-58 months; M = 39.9, SD = 3.1). ASD diagnosis was confirmed by administrating the Autism Diagnostic Observation Schedule (ADOS-2 Toddler module, Module 1 or 2). Participants observed 30 video clips in which an actor performed a grasping and placing action or pointing action (Figure 1). They were able to predict that the actor would first move towards the toy before moving toward the container, since the sequence was the same in all videos and the participants were first familiarized with the sequence. During the observation of the videos, eye movements were recorded using a Tobii Pro X2-60 eye-tracking monitor. Predictive gaze shifts were defined as eye movements toward the toy before action onset.

Results:

There was a significant difference in predictive gaze shifts between the two groups, $F(1, 30) = 5.83$, $p = .02$, $\eta_p^2 = .16$ (Figure 2). The TD children look more towards the toy prior to the onset of the action (M = .33, SD = .10) compared to the group with ASD (M = .22, SD = .16). In the group with ASD, there was a negative correlation between the total score on the ADOS, indicating the severity of autism symptoms, and the proportion of looking at the toy prior to action onset relative to looking anywhere else on the screen, $r(14) = -.68$, $p = .01$.

Conclusions:

Our findings suggest that prior to the onset of an observed action, young children that are typically developing predict what another person is going to do, while young children with ASD make these predictions less frequently. Especially, children with more severe autism symptoms showed fewer predictive gaze shifts, supporting a link between autism symptoms and impairments in prediction abilities. Therefore, the current study provides new evidence for the theory that individuals with ASD have impairments in predictive abilities.

311 **148.311** Predictors of School Refusal Due to Bullying: The Role of ASD + ADHD Co-Occurrence

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Background: Children with Autism Spectrum Disorder (ASD) experience bullying victimization more frequently than children without ASD (Maïano et al., 2016). This disparity is concerning as victimization is related to physiological distress, internalizing symptoms, and school refusal (Bitsika & Sharpley, 2014; Havik et al., 2014, 2015; Tipton-Fisler et al., 2018). Predictors of victimization vulnerability include: externalizing/conduct behaviors, older age, non-Caucasian race, co-occurring diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD), and public school/general education classroom placement (Fink et al., 2018; Sreckovic et al., 2014). However, the relation of victimization predictors and negative outcomes is unknown. Understanding predictors of negative responses to bullying may elucidate characteristics of particularly vulnerable children.
Objectives: Identify predictors of school refusal due to bullying.

Methods: Participants were 97 parents of 154 children (4-16 years old). Children were diagnosed with ASD (*n*=36), ADHD (*n*=16), ASD + ADHD (*n*=31), other diagnoses (*n*=15), or no diagnosis (*n*=56). Parents were asked if their child had ever resisted going to school due to being bullied and how frequently this resistance had occurred (i.e., at least once per month, past school year, in the past but not this school year, never). Parents of children with ASD also completed the Autism Spectrum Quotient: Children's Version (AQ-Child; Auyeung et al., 2008) as a measure of ASD symptom severity. Study participation occurred online.

Results: Parents reported 35% of children had resisted attending school due to bullying. Of these, 63% had resisted within the past school year. Binary logistic regression was conducted to determine the impact of hypothesized predictors (i.e., age, gender, race, diagnosis, attending public school, general education placement, having a behavior plan) on school refusal likelihood. This model was significant, $\chi2(10) = 35.44$, $p < .001$; it explained 28.4% of variance in school refusal and correctly classified 73.2% of cases. Greater likelihood of school refusal was predicted for children with co-occurring diagnoses of ASD + ADHD (Odds Ratio (OR) 6.6, 95% CI 2.1 to 20.6, $p < .01$) and children of older age (OR 1.16, 95% CI 1.0 to 1.3, $p < .01$; see Table 1). Within ASD, symptom severity (AQ-Child) did not predict school refusal (OR 0.97, 95% CI 0.90 to 1.04, *ns*).

Variables that predicted school refusal with at least trend-level significance were analyzed using ordinal logistic regression for school refusal frequency. The model with these predictors was a significant improvement over the intercept-only model ($\chi2(8) = 33.51$, $p<.001$). Compared to ASD, diagnoses of ADHD or co-occurring ASD + ADHD predicted more frequent school refusal (OR 4.53 and 5.45, respectively). Older child age and having a behavior plan also predicted more frequent school refusal (see Table 2).

Conclusions: Older children with ASD + ADHD and behavior difficulties may have particular difficulty managing victimization and should be targeted for bullying intervention efforts. In contrast to research on victimization predictors, environmental factors (public school, general education placement) did not predict school refusal. Future research should characterize children with ASD who are bullied and display less severe negative outcomes. These children may possess skills that should be intervention targets.

312 **148.312** Pretend Play As a Predictor of Reciprocal Social Behaviors in Children with Autism Spectrum Disorder: A Two-Year Follow-up Study

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Background: Children with autism spectrum disorder (ASD) have been found to have difficulties in both social interaction and pretend play. Social interaction is a back-and-forth process of reciprocal social behaviors. Pretend play is a form of playful behavior that involves nonliteral correspondence to reality. Preschool-age children practice reciprocal social behaviors in the social situations they create during pretend play and later transfer these behaviors into real life. However, previous studies on the relationship of pretend play to social interaction in preschool children with ASD have only focused on the cross-sectional relationship. The elaborateness of pretend play and reciprocity have not been examined.

Objectives: The purpose of this two-year follow-up study was to examine whether the pretend play of preschool children with ASD could predict their reciprocal social behaviors at school age by using elaborated assessments of pretend play and reciprocal social behaviors.

Methods: Children with ASD aged 3 to 12 years were invited to participate in two evaluations at an interval of two years. At the first evaluation, the Child-Initiated Pretend Play Assessment (ChIPPA) was used to assess children's pretend play in sessions of conventional imaginative play and symbolic play. The ChIPPA has three types of scores were percentage of elaborate pretend play (PEPA), number of object substitutions (NOS) and number of imitative actions (NIA). At the second evaluation, the Reciprocal Social Behavior Observation (RSBO), verbal comprehension index (VCI) of the Wechsler preschool and primary scale of intelligence, fourth edition (WPPSI-IV), and Childhood Autism Rating Scale (CARS) were respectively used to assess children's reciprocal social behaviors, language ability and severity of symptoms. Nine linear regression models were used to analyze the prediction of early pretend play to reciprocal social behaviors while considering the covariates of language ability and severity of symptoms.

Results: A total of 64 children with ASD aged 41 to 84 months (SD: 11.75) were recruited at first evaluation. Participants had moderate severity of symptoms and normal language ability, respectively indicated by the CARS total scores (mean = 32.28, SD: 4.67) and VCI (mean = 95.11, SD: 23.29). After controlling for children's CARS total scores and VCI, three early PEPA scores (i.e., conventional imaginative play, symbolic play, and total scores) and two early NOS scores (i.e., symbolic play and total scores) ($p < .05$) significantly predicted the RSBO total scores, respectively. However, no significant predictors of the RSBO total scores were found in other models after controlling for the children's CARS total scores and VCI.

Conclusions: The quality and quantity of pretend play were predictors of reciprocal social behaviors in children with ASD at two-year follow up,

with language ability and severity of symptoms controlled for. This study provides evidence that improving pretend play in preschool children with ASD may lead to better reciprocal social behaviors when they reach school age.

313 **148.313** Quantifying the Active Ingredients of Music Therapy: An Analysis of Movement Dynamics between Therapist and Children with Autism

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Background: In a randomized controlled trial, we recently showed that 8-12 weeks of music intervention can improve auditory-motor brain connectivity and parent-reported social communication in school-age children with ASD (Sharda et al., 2018). This suggest that collaborative music-making can enhance communication. It has been argued that music is unique in engaging both sensory and motor systems while synchronizing with another person, and that this bears positive effects across domains (Srinivasan & Bhat, 2013, Janzen et al., 2018). Yet we know little about the mechanisms that lead to these effects. Prior work has shown that interpersonal synchrony (coded subjectively) increases in children with ASD over the course of a rhythm intervention (Srinivasan et al., 2015), possibly through enhanced movement coordination. Here we applied a novel, optical flow analysis method to video of therapy sessions from Sharda et al. (2018) to examine dynamic movement amplitude and coordination between child and therapist.

Objectives: 1) To apply a novel, optical flow-based methodology to quantify movement amplitude and coordination between therapist and child; 2) Examine how movement amplitude and coordination may evolve over time; 3) Compare therapist-child movement coordination patterns across music-based intervention and a control play-based intervention.

Methods: Data is available from 51 children with ASD aged 6-12; 26 participated in music-based intervention (MI) and 25 participated in a control play-based intervention (PI), all one-on-one with the same therapist. A preliminary analysis of 10 MI participants is described, with the rest of the sample underway. The duration of therapy was one weekly session (comprising 4 activities) over 8-12 weeks. Specific activities were rotated and reoccurred over the course of intervention. For each participant we selected 1 minute video clips of the same activity (e.g., handheld percussion) occurring in the first third (T1) or last third (T2) of therapy sessions. Movement patterns between child and therapist were analyzed using Correlation Map Analysis (CMA) software. Non-overlapping whole-body plus instrument regions of interest were identified for the child versus therapist. CMA uses a standardized optical flow to assess movement within a given region based on changes in video pixels across video frames. A moving-window filter is applied to calculate an instantaneous correlation between regions across the length of the video (Barbosa et al., 2012).

Results: Average amplitude of motion was calculated for both the child and therapist at each time point. Some dyads exhibited more similar or matched motion amplitude over time (Figure 1). Figure 2 shows that this effect was observed across activities; the mean difference in child-therapist motion amplitude significantly decreased from 3.47 at T1 to .72 at T2 ($p = .018$).

Conclusions: This novel method provides numerous insights into the movement dynamics of a dyad during intervention. Preliminary results demonstrate increased movement matching over the course of music intervention. We are examining individual differences in this effect in our full sample relative to communication and brain connectivity outcomes. Comparisons of movement dynamics between music-based and play-based therapy may elucidate an active ingredient of music intervention: increased interpersonal motion matching.

314 **148.314** Beyond the Lorna Wing Typologies: Personality Profiles in Autism Spectrum Disorder Reconsidered

M. Solomon[1], *A. J. Gordon*[2], *M. K. Krug*[1], *A. Cho*[3] *and J. J. Wood*[3], *(1)Department of Psychiatry & Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, University of California, Davis, Sacramento, CA, (2)Psychiatry & Behavioral Sciences, University of California, Davis, M.I.N.D. Institute, Sacramento, CA, (3)Human Development & Psychology, University of California, Los Angeles, Los Angeles, CA*

Background:

Recent research has highlighted the substantial association between personality traits as assessed by the Five-Factor Model (FFM) and autism spectrum disorder (ASD) characteristics (Lodi-Smith et al., 2018). Notably, FFM personality domain scores appear to differ across the typically-developing and ASD populations and are correlated to some extent with measures of core ASD features. Despite these findings, there is a great deal of variability in personality profiles of individuals with ASD (Schwartzman et al., 2016). This heterogeneity of personality trait expression in the ASD population reflects the notion of "multiple autisms" found in the ASD genetics and neuroscience literatures. By observing ASD symptomatology through a personality lens, it may be possible to better identify ASD subtypes, and to understand variability in symptom profiles. Establishing these links and subtypes could ultimately contribute to efforts to understand developmental pathways and moderators of these pathways for people with ASD.

Objectives:

The current study aimed to extend previous findings on differences in personality traits between typically-developing and ASD populations, determine the extent to which personality traits predict autism symptom expression, and identify common personality profiles that may be representative of autism subtypes in the ASD population.

Methods:

Personality and ASD symptom expression data were collected in a sample consisting of both typically-developing individuals and individuals with ASD ages 12 to 22 (N=176). Youth with ASD (cASD; n=47; M_{age}=14.49 years) were compared with typically-developing youth (cTYP; n=49; M_{age}=14.47 years) and adults with ASD (aASD; n=41; M_{age}=19.88 years) were compared with typically-developing adults (aTYP; n=39; M_{age}=19.95 years) on each Big Five Inventory (BFI) domain (Extraversion, Agreeableness, Conscientiousness, Negative Emotionality, Open-Mindedness) and on secondary personality facets. Regression models were used to calculate the amount of variance accounted for by BFI domains and facets in Social Responsive Scale (SRS) scores. A K-means cluster analysis was used to examine the score patterns to identify common profiles within the ASD subsample (n=81).

Results:

T-tests revealed significant differences (p<.05) across three personality domains (Extraversion, Conscientiousness, Negative Emotionality) between

the cTYP and cASD groups; significant differences (p<.05) were also found across all five domains between the aTYP and aASD groups. Personality facets accounted for 30% and 37% of variance in autism core symptom expression in the youth and adult subgroups, respectively. Three distinct personality profiles were identified in the ASD subsample (37%, 35%, and 28% of the sample, respectively). The clusters differed markedly on Extraversion, Agreeableness, Conscientiousness, and Negative Emotionality. These groups had unique associations with other clinical characteristics such as SRS scores.

Conclusions:

The present results converge with previous findings, suggesting a significant association between personality traits and ASD characteristics. The three identified cluster subgroups present distinct personality profiles that are indicative of notably heterogeneous ASD phenotypes. Future research should use the FFM framework to better understand the substantial heterogeneity within ASD and investigate the degree to which personality may moderate or mediate the relationship between core neurocognitive processes and ASD symptom expression as individuals develop.

Poster Session
149 - Technological approaches
5:30 PM - 7:00 PM - Room: 710

315 **149.315** A Community-Based Randomized Comparison of Speech Generating Devices and the Picture Exchange Communication System for Children with Autism

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Background: Extensive research has established the Picture Exchange Communication System (PECS) as evidence-based practice for establishing functional communication in nonverbal and minimally verbal children with autism. However, despite strong preference of both families and users to utilize high-tech augmentative and alternative communication systems, such as tablet-based speech-generating devices (SGDs), definitive evidence on the relative effectiveness of SGDs versus PECS for communication training is lacking.
Objectives: To determine the relative effectiveness of SGD versus PECS based communication intervention in a community-based intervention setting, we conducted a randomized controlled trial directly comparing the impacts of SGDs and PECS to an Education As Usual (EAU) comparison control in specialist schools for children with autism in Ireland.

Methods: Nonverbal and minimally verbal students diagnosed with Autism Spectrum Disorder were randomized at the classroom level to receive 2 months of communication intervention via SGD (n=15) or via PECS (n=13), versus EAU (n=13). Experimental change measures were scored from a live interaction previously developed to index unprompted communicative functions, including mands, intraverbals, and tacts, which was administered to all participants at both pre- and post-training.

Results: The groups did not differ on either chronological age or levels of communication at intake. Statistical analyses further indicated significant increases in rates of total communication in both the SGD and PECS groups, each compared with the EAU condition, which was driven by significant increases in overall communication from pre-training to post-training in both conditions. Further analyses indicated that neither total communication nor manding differed for the SGD versus PECS conditions.

Conclusions: The results of this study provide experimental evidence indicating that school-based implementation of communication intervention via SGD and via PECS are each effective for establishing basic functional communication skills, with each modality providing significant improvements above and beyond education as usual. Critically, these effects were driven by significant increases in rates of manding in both conditions, and communication improvements did not differ between the high-tech and low-tech intervention conditions. Taken together, these results provide further support for both high-tech and low-tech augmentative and alternative communication intervention strategies as evidence-based practice for establishing basic functional communication skills for children with autism.

316 **149.316** Leveraging Reward Mechanisms in ASD Behavioral Treatment: A Computer Game Intervention

L. Cordero[1], *C. Sides*[2], *M. Farber*[2] *and J. D. Herrington*[3], *(1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphi, PA, (2)BioStream Technologies, LLC, Philadelphia, PA, (3)Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA*

Background: Consensus is growing that differences in motivation and reward mechanisms are central to the etiology of ASD. These differences not only affect the development of social skills in ASD, but also diminish the effectiveness of behavioral treatments (which typically rely on reward to influence behavior). There is significant untapped potential in using computer game platforms to facilitate social skill enhancement in ASD, as children with ASD (and neurotypicals) generally find these platforms highly rewarding.
Objectives: This presentation focuses on the development and testing of an eye gaze-controlled space adventure game designed to enhance social abilities in ASD. Initial piloting focuses on 1) user experience data, 2) within-game metrics of social skill changes, and 3) the development of naturalistic eye contact assessments for a subsequent clinical trial.

Methods: This National Science Foundation-supported initiative represents a partnership between the Children's Hospital of Philadelphia, University of Pennsylvania, and BioStream Technologies, LLC. This team has developed an immersive, interactive space adventure game that uses consumer-grade eye tracking technology to teach children to make and hold eye contact with game characters. To date, the game has been administered to 99 children with and without ASD (ages 4 to 16), across a total of 269 game sessions, including 52 children with ASD across a total of 172 game sessions.

Results: User experience data suggest a high level of engagement and favorable responses to the game. Preliminary analyses on a subset of data (N = 18) indicate that within-game metrics are useful indicators of social skill, with ASD individuals showing diminished eye contact during initial, incidental interactions with game characters. Preliminary data also indicate that the game's facial expression exercises yield increased emotion recognition scores after 4 or 5 gameplay sessions ($p < .001$, n=24). Analysis of mutual eye gaze data (during a live social interaction) are ongoing,

and involve computer vision and machine learning analyses of video data.

Conclusions: BioStream's game has proven to be safe and well tolerated by all participants to date. The vast majority of participants liked the game, which is essential to assuring that it can be played for a sufficient duration to facilitate behavior changes. Preliminary results suggest that the game provides social skill metrics that have significant potential as change measures (as well as cross-sectional assessment). Next steps in this line of research include the analysis of novel outcome data, and the implementation of a Phase II clinical trial.

317 **149.317** Novel in-Vivo Approach Using Smartphone Reporting to Map Real-World Social Interactions in ASD

A. H. Gerber[1]*, J. M. Girard*[2] *and M. D. Lerner*[3]*, (1)Stony Brook University, Stony Brook, NY, (2)Language Technologies Institute, Carnegie Mellon University, Pittsburgh, PA, (3)Psychology, Stony Brook University, Stony Brook, NY*

Background: While considerable research demonstrates deficits in the quality of social interactions of adults with ASD, little work has examined the quantity and temporal patterning of such interactions. Prior work suggests that adults with ASD engage in few social interactions (Orsmond et al., 2004), however, these studies have almost exclusively utilized caregiver reports, which are subject to recall biases (Shiffman et al, 2008). Ecological momentary assessment (EMA) is designed to address these limitations by facilitating in-vivo data collection, providing a more accurate estimate of social behavior. This is particularly important for individuals with ASD who may have limited insight upon reflection (Damiano et al., 2014). Only one study has utilized an EMA approach to examine social interactions of adults with ASD, finding lower levels of social interaction relative to other activities (Chen et al, 2017). However, this study used beep-contingent reporting, restricting inferences about quantity and patterning of interactions. Finally, prior work has indicated that symptoms of alexithymia (an impairment recognizing and understanding emotion), not ASD, may account for some of the social deficits in ASD (Bird & Cook, 2013). The current study represents a novel EMA approach to quantifying in-vivo patterns of social interaction in adults with ASD and the first examination of temporal patterns and psychosocial correlates of real-world social interaction.

Objectives: Based on previous research, we hypothesized that, controlling for demographic variables, adults with ASD would exhibit fewer social interactions and a daily cycle of social interaction with a lower peak than TD adults. We also hypothesized that symptoms of alexithymia, above and beyond the effects of ASD, would be related to fewer social interactions, and an attenuated peak in daily cycle of social interactions.

Methods: Adults with and without ASD (N_{ASD} = 23, N_{TD} = 52), aged 18 to 47 years (M=22.15 years, SD=5.53; 33 males) reported their social interactions in-vivo via smartphone over one week. Participants completed measures of IQ, ASD symptom severity and alexithymia symptom severity. Cyclical multilevel models were used to account for dependency of observations within person.

Results: Results demonstrated a daily cyclical pattern of social interaction that was robust to symptoms of ASD and alexithymia (Figure 1). Adults with ASD did not report fewer social interactions than TD peers; however, alexithymia symptom severity was negatively related to social interactions regardless of ASD status (Table 1).

Conclusions: This is the first study to use an EMA approach to map quantities and patterns of real-life social interactions. Results suggest a temporal pattern of social interaction, comparable across groups, that could not otherwise be identified. Our findings are the first to link alexithymia to reduced social interactions and suggest that these symptoms, not ASD severity, may drive social isolation for adults with ASD. This implicates a unique subset of individuals with ASD who struggle with social interactions and suggests an avenue for improving personalized intervention. In conclusion, results highlight the utility of a smartphone-based EMA approach for capturing subtle details of daily life in ASD with potential to provide a novel real-world outcome measure.

318 **149.318** A Comparison of Different Technological Interfaces and Activities on Autistic Children's Social Play

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Background: Technology is widely used by autistic children and is increasingly used to develop skills in the social domain. However, there are ongoing concerns that technology is socially isolating and prohibits real-world interaction. Many of these concerns are directed towards touch-screen devices, however, we won't know whether (and how) different technologies create opportunity for different types of social interaction. Understanding the influence of different technologies has applications to better address community concerns and evaluate uses of new technologies to support autistic children.

Objectives: To compare autistic children's social play whilst using different types of technological devices and software

Methods: Four autistic children were video-recorded in their classroom playing with three different technological interfaces: (a) iPads(tm) with various recreational and educational apps and games, (b) Osmo(tm), a tangible system (physical-digital hybrid) with various educational apps, and (c) Code-A-Pillar(tm), a musical-construction robotic toy. Children's profiles were characterised using the teacher versions of the Social Responsiveness Scale 2 (*mean total t* = 78), Vineland Adaptive Behaviour Scales 3 (*mean ABC* = 58.75), and Wing's Subgroups Questionnaire. A total of 51 five-minute video clips (*mean* = 13 clips per child) were sampled (2 hours 5 minutes footage analysed, comprising 19% of full dataset collected over 4 weeks) and categorical coding of interactive social play applied using Howes' Peer Play Scale. The scale includes 7 categories of social play (in hierarchical order): non-play interaction with adults, non-play, solitary play, parallel-play, parallel-aware play, simple social play (SS), and complementary & reciprocal play (CR). For each observation, the child's play partner (staff or peer) was also coded, as well as interface and app (e.g. Osmo Numbers, iPad Reactickles).

Results: For each interface, patterns of observed play type are reported. Of all observations of SS with peers, 61.2% was observed whilst children played with iPads, 22.4% was observed while children played with Osmo, and 16.4% while children played with Code-A-Pillar. Of all observations of CR with peers, 87.5% was observed on the iPad, 12.5% observed on the Code-A-Pillar, and none observed with Osmo. Of all observations of SS with adults, 47.9% was observed whilst children played with Osmo, 26% observed on iPad, and 26% observed on Code-A-Pillar. Of all observations of CR with adults, 50% observed with iPads, 35% observed with Code-A-Pillar, and 15% observed with Osmo. Between the first two sessions (2 weeks) and the last two sessions (8 weeks), an increase was observed in observations of SS (mean at 2 weeks = 7, mean at 8 weeks = 21.5), but not CR (mean at 2 weeks = 3, mean at 8 weeks = 4).

Conclusions: This study compared autistic children's social interactions whilst using different types of technology, including tablets, tangibles and robotics. The highest rates of social play were observed whilst children used iPads, and more complementary types of play were observed whilst

children used Code-A-Pillar compared to Osmo. These results provide important insights into the differences between different types of technology that can be used to support autistic children in education and therapeutic contexts.

319 **149.319** A Physiologically-Mediated Virtual Reality Experience for Children with Autism Spectrum Disorder

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Background: Many children with autism spectrum disorder (ASD) have difficulty with transitions to new situations and settings, and this can lead to increased anxiety and missed opportunities for education and meaningful participation. Virtual Reality (VR) systems have highly desirable features to help children cope with such transitions. In particular, they can offer high levels of authenticity and realism, allowing children to explore new and anxiety-provoking settings in safe, controlled, and personalized settings prior to the actual experience. Although many VR systems are commercially available, very little is known about the safety and usability of these systems for children with ASD.
Objectives: The objective of this study was to evaluate the safety and usability of an immersive head mounted display (HMD) VR system for children with ASD.

Methods: Thirty-five children with a diagnosis of ASD participated in the study (age=13.0±2.6 years; 10 females; IQ>=70). During a two-hour session, participants watched two 5-minute, 360º video of a school bus, presented in two ways: a video on a computer monitor (video) and an immersive VR experience on an HMD (VR; Oculus Rift). Each task was separated by a baseline video clip from the Blue Planet series. The order of presentation (video/VR) was randomized. After each task, the participants completed questionnaires probing self-reports of anxiety (State-Trait Anxiety Inventory), sense of presence (ITC-SOPI), and usability (custom questionnaire).

Results: Of the 35 participants, 33 completed the study. The reasons for early drop-out were previous negative experiences on the school bus, sensitivity to the video content (whistling), and difficulty with heart monitoring electrodes. There was no significant difference in self-report of anxiety level pre/post the video and VR conditions. None of the participants reported side effects (e.g., cybersickness, nausea) on the ITC-SOPI for either condition. No significant differences were found between video and VR conditions on the ITC scales of spatial presence, engagement, ecological validity, or negative effects. Based on responses to the usability questionnaire, there were no significant differences between the VR and video condition in self-reports of levels of fatigue, enjoyment, task understanding, ease of navigation, and helpfulness in future school bus experiences. However, 29 of 33 participants indicated that they preferred VR to video. On a follow-up call a month after the study, no side effects were reported. Three of the 35 participants indicated that the study had helped them with school bus anxiety in real life.

Conclusions: The results of this study provide preliminary evidence to support safety and usability of virtual reality for children with ASD.

320 **149.320** An Evaluation of Practitioner Attitudes on Touch Screen Use in Children with an Autism Spectrum Disorder

ABSTRACT WITHDRAWN

Background: The prevalence for Autism Spectrum Disorder's (ASD's) in Australia has increased by 42.1% from 2012 to 2015 (Australian Bureau of Statistics, 2015). This rapid increase in prevalence has also been reported in the United States, UK and Europe (Kuehn, 2012; Baird, Simonoff, Pickles, Chandler, Loucas, Meldrum & Charman, 2006; Hughes, 2011). This escalation in prevalence has subsequently increased the demand for therapeutic services. Touch screen applications (apps) have the potential to alleviate the demand on therapeutic interventions or supplement them because of the way in which they deliver information. For instance, touch screen apps can meet a child with ASD's need for repetition or minimise the reliance on social communication. Furthermore, apps might provide a cost effective solution for families who require intervention while on a waiting list or as an adjunct to therapy. There is limited information on practitioners' experiences with touch screens as a tool for learning and therapeutic outcomes. These data would inform future practice of the efficacy of interventions delivered by touch screens for children with ASDs.
Objectives: This research has set out to explore whether practitioners working with children with ASD's (2-17 years) are using touch screens and ASD specific apps as part of their therapy. An understanding of *how* touch screens are used (e.g. as an AAC, reward, video modelling) could indicate what practitioners are finding most useful for children's therapy and might help educate other practitioners and parents on suitable uses of touch screen apps. This research aims to further understand whether children with ASD's are learning as effectively, or better from touch screens, compared with non-technological methods.

Methods:

Practitioners (*n*=69) were recruited from the health sector (*n*=51) and education sector (*n*=18). The majority of practitioners were psychologists and primary school teachers.

Participants views were accessed using an online survey. The survey was developed for the purpose of this study. Questions were informed by own practice, and parent and practitioner comments on their views of touch screen use as a therapeutic tool. The survey was shared on the University website, and shared amongst practitioners.

Results: Psychologists used ASD apps more often in their sessions (72%) than educators (38.9%). A chi square test indicated the difference between groups was significant p = 012. Quantitative and qualitative analyses informed that practitioners in both groups reported more positive behavioural effects as a consequence of using touch screens (e.g. calming, more engaged and attentive), compared to negative effects (tantrums, challenging behaviour observed). Practitioners in the health sector indicated children's learning from a touch screen was more effective than non-technological methods (58.3%). Practitioners in both groups described children with ASD as less anxious when learning from touch screens, compared to other methods (health: 61.1%, educational: 80%).

Conclusions: This research demonstrates touch screens are being used by practitioners as a tool for engagement with therapy and children, and adolescents with ASD's are benefitting from such platforms. These data might encourage other practitioners to use touch screens in their therapy and furthermore help shape future therapeutic practice for this population.

321 **149.321** An Open-Source, Computing Platform-Agnostic, Calibration-Free Preferential Gaze Detection Approach for Social Preference Assessment

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Background: Social preference assessment, using contrasting video or image pairs, has been commonly used in autism screening. Such assessments tend to be conducted in the presence of experts in a controlled laboratory environment, primarily because most gaze-tracking apparatus are not portable. Further, the solutions employed are proprietary, and platform-dependent, inhibiting the wide acceptance of this important method across researchers. Recent advancements in machine-learning based gaze-tracking techniques, combined with the proliferation of low-cost hand-held devices, have challenged this paradigm. We present an open-source eye-tracking pipeline which enables casual, on-field preferential gaze understanding that can be carried out cost-effectively under minimal supervision in a typical home environment.

Objectives: To develop a portable, fast, open-source preferential gaze tracking pipeline for visual-stimuli guided social preference assessments.

Methods: The proposed gaze-tracking pipeline was deployed on data sourced from the 'preferential-looking' task of START ("Screening Tool for Autism Risk using Technology)", a tablet-based app usable by non-specialists in home settings. The task was administered to a group of 127 children aged 2-7 years at their homes in India. The preferential looking task presents the child with simultaneous social and nonsocial videos on the tablet screen. The tablet camera records the child's face during the task. This recording is analyzed asynchronously by our gaze tracking algorithm to predict the child's visual preference in each frame. The algorithm implemented in python is deployed offline on a desktop system, and processes the data for multiple children in a batch mode. The average processing time for the algorithm is 90ms per frame. The algorithm pipeline, consisting of existing open-source modules,
(a) extracts (using OpenCV[1] library calls) regions corresponding to the face and the eyes,
(b) obtains gaze coordinates[2] in pixels based on the device used (no reference needed for the subject or the camera parameters), and
(c) transforms, with temporal smoothing by a median filter, raw pixel coordinates to higher level preference prediction, enabling social preference assessment.
Results: The algorithm achieved 91% accuracy (percentage of frames with correct classification of gaze preference) on a manually annotated dataset with 5000 frames. The frame-drop rate (failure to detect faces due to poor lighting, occlusions, multiple faces, etc.) is observed to be no more than 5% for more than 73.2% of the on-field dataset, and it exhibits a decreasing trend in this range (Figure 1).
Conclusions: Our computer program (available freely[3]) works on video frames, and can, therefore, be used in any system as long as video frames are provided. The video can be captured by non-specialists in casual environments regardless of the hardware employed, making the system cost-effective for a screening measure. The approach is calibration-free, and can be executed asynchronously on video inputs.

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322 **149.322** Are Avatars Just like Humans? Comparing Autism Spectrum Disorder Individuals' Emotion Recognition of Virtual Avatar and Human Faces

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Background:
Computer-based interventions, as a more economical and accessible option, are commonly used to teach much-needed skills to ASD individuals (Bekele et al., 2014). Virtual reality (VR) has been used to provide a realistic setting with interactive avatars, allowing ASD individuals controlled opportunities to practice and potentially improve their social interaction skills in a stable learning environment (Ramdoss et al., 2011). Avatars have aided in teaching emotion recognition, allowing ASD individuals to practice social interaction without the anxiety commonly associated with real-world interactions (Parsons, 2000; Golan & Baron-Cohen, 2006) and offer unique benefits such as their ability to be controlled and animated (Dyck et al., 2010), as well as customization of features such as physical appearance, emotion intensity, and gaze (Joyal, 2014). Despite the benefits of their use, we lack data directly comparing emotion recognition tasks utilizing avatars compared to humans in individuals with ASD.

Objectives:

The current project aims to provide a controlled, empirical assessment of the validity of virtual avatars with respect to emotion recognition intervention tasks for individuals with ASD.

Methods:

Virtual avatars were customized and rigged using Mixamo and Autodesk Maya then imported into Unity for final use in a virtual classroom environment. Avatars dynamically displayed the 7 universal emotions (anger, fear, disgust, happiness, sadness, surprise and contempt) at 3 levels of intensity, each display moving from a neutral expression to the emotion in 2 seconds. Twenty-two typically developing adolescents validated these prior to the study. Post validation, the avatar presentation of emotions was matched to human faces, also dynamically displaying 7 emotions at 3 levels of intensity, from neutral expression to emotion in 2 seconds. Human faces were selected from the Amsterdam Dynamic Facial Expression Set - Bath Intensity Variations (ADFES-BIV) database (Wingenbach et al., 2016). All participants selected the emotion displayed by human or avatar and provided a confidence rating for each response. Scores on the tasks were first compared to evaluate performance

differences between human vs. virtual presentations as well as group differences.

Results:

There was no significant difference ($t(24)= -1.796$, $p= 0.085$) between the overall scores for emotions presented by the avatar (M= 14.56, SD= 1.92) compared to human (M= 15.56, SD= 2.48). Certain emotions had significant differences between the avatar and human tasks (Figure 6). "Surprise" and "Contempt" were easier to identify when presented by human faces (surprise: M= 2.80, SD= 0.50; contempt: M= 1.56, SD= 1.04) compared to avatar faces (surprise: M= 2.04, SD= 0.61; contempt: M= 0.72, SD= 0.89), (surprise: $t(24)= -5.729$, $p < 0.001$; contempt: $t(24)= -3.280$, $p= .0003$). "Anger" however was more correctly identified in avatar faces (M= 2.68, SD= 0.48) compared to human faces (M= 2.12, SD= 0.88), ($t(24)= 2.682$, $p= 0.013$). There was no main effect for group (ASD vs. TD) on identifying emotions presented by avatars or humans.

Conclusions:

Virtual avatars may serve as an accurate and realistic comparison to human faces, making them suitable for measuring and teaching emotion recognition in ASD with promise for effective use in therapeutic interventions.

323 **149.323** Automatic Analysis of Temporal Patterns of Head Movement Discriminate between ASD Outcome Groups

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Background:

Recent work has shown the importance of quantifying head movement differences in children with and without ASD to better characterize the ASD phenotype (Martin et. al, 2017). However, these analyses relied on aggregated data and did not examine the temporal dynamics of head movement in children with and without ASD. Further, little is known about the head movement patterns in siblings of children with ASD. In this study, we performed a temporal pattern analysis to determine whether the sequential patterns of head movement differed by family history of ASD and ASD outcome.

Objectives:

A computational framework was implemented to extract the temporal patterns of head movement tracking data. We then examined whether these temporal patterns differentiated between ASD outcome groups.

Methods:

Fifty-four participants were 2.5-6.5-year-old children (mean=4.72 years, SD=1.14 years) with (high-risk, n=33) and without (low-risk, n=21) an older sibling with ASD. ASD diagnoses were confirmed for low- and high-risk children by a licensed clinical psychologist. We examined differences in head movement patterns in three independent groups: children with ASD (n=21), children at high-risk for ASD (n=12, HR/NoASD), and low-risk children (n=21, LR/NoASD). Children were video-recorded while watching a 16-minute video containing social and nonsocial stimuli. Three dimensions of rigid head movement—pitch, yaw, and roll (Figure 1) —were tracked using an automatic person-independent tracker (Zface). The temporal patterns were extracted from the head movement tracking data of multiple motion feature dimensions. The categorical timeline allocation process identified the imbalance of the temporal pattern distributions between groups using mean discriminative ratios (mDR). A higher mDR indexes greater differential occurrence of head movement patterns (their differential presence in one group but not another).

Results:

The categorical timeline allocation results show differential occurrence of sequential patterns between groups. Sequential patterns based on pitch, yaw, and roll differentiated ASD and HR/NoASD children, with mDRs of .91, .90, and .94, respectively. Sequential patterns based on pitch, yaw, and roll differentiated LR/NoASD and HR/NoASD children, with mDRs of .90, .92, .94, respectively. Sequential patterns based on pitch, yaw, and roll moderately differentiated ASD and LR/NoASD children, with mDRs of .52, .76, .64, respectively (Table 1). There were 7 patterns of pitch and yaw and 8 patterns of roll that were observed in the ASD but not the HR/NoASD group. There were 7 patterns of pitch and yaw and 8 patterns of roll that were observed in the LR/NoASD but not the HR/NoASD group. There were 2 patterns of pitch and roll and 5 patterns of yaw that were observed in the ASD but not the LR/NoASD group (Table 1).

Conclusions:

The presented analysis framework identified potential diagnostically-relevant head movement motion patterns in ASD. Temporal patterns extracted from head movement tracking data show the ability to discriminate between ASD outcomes. Many temporal patterns appear in one group but are absent in the other, suggesting that these unique patterns distinguish between groups. Together, the discriminative power of temporal patterns and their ability to distinguish between groups indicate the potential of these automatic methods for diagnostic utility in ASD.

324 **149.324** Challenges in the Use of Technology for Autism Spectrum Disorder in Low- and Middle-Income Countries

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Background:

Efforts to utilize technology to address the practical challenges people affected by ASD face every day, are laudable and important. However, the global ASD community is culturally, linguistic, socio-economically and geographically immensely diverse. If our overarching goal is to address the disparities in access to ASD screening, diagnosis, and treatment in low- income country (LMIC) settings using technology, these technologies need to be designed from the outset with this specific context, community and end user in mind. Many reviews have been performed of a range of technologies for ASD. However, the feasibility of the use of such technologies will depend on the ability to implement them including their accessibility, affordability, appropriateness, and scalability.

Objectives:

Here we set out to examine the feasibility of a range of ASD-related technologies for low- and middle-income settings.

Methods:

Six classes of ASD-related technologies were selected: 1) Personal Computers (PC) 2) Sensing Technologies (ST), 3) Robotics (RT); 4) Virtual Reality (VR), 5) Shared Active Surface (SAS), and 6) Mobile Technologies (MT). Technologies were evaluated for accessibility, affordability, appropriateness, and scalability. Two independent raters reviewed each methodology for each element of feasibility selected, and then provided an overall feasibility rating for implementation in LMIC. Ratings were then compared and consensus reached on all categories.

Results:

RT, VR and SAS were found to be the least affordable, required highly skilled technicians to operate and maintain the equipment and their use limited to research facilities and clinics therefore rating lowest in all categories evaluated. Although people in LMICs have access to PCs they typically are young, educated males living in cities. Furthermore, technologies using photography or video of people are forbidden in some cultures and therefore not universally appropriate.MT scored highest for relative cost (affordability), range of users, settings and purpose (accessibility and scalability).

Conclusions:

Our findings suggest that the feasibility of the majority of existing technologies are very limited in the context of affordability, accessibility, acceptability, cultural appropriateness and scalability. Given the widespread usage of mobile and smartphones and the increasing availability of affordable high speed mobile internet access in the majority of LMIC, mobile health (mHealth) seems to have the greatest potential to increase access to ASD screening, diagnosis and treatment in LMIC settings. There is, however, a striking difference between the large number of Apps available for public download and the small number of tested, evidence-based Apps. To our knowledge, no Apps for ASD have been evaluated specifically for a LMIC setting to date. To address the disparities in access to ASD screening, diagnosis, and treatment in low-resource settings using technology, research will be required to establish the feasibility of mHealth to provide access to quality metal health services and care to the culturally, linguistic, socio-economically and geographically diverse global ASD community.

325 **149.325** Comparing Autistic Children's Social Communication Behaviours in a Robot-Assisted Versus Adult-Led Activity

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Background: Autistic children experience difficulties with social communication behaviours (SCB). Robots have been proposed as potentially useful tools to support autistic children's SCB, based on claims that their predictable behaviour and simplified characteristics might be less socially demanding for autistic children than human interactions. Yet, very few studies have directly compared autistic children's SCB when interacting with robots versus humans.

Objectives: The DE-ENIGMA project is a large, collaborative project investigating the potential of humanoid robots as tools in autism education, including for teaching about social behaviours. Here, we directly compared autistic children's use of SCBs in child-robot versus child-adult interactions.

Methods: An initial feasibility study collected recordings from a large cohort (n=128) of 5- to 12-year-old autistic children in special education settings, in the context of a 6-step emotion-recognition teaching programme (based on Howlin et al., 1999). Children were randomly assigned to robot-assisted or adult-led teaching conditions. We selected a subset of 5- to 8-year-old participants with at least 15 minutes of recorded interaction during the feasibility study for annotation and analysis. Groups were well-matched for age (p=.699) and for autism severity symptoms, as measured by the CARS2-ST (p=.485). We designed a coding scheme based on the SCERTS model (Prizant et al., 2006) to identify a range of children's SCB in the video data, including *commenting*; *pointing*; *imitation*; *protesting*; *requesting; responding,* etc. Instances of shared affect were also annotated.

Results: Data annotation and analysis are ongoing. Of the data that have been annotated (n=12; 2 females; 6 children from each condition), there were 926 instances of SCBs (excluding shared affect) in a 180-minute sample (15 minutes/child). The median number of SCBs in the robot-assisted condition was 59.50 (*range* = 17 – 87), while in the adult-led condition was 84.50 (*range*= 35 – 198), although there was no significant difference between teaching conditions (Mann-Whitney *U*=24.00, *p*=.394, *r*=.28). When comparing the medians of each type of SCB, we found a significant difference for *imitative behaviours* between the adult-led condition (*Mdn*=1) and the robot-assisted condition (*Mdn*=14.50), *U*=33.50, *p*=.012, *r*=.72. There were no significant between-group differences for any other SCBs.

Shared affect was frequently combined with other behaviours; it is reported separately to give a clearer picture of its extent (Figure 1). We found a significant difference for *sharing positive affect* between the robot-assisted condition (*Mdn* = 10.5) and the adult-led condition (*Mdn* = 3), *U*=5.50, *p*=.045, *r*=-.58. *Sharing negative affect* did not significantly differ between teaching conditions (*U*=9.00, *p*=.059, *r*=-.55).

Conclusions: Of the data examined thus far, the results indicate that children's SCBs were similar in the robot-assisted and adult-led teaching conditions on the total number of SCBs observed, and on instances of most individual SCB types. It is encouraging that children shared more positive affect in the robot-assisted condition, indicating that a humanoid robot can be part of enjoyable, social interactions. Variance in children's SCBs *within* each group highlights the importance of considering individual differences when studying social communication in autistic children, particularly those with limited spoken communication.

326 **149.326** Dynamic Process of Obtaining Stakeholders' Feedback to Develop an Assistive Technology for Children with Asd; Increasing Social Participation

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Background:

Autism spectrum disorder (ASD) is characterized by difficulty with communication and reciprocal interaction affecting social participation. The common social impairments experienced by children with ASD have a profound impact on daily functioning. Virtual-reality programs are affordable tools that can be used to improve social skills among children with ASD. These programs have the potential to be applied as tele-rehabilitation, as an alternative and promising way, to improve accessibility of health services. Despite the importance of developing a customer-based tele-rehabilitation program for children with ASD, there is no program incorporating stakeholders' ideas.

Objectives:

This study aimed to involve stakeholders in designing and developing a tele-rehabilitation program to help children with ASD improve their socio-emotional skills.

Methods:

We involved over 100 stakeholders, including children with ASD (aged 8-11 years), youth with ASD (aged 13-17 years), their parents, and clinicians work in the field. Inclusion criteria were high functioning and verbal children and youth with ASD who can express their ideas; clinicians with at least one year working experiences in the field of ASD; and parents of a child diagnosed with ASD. All stakeholders needed to be able to communicate in English.

Using a participatory design approach to co-develop the product, this project included three stages of development.

(a) "pre-development phase" to explore ideas on direction and content of the program. First, 26 stakeholders (13 parents, four youth with ASD, and nine clinicians) were interviewed to highlight the focus and shape of the program, and then 63 stakeholders (39 parents and 24 clinicians) confirmed the content via online surveys.

(b) "Development phase". Using iterative process, 20 youth/children with ASD (10 youth, 10 children) and their parents provided feedback on the design of the program.

(c) "Post-development phase". The program was tested among 10 children with high functioning ASD. We evaluated the usability and efficacy of the program.

Results:

Findings showed that stakeholders emphasize the importance of perspective taking and social participation to target. Given the heterogeneity of children with ASD, stakeholders valued individualizing the program rather than trying to fit all children into one program. They described that adding adaptive features to customize the program based on stakeholders' preferences and clinicians' needs would optimize outcomes. Adjusting the audio-visual features and strategies to engage users such as modeling were also expressed. The program was easily used by children and they showed some improvements in socio-emotional skills, though it was not significant.

Conclusions:

This study introduces the development process of a novel program for children with ASD in collaboration with stakeholders. By involving stakeholders during the development, there will be an increased likelihood of uptake of the program. Stakeholders offer valuable perspectives that should be considered in rehabilitation settings both in research and practice.

327 **149.327** Employing K-Means Clustering to Identify Key Performance Indicators for Autism: Data from Eye-Tracking in Joint Attention Tasks

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Background: Joint attention might be shown in the developmental deficits of children with autism spectrum disorder (ASD). To quantify performance of joint attention, eye-tracking data analysis is often considered, where there are several performance indicators, namely the proportion of fixation time in the area of interests (referred to as fixation time), the latency of the first fixation (referred to as the first fixation) and the longest common subsequence (LCS) similarity (to quantify how the participant's gaze dynamically follows the given logic of the stimulus). However, it is still a research question which performance indicators can properly reflect the difference of joint attention skills between children with autism and typical developing (TD) children. *K*-means clustering is a popular method for cluster analysis in data mining and could be potentially applied to identify the most relevant performance indicators for eye-tracking data analysis in joint attention tasks.
Objectives: This study aimed at implementing *K*-means clustering to explore which performance indicators are the most relevant ones to reflect the capacity of joint attention of autism. We did not only focus on the individual performance indicator, but also investigating their correlations.

Methods: 14 ASD (mean age: 4.96±1.10) and 16 age-matched TD children (4.53±0.90) participated in joint attention tasks. Video stimuli were used to induce joint attention behaviors of the participants. The video consisted of a man sitting behind the table together with three objects (left, middle and right side of the table). The man would turn his head to one object, and the eye movement was recorded by the Tobii X3-120 eye-tracker. The flowchart of the proposed *K*-means clustering algorithm is shown in Fig. 1.

Results: Figure 2 (a) and (d) show the distribution of measured eye-tracking data for ASD and TD children based on one performance indicator (LCS similarity) and a combination of two performance indicators (fixation time and the first fixation), respectively. The corresponding clustering results by applying the proposed *K*-means algorithm can be seen in Fig. 2(b) and (e), respectively. Figure 2(c) and (f) show the exact number of ASD and TD in the group clustered by the proposed *K*-means algorithm. Chi-squared test reveals that as an individual performance indicator, the LCS similarity shows the most significant difference (p=0.002), the fixation time (p=0.024) still reach the significance, but the first fixation (p=0.157) is not significant. However, the difference becomes significant when combining the first fixation to the fixation time(p=0.024) as well as the LCS similarity (p=0.037). When all three performance indicators are considered, there is no significant difference (p=0.063).

Conclusions: We applied *K*-means clustering to identify the key performance indicator for eye-tracking data analysis in joint attention tasks. We found that the LCS similarity was most likely (99.8%) to reflect the difference between ASD and TD children in joint attention tasks. Although the first fixation does not show a significant difference as an individual performance indicator, its correlation with the fixation time and LCS similarity greatly improves the significance.

328 **149.328** Examining the Effect of a Wearable Physiology-Based Anxiety Detection Technology on Self-Awareness of Anxiety Signs in Autism Spectrum Disorder: Data from the Pond Network

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Background:
Co-morbid anxiety is prevalent in autism spectrum disorder (ASD) and can negatively impact physical and mental health. Symptom awareness is fundamental to traditional anxiety treatments. However, self-awareness of anxiety symptomology can be challenging in ASD due to differences in emotional awareness and introspection. To address this challenge, we conducted a randomized controlled trial to assess the efficacy of the Anxiety Meter, a wearable, real-time anxiety detection technology, to support awareness of symptoms of anxiety in children and youth with ASD. The Anxiety Meter uses wearable sensors to translate heart rate into a visual display of anxiety (green = calm, red = anxious).

Objectives:

The objective is to determine if the Anxiety Meter can improve awareness of anxiety symptoms and increase self-initiation of relaxation techniques.

Methods:

Twenty-seven children and youth with ASD (Age = 12.9 ± 2.7, 16 males) participated in the study. All participants were part of the Province of Ontario Neurodevelopmental Disorders (POND) Network, had a full-scale IQ score above 50 (IQ = 98.7 ± 18.3), and had not previously received Cognitive Behaviour Therapy. All participants were trained on the use of the Anxiety Meter and taught a diaphragmatic breathing relaxation technique over three visits. On the fourth visit, participants were randomized to either receive feedback of their anxiety level (n = 14) or no feedback (n = 12) from the Anxiety Meter while completing a stress-eliciting task (public speaking) and asked to engage in deep breathing if anxious. Data from one participant in the no feedback group was excluded prior to analysis as the participant did not complete the task. The proportion of participants who initiated deep breathing in each group was measured.

Results:

The proportion of participants who initiated deep breathing to those who did not was significantly higher in the Anxiety Meter feedback group compared to the control group (14:0 versus 3:9; Fisher's exact, p<0.0001). Of those who initiated deep breathing, 10/14 in the Anxiety Meter feedback group and 3/3 in the control group reported feeling calmer after deep breathing.

Conclusions:

Feedback from the Anxiety Meter was associated with a significant increase in the proportion of children who initiated deep breathing in response to anxiety. The results support the feasibility of using a wearable device and real-time feedback to improve anxiety symptom awareness in children with ASD.

329 **149.329** Fully Automated Measurement of Imitation and Motor Learning Differences in Children with ASD

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Background: Meta-analysis indicates that imitation impairments are strongly and specifically associated with ASD. While impairments are robust across tasks, how imitation is *operationalized* within studies moderates whether impairments are detected – i.e., measuring *form* distinguishes ASD from non-ASD better than simply measuring end states. Accurately measuring the *form* of actions as they unfold requires tools that are spatially and temporally granular – now achievable via computer vision. We used computer vision to quantify gross motor imitation in children during a brief task.
Objectives: Apply automated computer vision approaches to measure imitation accuracy and change over time; compare a scalable, open-source motion-tracking program against an established but more resource-intensive system.

Methods: Participants were 21 children with ASD and 18 matched typically developing children (TDC; see Table). Children imitated in real time a 2.5-minute video of a man making a sequence of body movements. The task was completed twice, separated by another brief task. Kinect V2 units collected front-facing whole body video at 30 frames/second. Joint movements were digitally tracked in coordinate space using two platforms: (1) 3D tracking with iPi Motion Capture; (2) 2D tracking with OpenPose (open-source software). Imitation performance was quantified through windowed cross-correlations (4-second sliding windows) between child joint coordinates and joint coordinates from the stimulus video. Results herein are for a subset of joints – child's left wrist relative to stimulus right wrist and vice versa. Mean peak cross-correlations were analyzed in the context of 2 (ASD/TDC) x 2 (Time 1/Time 2) mixed ANOVA.

Results: iPi (3D): There were significant group by timepoint interactions for both wrists, with large effect sizes [left: p=.02, η_p^2=.15; right: p=.01, η_p^2=.16]. TDC significantly outperformed ASD for both wrists at Time 2 [left: p=.002, d=1.07; right: p=.003, d=1.03], but not Time 1 [left: p=.11, d=.53; right: p=.17, d=.46]. TDC performance was significantly higher at Time 2 than Time 1 [left: p=.03, d=.54; right: p=.03, d=.54], whereas the ASD group did not differ significantly across timepoints [left: p=.15, d=-.34; right: p=.11, d=-.40], suggesting a lack of improvement with practice in ASD. OpenPose (2D): The pattern of results was highly similar to iPi (see Figure). There was a significant group effect for both wrists, with medium and large effect sizes respectively [left: p=.046, η_p^2=.10; right: p=.01, η_p^2=.16]. Neither interaction terms nor timepoint effects reached significance for either wrist. While iPi and OpenPose patterns were consistent, mean cross-correlations from OpenPose were lower and standard deviations were higher.

Conclusions: Results are consistent with literature documenting imitation differences in ASD, and are specifically suggestive of impaired motor learning. The novelty of our approach is direct acquisition of raw movement data, rather than reliance on human raters. Such granular measurement should improve imitation assessment, particularly of change over time (e.g., treatment outcomes). 3D motion tracking outperformed 2D tracking; the latter yielded somewhat higher levels of noise in movement representations. However, the freely available, fully automated 2D method yielded the same pattern of results and can be used with standard video (vs. Kinect), which holds promise for large-scale deployment.

330 **149.330** Gait Analysis in Children and Young Adults with Autism Spectrum Disorders Using Instrumented Insoles

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Background:
The diagnosis of autism spectrum disorder (ASD), is based on two behavioral criteria: (1) social and communication impairments; and (2) restricted interests and/or repetitive behaviors. Motor abnormalities, not considered "core" diagnostic criteria, are nonetheless prominent and lifelong in idiopathic or genetic-based ASD. Common clinical tools often lack the sensitivity to capture subtle differences to further define the motor profile across the lifetime. Consequently, the motor phenotype of ASD remains ill-defined. Moreover, due to lack of accuracy in measurement, motor behaviors are not considered valid outcome measures, despite their potential response to behavioral or pharmacological treatment. Among motor behaviors, gait in older children or adults with ASD have been analyzed using cumbersome equipment, and report mixed results in cadence, stride length and base of support. The advent of wearable technologies encourages the use of quantitative gait assessments that are independent of potential clinical assessment limitation.

Objectives:

This project addresses the challenge of accurately measuring gait in children and adults with HNRNPH2-variant who present ASD, anxiety, developmental delays and motor impairments. We used a novel unobtrusive wearable technology (instrumented insoles) developed by our team, to validate our gait methodology against usual command-based motor assessments, which often introduce bias in assessments due to the inherent behavioral constraints of ASD. Herein we show, in a naturalistic environment, the significant value of this technology to assess spatial and temporal features of gait that are not easily identifiable by an observer. The identification of precise gait abnormalities will shed light on underlying motor pathway dysfunctions such as the cerebellum involved in motor control and walking behavior

Methods:

Six patients with HNRNPH2/ASD and two typically developing controls, aged between 5 and 37 years were evaluated. Participants with ASD received complete neurological, neuropsychological, and clinical motor assessments using standardized instruments as well as ASD diagnosis using the gold standard battery. Wearing shoes equipped with comfortable instrumented insoles, participants performed gait (preferred and fast pace, running) and balance tasks (standing on one leg). The gold standard electronic walkway (Zeno mat) was used for comparison to the wearable device in quantifying spatial (stride length, velocity) and temporal (stride time, swing time) gait parameters as participants completed 4 full laps along a 16-meter long straight-line path. All sessions were videotaped.

Results:

All 6 subjects tolerated well the instrumented insoles and, performed safely the walking tasks. We found very good level of agreement between the wearable system and the reference system. In relative terms, mean-absolute-errors (MAE) in stride time, length and velocity were ≤4.2% and ≤1.6% for ASD and controls, respectively. For swing time, the percentage MAE was 5.3% for ASD and 3.0% for controls

Conclusions:

The study confirms, for the first time, the validity and ease of use of our instrumented insoles to accurately assess spatial and temporal gait parameters in individuals with ASD with low complain. These results provide strong support for further gait studies in order to interrogate motor pathways and to characterize the motor trajectory of children and adults with idiopathic or genetic-based ASD.

331 **149.331** Groopit: An Innovative Platform to Speed up Rare Genetic Disorder Research

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Background: One of the most prevalent disruptive single gene mutations strongly associated with Autism Spectrum Disorder (ASD) is *CHD8* (Bernier, 2014). Due to the rarity of this mutation, families affected by *CHD8* are geographically widespread and use social media, such as Facebook, as a community engagement tool to share experiences and symptoms. For example, aligned with scientific literature (Bernier, 2014), sleep issues are noted by parents as a problem in *CHD8*, however very little is known about the extent to which these problems interfere with daily life. A new mobile platform, GroopIt (letsgroopit.com), may be a useful data collection tool to research the *CHD8* phenotype at a faster pace than traditional research methods by reporting and tracking behaviors in real time.
Objectives: 1) To identify and characterize common sleep issues for individuals with *CHD8* to further understand the *CHD8* phenotype. 2) To evaluate parental engagement in fast-paced research via an online tool.

Methods: Parents from the *CHD8* Facebook group were invited to join the *CHD8* GroopIt. Parents posted real-time observations every day for one month (30 days) regarding characteristics of their child's sleep from the previous night (see figure 1). Analyses were run on the number of instances behaviors were reported as well as how many children experienced the behavior at all. We measured parental engagement by computing the number and frequency of responses over the 30-day period.

Results: Eight families (n=8) participated in the 30-day sleep tracker on GroopIt with at least one response; 63% of those families (n=5) were active participants with over 15 responses. At the end of the study, 159 responses were recorded for 8 children with *CHD8* (see figure 2). Sleep issues with the highest reported prevalence include: difficulty falling to/back to sleep (n=7, 88%), waking up in the middle of the night or very early in the morning (n=6, 75%), waking up crying and/or screaming (n=5, 63%), and sleep quality disturbances (e.g., restless sleep, nightmares; n=5, 63%).

Conclusions: This pilot study highlights the GroopIt platform as a successful research initiative to better outline the phenotype of rare genetic events of geographically dispersed individuals by virtually collecting relevant data longitudinally. We were able to track 159 nights of sleep behavior for 8 children with *CHD8* over 30 days. Our findings expand the existing literature by identifying specific areas of sleep concern for children with disruptive mutations to *CHD8* (e.g., problems falling and staying asleep, waking up early). This highlights particular areas for intervention to address difficulties with sleep. The response rate also shows that mobile platforms provide a useful medium for parental engagement in collecting key phenotypic information.

332 **149.332** How to Select Technologies for Autistic Users: A Co-Developed Evidence-Based Framework

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Background:
When seeking technology-based interventions, a particular challenge for members of the autistic community is identifying which of the multitude of digital technologies available is most appropriate. What kind of evidence do the autistic community use to inform their decisions regarding technology-based interventions? And to what extent does this match with any evidence provided by those developing or evaluating the digital interventions? This study is part of a project aiming to integrate the perspectives of the autistic, practitioner, developer and researcher communities as to what constitutes evidence for technology-based interventions.

Objectives:

To develop an agreed framework, shared among all relevant stakeholders, for good practice with regard to the provision of accessible evidence for technology-based interventions for autism.

Methods:

We carried out a Delphi-inspired qualitative study adopting Delphi methodology's iterative nature, participant anonymity and online communication (Hasson et al. 2000; Boulkedid et al., 2011) and performing a thematic analysis on the aggregated data. An international panel of 23 specialists (researchers, practitioners, developers, autistic community) in autism and digital technologies completed a four-phase Delphi consultation initially informed by a systematic literature review. Suggestions for evidence usage in technology-based interventions for autism were elicited from the panel, grouped and reviewed by a moderator and rated by the panel at every phase.

Results:

Three separate and distinct requirements emerged for technology-based interventions for autism, namely: reliability, engagement and efficiency. Four sources of evidence were consistently considered high-value by our expert panel, namely: hands-on experience, academic sources, expert views and online reviews. The relative weighting of the importance of each source of evidence varied between reliability, engagement and efficiency. For example, hands-on experience was thought to provide the strongest evidence for reliability and engagement, whereas academic sources were thought to provide the strongest evidence for efficiency. The panel also identified need for caution in relation to some sources of evidence, such as information provided by product developers themselves, as well as a detailed list of resources for digital products for the autism community.

Conclusions:

For the first time, a framework for considering the evidence for technology-based interventions for autism has been developed. The framework has been co-developed by all the relevant stakeholders and is an accessible guide to the available evidence. It can be quickly and easily applied to technology-based interventions for autism by the members of the autism community. This framework can be used as a guide when selecting or recommending a technology-based intervention for autistic people.

333 **149.333** Systematic Review of Evidence-Based Practice and User-Centered Design for Technology-Based Interventions for the Autistic Community

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Background:
The past decade has seen an exponential increase in the number of technology-based interventions for the autistic community. Interventions having robust evidence of effectiveness are rarely commercially available, whilst commercially available therapeutic technologies are infrequently evaluated in research (Constantin et al., 2017). Evidence-Based Practice (EBP) dictates that practitioners should ensure interventions are informed by good evidence (Reichow, 2008). While an EBP framework has been applied to traditional interventions for autism (Mesibov & Shea, 2011), this is not the case for technology-based supports. We argue that technology-based support requires not only a robust evidence base, but also the participation of the autistic community in the development process (Brosnan et al., 2016) to ensure the needs of the autistic community are satisfactorily met. According to ISO 9241-210:2010, User-Centred Design (UCD) is an iterative design approach based on explicit understanding of users, tasks and environments, driven by user evaluation and including multidisciplinary perspectives.

Objectives:

We aimed to systematically review the current state of EBP and UCD for technology-based interventions for the autism community. Additionally, we examined the potential link between EBP and UCD.

Methods:

We followed the PRISMA guidelines for systematic reviews and we used keywords pertaining to technology-based interventions combined with autism conditions. We searched in scientific databases of different foci to accommodate the multidisciplinary nature of the field. From 792 eligible articles we took a random sample of 30% (n= 215) to evaluate two dimensions:

1. EBP: We implemented Reichow's (2008) evaluative method that identifies evidence-based practices for autistic children and we gave group or single-subject designs a score according to a set of quality indicators.
2. UCD: We developed a scale evaluating the extent to which the end-users and their characteristics were taken into account in the development process. The scale was based on Druin's (1999) taxonomy of user participation and ISO norms for human-computer interaction.

Results:

The mean score on Reichow's scale was 1.055, 95% CI [0.915, 1.19] (with 1=weak) and on the UCD scale 3.555, 95% CI [3.36, 3.75] (in a range between 0 and 8). Reichow's scale was not applicable for 81 (38%) of the papers. 71 (33%) papers were rated as weak, 33 (15%) as adequate and 30 (14%) as strong in terms of research rigour. In terms of user-centeredness of the design, 59 (28%) papers received low scores, 135 (62%) medium and 21 (9%) high.

A marginally significant correlation was found between the ratings on the two scales (p=0.05153).

Conclusions:

The resulting ratings indicate a low level of evidence base and a medium to low user consideration and inclusion in the existing literature on technology for autism. Many of the included studies did not meet standard criteria of quality group or single-subject designs. In addition, many of the included studies did not involve end-users or proxies at all. EBP and UCD seem to have a marginally significant positive correlation. Neither framework is currently being applied within the majority of technology-based interventions for autism.

334 **149.334** Outcomes of a Robot-Assisted Social-Emotional Understanding Intervention for Young Children with Autism Spectrum Disorders

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Background:

People in the autism spectrum show impairment in social emotional skills and these difficulties contribute to the impairments in initiating and sustaining typical peer relationships (Berenguer et al., 2018; Jones et al., 2018).

Social robots show great potential for boosting treatment outcomes in children with ASD and robot-assisted autism therapy (RAT) has become an emerging application area in the past few years (Scassellati et al., 2012).

Objectives:

This study is a randomized control trial aimed to test the role of a human-assisted social robot as a treatment mediator in a social emotional understanding protocol for children with autism spectrum disorders (ASD).

Hence, we aim to investigate the feasibility and efficacy of using a partially controlled social robot (NAO) in the context of a group-based CBT intervention trial focused on emotion comprehension and related mentalizing skills, knowledge of basic emotion lexicon and the ability to attribute appropriate emotions in relation to the context.

Methods:

A total of n= 14 high functioning ASD children (13M:2F) participated in the study and completed the intervention. Children were randomly assigned either to the robot-assisted intervention group (RG) (n= 7 children, 6M:1F, mean age in months= 73.3; SD = 16.1) or to the control group (CG) applying the same intervention protocol without the use of the assistive-robot (n= 7 children, 6M:1F, mean age in months=82.1; SD = 12.4).

The intervention consisted of 10 sessions (90 minutes each administered twice a week) of a group-based cognitive behavioural (CBT) emotional understanding skills training protocol based on the principles of the Rational Emotional Behaviour Therapy (REBT). The protocol was specifically designed for implementation with the assistance of a social robot actively interacting with the children and providing verbal antecedents, prompts and reinforcing consequences according to an Antecedent-Behaviour-Consequence (ABC) model.

Pre- and post-intervention assessments were conducted using the Test of Emotional Comprehension (TEC) (Pons & Harris, 2000) and the Emotional Lexicon Test (ELT) (Grazzani, Ornaghi, & Piralli, 2009).

Both the TEC and the ELT are objective measures of the child's performance related to Emotion Comprehension (EC) and Expression in specific social contexts.

Results:

Pre-treatment outcome measures were comparable between the two groups.

The RG displayed a significant improvement on TEC (U=47.0, W=75.0, Z=2.9, p=.001), with a gain of 59% in the total score. Conversely the CG, although improving on the TEC total score by 21%, did not show a significant change (U=32.5, W=60.5, Z=1.04, p=.16).

Likewise, post-treatment total scores on ELT increased by 48% in the RG and by 12% in the CG, showing a significant improvement in the RG (U=49.0, W=77.0, Z=3.4, p=.001), but not in the CG (U=36.5, W=64.5, Z=1.9, p=.06). Furthermore, following the intervention, all children in the RG, but none in the CG, reached the top scores on ELT (Table 3).

Conclusions:

Substantial improvements in contextualized emotion recognition, comprehension and emotional perspective taking through the use of human-assisted social robots were obtained.

335 **149.335** Probabilistic, Model-Based Eye-Tracking Using Machine Learning

***J. A. Olmstead**, A. Klin, S. Shultz and W. Jones, Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA*

Background:

Eye-tracking is a popular research method for neuroscience and biomedical research in general, and for studying social development and autism spectrum disorder (ASD) in particular (Jones & Klin, 2013). In theory, the technology is applicable to participants of all ages and all levels of cognitive and adaptive ability. In actuality, however, traditional calibration techniques required by many model-based eye-tracking technologies (i.e., those that use models of infrared corneal reflection and pupillary geometry to determine gaze, such as EyeLink, SMI, and ISCAN) are difficult to complete for neonates and for individuals with behavioral or cognitive challenges, including some individuals with ASD. This limitation can prevent data collection from important community stakeholders.

Objectives:

To circumvent pre-session calibration procedures for model-based eye-tracking using post-hoc machine learning techniques, while still enabling high-fidelity data collection for studies of social visual engagement in neonates and intellectually-disabled individuals with ASD.

Methods:

By using a set of accurately calibrated, high-quality eye-tracking sessions (N = 18, Table 1) as ground truth estimates during supervised machine learning (Google TensorFlow 1.12.0 library with Keras backend, Abadi et al., 2015), we empirically constructed a calibration transformation from 2-D eye-image space into 2-D screen-coordinate space (Figure 1a-b). We then used an independent set of accurately calibrated, high-quality eye-tracking sessions (N = 111, Table 1) to test the calibration transformation on novel data collected under the same lab conditions.

Results:

The median absolute point of gaze (POG) error (actual POG - predicted POG) subtended 2.64 degrees of visual angle (Figure 1b-c). We then used the empirical error distribution to demonstrate potential future area-of-interest (AOI) analyses: In videos that are segmented into AOIs at each frame, we can probabilistically determine what AOI is being fixated.

Conclusions:

Data collected through model-based eye trackers can be accurately calibrated post-session using machine learning. The estimated gaze position error can be minimized by quantifying and indexing covariates to discard data that are likely to be poorly estimated. Once an error distribution has been empirically determined, it may be used to probabilistically determine fixated elements in naturalistic social scenes. The strength of this eye-tracking approach is that it can be developed and deployed to collect data from participants for whom traditional eye-tracking experiments may not be possible—i.e., from neonates or from individuals with ASD with behavioral challenges or with substantial comorbid intellectual disability. Probabilistic eye-tracking analyses have the promise of extending quantitative research methods into populations of extreme interest, allowing insight into the earliest periods of development and the results of its disruption.

References:

Jones, W., Klin, A. Attention to eyes is present but in decline in 2-6-month old infants later diagnosed with autism. (2013). *Nature, 504, pp. 427-431.*

Abadi, M., Agarwal, A., Barham, P., Brevdo, E., Chen, Z., Citro, C., Corrado, G. S. et al. Large-scale machine learning on heterogeneous systems. (2015). Retrieved from https://www.tensorflow.org/.

336 **149.336** Robustness Analysis for Computational Speech Features during Naturalistic Clinician-Child Interactions

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Background:

Computational analysis of autism diagnostic sessions using automatically extracted features combined with machine learning has provided valuable insights (Bone et al., 2016). Specifically, speech and language features extracted from both child and the interacting clinician have shown to be significantly predictive of autism symptom severity (Bone et al., 2015). However, feature extraction is dependent on availability of *who spoke when and about what (*i.e., speaker labels, durations and transcripts), which can be time-consuming and expensive to obtain manually. Recent technological developments have enabled accurate automatic speaker segmentation, labeling and speech-to-text conversion. However, behavioral feature extraction using these algorithms need to be refined in order to obtain clinically meaningful interpretation for ASD.

Objectives:

We test the feasibility and validity of an automated end-to-end speech processing pipeline (consisting of speech detection, speaker diarization, automatic speech recognition (ASR) and role-assignment modules) to extract speech and language features from audio obtained from naturalistic clinician-child interactions. By replacing oracle labels with system outputs at each module, we simulated multiple error conditions which result in inaccurate features. For each condition, we studied the feature robustness across categories (lexical, turn-taking, prosodic) and the autism symptom severity.

Methods:

As a preliminary analysis, we selected 27 semi-structured, examiner-child interaction sessions from the new treatment outcome (Brief Observation of Social Communication Change [BOSCC; Grzadzinski et al., 2016]; n=24) and gold-standard diagnostic (Autism Diagnostic Observation Schedule-2 [ADOS-2, Lord et al., 2012]; n=3) measures (age: μ=9.3 years, σ=3.4; verbal IQ: μ=98.6, σ=24.3). Trained annotators labeled speaker boundaries and transcripts, which were used to extract session-level features (*oracle features*). Next, the speech pipeline was employed to extract an identical set of features *(pipeline features)* wherein at each module the oracle labels were replaced with previous module outputs. Feature robustness is estimated by comparing pipeline features to oracle features. For each type of module error, we used normalized mean squared error (NMSE) to identify a subset of robust features. Using linear regression models, we compared the ADOS calibrated severity scores (CSS) predicted using pipeline features versus oracle features to assess predictive power of symptom severity in the former.

Results:

We obtained perfect role assignment for all sessions, word error rates of 45.61% (clinician) and 75.63% (child) from the ASR system, speaker error of 9.42% from the speaker diarization system and an f-score of 0.90 from the speech detection system. Similar feature subsets were found to be robust under both conditions: (lexical) first-person pronoun use by clinician, (turn-taking) clinician speaking fraction and utterance lengths and (prosodic) intonation slope and intercept from both speakers (Table 1)**.** Further, the regression model (adjusted R^2=0.26, DF=16) trained from pipeline features predicted almost similar CSS scores (Fig. 1) when compared to the oracle features (NMSE=0.026).

Conclusions:

We built a fully automated speech pipeline to extract behavioral features during semi-structured, naturalistic examiner-child interactions. We identified features robust to different module errors. We further demonstrated similar predictive power between robust pipeline features and oracle features. These results are promising for more automated, scalable analyses fo speech while removing the need for manually annotated speaker labels.

337 **149.337** Spline Fitting for More Robust ERP Derived Dependent Variables

T. McAllister[1], *A. Naples*[1], *A. Bagdasarov*[1], *C. Carlos*[1], *C. C. Cukar-Capizzi*[1], *E. Hamo*[1], *E. Jarzabek*[1], *S. Kala*[1], *M. L. McNair*[1], *D. Stahl*[1], *T. Winkelman*[1], *J. Wolf*[1], *A. Anticevic*[2], *V. Srihari*[2] *and J. McPartland*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Division of Neurocognition, Neurocomputation, and Neurogenetics (N3), Yale University School of Medicine, New Haven, CT*

Background:

Electroencephalography (EEG) is a valuable tool for studying Autism Spectrum Disorder (ASD) due to its high temporal resolution. By repeated exposure of participants to stimuli, researchers can construct Event Related Potentials (ERPs). For statistical analysis, measures of ERP peaks often utilize automated window-based peak picking (AWPP) to find peak activity during a specified time window. AWPP offers no reliable way to assess accuracy of derived dependent variables (DVs), such as peak amplitude and latency to peak. Manual peak picking (MPP), in which humans select peaks based on visual inspection, offers this benefit but is significantly more time consuming and prone to human error. Splines are smooth lines made of Bezier curves. Fitting splines to ERPs presents an alternative method to derive DVs, which may offer a middle ground of performance assessment and time efficiency. Given the unusual waveform morphologies commonly observed in ASD, this would represent a significant advance, particularly in large samples.

Objectives:

We sought to: (1) develop an algorithm to fit splines to ERP data; (2) assess the success in both ASD and typical development (TD) using spline parameters instead of AWPP; (3) identify avenues for further development as a tool for analyzing EEG data in ASD.

Methods:

Data were collected across 106 EEG sessions with adult participants clinically diagnosed with ASD or TD controls. Participants were shown dynamic faces displaying emotional expressions. Data were processed with simple filtering and artifact detection and averaged across trials. AWPP was used to find a positive peak within a window of 40-190ms relative to the event (P100), and a negative peak in the window of 120-250ms (N170), both in averaged channel groups representing the left and right occipto-temporal scalp. A grand average was used to manually create a starting spline, which was then automatically fit to each ERP for the same channel groups by our algorithm. The parameters that defined the fit splines were used in analysis.

Results:

Based on simple ANOVAs using both AWPP values and corresponding spline control points values (SCPV), our algorithm was successful in extracting meaningful data from ERPs. A statistically significant difference between groups was detecting using both AWPP-derived N170 amplitude (p=.015) and the SCPV (p=.007). In addition to comparable performance in group discrimination, the SCPV offer a goodness of fit with R^2 values, and thus an estimation of divergence from recorded waveforms. Further, some SCPVs with no AWPP equivalent show promise of discriminatory power, indicating that our method may capture additional, novel aspects of waveform shape.

Conclusions:

Our promising results warrant further development of these methods. Given the same data, novel methods were able to extract equivalent meaningful information from the ERPs when compared to AWPP. Further, goodness of fit estimation and novel values with possible discriminatory power offer advantages over the traditional method. While our methods were not compared to MPP, the vastly lower cost in human effort highlights the value of this approach in quantifying individual differences in an automated and unbiased fashion. Ongoing analysis is examining our approach with other ERPs, such as Visual Evoked Potentials.

338 **149.338** Investigating ASD-Specific Salient Visual Features Using Discriminatory Convolutional Neural Networks: Results from the ABC-CT Interim Analysis

C. Carlos[1], *A. Naples*[1], *K. Chawarska*[1,2], *R. Bernier*[3], *S. Jeste*[4], *C. A. Nelson*[5], *G. Dawson*[6], *S. J. Webb*[3], *M. Murias*[7], *F. Shic*[8,9], *C. Sugar*[4] *and J. McPartland*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Child Study Center, Yale School of Medicine, New Haven, CT, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (4)University of California, Los Angeles, Los Angeles, CA, (5)Boston Children's Hospital, Boston, MA, (6)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (7)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (8)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (9)Pediatrics, University of Washington School of Medicine, Seattle, WA*

Background: Autism spectrum disorder (ASD) is marked by atypical visual attention to socially meaningful visual stimuli. While reduced focus to social features is commonly studied, less research has been directed towards characterizing visual features that draw the attention of individuals with ASD. By training convolutional neural networks (CNNs) to discriminate among saliency maps of eye-tracking (ET) data from individuals with ASD vs. typical development (TD) vs. randomly generated maps, visual attention patterns associated with ASD can be described. Using the biophysically inspired CNN model, insight into the underlying mechanism of visual attention for ASD individuals may lead to better clinical treatment and intervention strategies.

Objectives: This study uses CNNs to model image characteristics that are most salient to ASD individuals relative to TD peers.

Methods: ET data were collected for 225 participants between the ages of 6 and 11 (ASD: N = 161, 131 male; TD: N = 64, 42 male) using an SR Eyelink 1000+ while participants viewed static images of social scenes. ET data were used to generate saliency maps, which were overlaid onto the respective trial's stimulus image. These masked images served as the dataset for the CNN models. A set of random saliency maps was also generated. Three identical CNNs were trained independently to discriminate between ASD and TD datasets (ASDvTD), ASD and random datasets (ASDvRAND), and TD and random datasets (TDvRAND). A consistency-of-gaze (CoG) metric was calculated to index a person's tendency to fixate on their most salient feature of a stimulus image by dividing the number of sampled viewings in the highest salient location by the total number of sampled viewing positions.

Results: A significant difference was found between the CoG metric for ASD and TD groups indicating less consistency of gaze in ASD; t(1333.7)=-3.76, p=1.8e-4. Validation set accuracy and mean squared error (MSE) assessed ability of CNNs to discriminate datasets. ASDvTD obtained accuracy=0.70, MSE=0.30. ASDvRAND obtained accuracy=0.59, MSE=0.41. TDvRAND obtained accuracy=0.86, MSE=0.11.

Conclusions: These data show that CNNs are capable of discriminating between groups based on saliency weighted image characteristics. CoG

significantly differed between diagnostic groups; this may reflect the previously reported tendency of TD participants in this sample, relative to ASD participants, to attend to faces in stimuli (Shic et al., 2018). This would also explain the high accuracy of TDvRAND, as the model was capable of easily learning head specific low-level visual patterns. The low accuracy of ASDvRAND suggests that, in contrast to the shared low-level features of TD salience, low-level ASD-specific features were not strongly distinct from random low-level visual features. Future research could add more convolutions to the model to increase the size of the receptive field for CNN. Such deeper model could test whether ASD-specific salient features are noisy and non-homogenous or whether that gaze in ASD individuals is mediated by a set of common visual features.

339 **149.339** Using a Participatory Approach to Iteratively Adapt a Collaborative Emotion Recognition Game for Non-Speaking Autistic Youth

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Background: Although autism is partially defined by social difficulties, some autistic people communicate more effectively through computers than in-person (Gillespie-Lynch et al., 2014). Consequently, computer-mediated supports for autistic people are proliferating (Fletcher-Watson, 2014). However, evidence that computer-mediated interventions help autistic people develop *generalizable* social-communicative skills remains limited (Whyte et al., 2015). Participatory research wherein autistic people collaborate in game design/evaluation may ameliorate the disconnect between the *potential* of computerized interventions and *limited benefits* documented thus far.
Objectives: By collaborating with speaking autistic people, we are developing a game to help non-speaking autistic people understand complex emotions and collaborate.

Methods: *Connecting through Kinect* uses animated tutorials rather than words to be accessible regardless of linguistic ability and promotes generalizable social-communicative skills by providing simultaneous opportunities to engage digitally and in-person. Players solve collaborative emotion matching puzzles using Kinect while standing together. Each puzzle depicts the outline of a figure in an emotional context. After constructing the body, players must agree on the correct emotion for the face by selecting from three emotions. This collaborative component was adapted from a task which promoted collaboration among minimally-verbal children (Holt & Yuill, 2014). In earlier iterations of game development (Sturm et al., 2018), autistic college students spearheaded many improvements including: demos, meaningful rewards, improved image quality, and a relatable storyline (an autistic child overcomes bullying through friendship with a friendly dragon; Figures). After qualitative coding revealed that autistic students initially looked at the screen rather than each other, we added a tutorial depicting collaborative play, an associated pause feature to encourage collaboration, and a face tracking component to automatically quantify collaboration. Autistic college students looked at one another more when playing the revised game. However, some played with mentors who prompted collaboration verbally. After incorporating extensive feedback from 10 autistic college students in our mentorship program, we asked 10 autistic adolescents from a technology camp for feedback.

Results: To evaluate if the game is accessible *without* spoken instructions, autistic adolescents played the revised game with a player who did *not* prompt interaction. They exhibited pronounced variability in emotion matching (0-16 errors), utterances (1-47) and looking at one another (0-6). They found the game useful/fun but critiqued motion control inefficiencies and found the collaboration animation confusing, indicating that it should be removed. They highlighted the need for tutorials to let players know that there is a "right answer." Some felt that "errors" were "glitches" and were surprised to realize that the background was relevant. An adolescent with low language skills kept approaching the Kinect asking "Why can't I help?" Findings indicate that emotion matching/collaboration are desired learning goals while highlighting areas for improvement.

Conclusions: Our autistic collaborators have spearheaded extensive improvements in game design. They remind us to incorporate key design principles that promote generalization but are often lacking in games designed for autistic people. After incorporating feedback, we will evaluate the game with non-speaking children this spring. The process of collaborating with speaking autistic people to develop computer-mediated interventions for non-speaking youth shows promise.

340 **149.340** Systematic Review of Web- and Smartphone-Based ASD Parent Trainings: Increasing Access and Improving Outcomes

E. Glenn[1], *H. Riehl*[2], *A. Taiwo*[1] *and L. L. McIntyre*[1], *(1)University of Oregon, Eugene, OR, (2)Tufts University, Boston, MA*

Background: Parents of children with ASD have difficulty obtaining services triple that of parents of children with other healthcare-related needs, with up to 56% of these parents reporting long wait-lists, local unavailability of services, or financial limitations (Montes, Halterman, Magyar, 2009). Telehealth coaching has begun to address issues of delivery of high-quality, efficacious services to more rural areas, but has not addressed issues of clinician availability, nor treatment costs. Online or app-based parent training have the ability to partially address these issues through providing triage, connecting parents with evidence informed practices and resources, and supplementing ongoing therapy. However, as studies on eLearning are rather nascent in comparison with tele-consultation, systematic reviews have yet to specifically explore the effects of parent eLearning programs on child social, emotional and behavioral outcomes.
Objectives: The aim of this systematic review was to evaluate the impact of web- and app- based parent trainings, not solely reliant on web-based video conferencing, on outcomes for children with ASD.

Methods: Using PRISMA methodology, we searched five different databases (EBSCO, ProQuest, PsychInfo, PubMed, Web of Science) for abstracts containing search terms in each of the following categories: ASD, web/smartphone, intervention, and parenting. The search results identified 1191 articles, with 737 unique articles once duplicates were removed. 40 relevant abstracts and 13 articles for inclusion resulted after screening for articles: 1) in English, 2) in a peer-reviewed journal, 3) included a parent-mediated intervention or training 4) intervention was disseminated at least partially online or in an app, 5) contained an online element besides teleconferencing, 6) reported child outcomes, and 7) were tested with an ASD population. Using the snowball method, we scanned the references of included articles, however failed to find additional articles that met inclusion criteria.

Results: Demographics for these studies largely represented middle class, college-educated, non-minority parents. Out of the 13 studies, 6 were single-subject multiple baseline designs, 5 were RCTs, and 2 consisted of pre- and post- measures with no control group. Interventions targeted

child social-communication skills, reciprocal imitation skills, joint attention, as well as secondary conditions such as anxiety. Parent skills targeted were modeling, prompting, reinforcement, creating visual supports, setting up behavior contingencies, and problem solving. Effect sizes for child outcomes ranged from d=0.58-2.2. Twelve studies supplemented online parent training with in-person or web-based coaching sessions. Eleven studies utilized web-based platforms, while 2 were application based. Programs varied in terms of length, online components, attrition, and research quality.

Conclusions: This review suggests that there is a burgeoning literature of promising online parenting programs. Published findings suggest moderate to large effect sizes for improving social-communication skills and reducing anxiety in children with ASD. Most of these studies were a hybrid of online and clinic or tele-health intervention modalities, thus, additional investigations are needed to test the independent contributions of online and tele-health components. Future studies should also explore factors that may moderate parent engagement and child outcomes. Additionally, future studies should target more diverse samples in terms of SES, parental education, and prior experience with parenting interventions.

Keynotes and Awards
- Welcome and Sponsor Update
8:45 AM - 9:00 AM - Room: 517AB

Welcome and Sponsor Update.

Oral Session -
Invited, Keynote Speakers, Awards
- Introduction and Sponsor Update
5:30 PM - 5:40 PM - Room: 517A

5:30 Introduction and Sponsor Update.

Oral Session -
Invited, Keynote Speakers, Awards
156 - Keynote Address - Jason Lerch, PhD
9:00 AM - 10:00 AM - Room: 517AB

9:00 Of Many Autisms or One Neurodevelopmental Disorder

***J. P. Lerch**, Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada; Wellcome Centre for Integrative Neuroimaging, University of Oxford, Oxford, United Kingdom*

Defining diagnostic boundaries is difficult. There is a case to be made for lumping disparate neurodevelopmental disorders, including autism, ADHD, and OCD, into a single category. Conversely, there are strong arguments for splitting autism into multiple, narrower diagnoses focused on genetics or other aetiological factors. Here I will use brain imaging data from both large human population samples as well as from over 100 mouse models related to the disorder to explore both the case for lumping and splitting. Human imaging finding, coming from structural MRI, diffusion imaging, and functional MRI indicates that the boundaries between different neurodevelopmental disorders are hard to recover in brain signatures. The mouse data indicates that there are 4 separate classes of models which share a neuroanatomical phenotype and link with known genetic pathways. The human and mouse data together suggest that our current nosological categories do not have a strong basis in biology, and that future choices of where to lump and where to split will be context dependent.

Panel Session
Adult Outcome: Medical, Cognitive, Behavioral, Social, Adaptive, Vocational
157 - Health and Well-Being in Transition-Age Youth and Adults with Autism Spectrum Disorder
10:30 AM - 12:30 PM - Room: 517C

Panel Chair: Beth Malow, *Sleep Disorders Division, Department of Neurology, Vanderbilt University Medical Center, Nashville, TN*

Discussant: Susan Brasher, *Nursing, Emory University, Atlanta, GA*

Health and well-being are considered core domains of quality of life (QOL) in autism research and are synergistic with other QOL domains and transition success. For example, greater vocational independence and engagement have been related to subsequent reductions in maladaptive behaviors. Self-determination, which encompasses identifying one's wants and needs, problem-solving obstacles, advocating for one's self, and believing that one has the capability to make positive changes for one's own life path, provides an essential foundation for other core domains of QOL. Research focused on health and well-being in transition-age youth and adults with autism spectrum disorder (ASD) has lagged far behind other types of ASD-related research. With many individuals with ASD turning 18 years old (estimated at 500,000 over the next decade), broadening our understanding of health and well-being, while improving QOL, in this population is timely and relevant. This panel will focus on topics related to health in transition-age youth and adults with ASD including the barriers and facilitators of a smooth transition from pediatric to adult care, sex differences in physical health conditions and healthcare utilization, predictors of self-determination, and the associations of self-determination and autism identity with physical and psychological health and QOL.

10:30 **157.001** Are Health Care Providers Ready to Transition Teens with Autism Spectrum Disorders to Adult Care? a Survey of Clinical Providers in California.

L. A. Croen[1], *J. Ames*[1], *M. L. Massolo*[1], *Y. Qian*[1], *H. J. Cerros*[1] *and M. N. Davignon*[2,3], *(1)Division of Research, Kaiser Permanente, Oakland, CA, (2)Pediatric Specialties, Kaiser Roseville Medical Center, Roseville, CA, (3)Kaiser Permanente Northern California, Oakland, CA*

Background: Health care continuity during the transition from pediatric to adult health care is critical to helping individuals with autism spectrum disorders (ASD) manage complex medical and psychiatric co-morbidities that start in childhood and evolve with age. However, the transition process is often difficult to navigate for young adults and their families. Youth with ASD often receive fewer transition resources than their peers with other special health care needs (SHCN) and experience lapses in care. While several studies have examined the health care transition from the perspective of patients and their families, fewer have approached the problem from the perspective of the providers.
Objectives: To assess providers' departmental and personal practices surrounding the transition of patients with SHCN from pediatric to adult care.

Methods: In 2016, we conducted a brief online survey (~20 questions) of pediatric and adult health care providers at Kaiser Permanente Northern California (KPNC), a large integrated healthcare delivery system serving over 4.2 million members. The survey was developed in consultation with the "Got Transition" Project and piloted by KPNC pediatric and adult care providers. Questions assessed departmental policies and personal approaches to transitioning patients with SHCN and desired training and resources to improve the process. Response formats included Likert scale, multiple choice, or select all that apply as well as space for optional free response.

Results: A total of 354 pediatric (43%) and 715 adult providers (33%) completed the survey. Survey respondents were approximately 75% primary care and 25% mental health providers. We found that a large majority of departments do not have transition policies, practices, or mechanisms in place. Even when departmental policies do exist, this information is only transferred to medical staff and patients less than 50% of the time. Furthermore, the majority of providers do not provide transition resources, review legal changes, use a standardized assessment tool, or communicate with next/previous provider – strategies endorsed by the American Academy of Pediatrics. When a transition readiness assessment tool was used, approximately 60% of providers incorporated the results into a care plan and shared the care plan with patients and/or their families. Deficiencies in transition approaches were apparent in both primary care and mental health settings. Pediatric providers also reported starting the transition planning when the patient reached age 17+, despite current recommendations to initiate the process earlier. Ninety percent of pediatric providers desired training in the specific transition needs of patients with ASD.

Conclusions: Our findings indicate that most pediatric and adult providers do not have consistent approaches to the transition of care for youth with SHCN and feel inadequately prepared to handle the process for children with ASD. As the population of transition-age youth with ASD continues to grow, there is urgent need to understand how to best implement transition policies that promote early and clear communication between providers and families and track outcomes among transitioning patients with SHCN.

10:55 **157.002** Sex Differences in Health Outcomes Among Adults with ASD

L. E. Smith DaWalt[1], *J. L. Taylor*[2], *A. Movaghar*[3], *J. Hong*[3], *M. H. Brilliant*[4] *and M. Mailick*[1], *(1)University of Wisconsin-Madison Waisman Center, Madison, WI, (2)Vanderbilt Kennedy Center, Nashville, TN, (3)University of Wisconsin-Madison, Madison, WI, (4)Marshfield Clinic Research Institute, Marshfield, WI*

Background:
Individuals with autism spectrum disorder (ASD) face many challenges during adulthood, including elevated health problems relative to the general population. An emerging body of evidence suggests that females with ASD may be doubly-vulnerable for poor outcomes across a range of domains because of both their sex and their autism status. However, sex differences are rarely investigated in ASD studies, often because too few females are included. The present study used electronic health records (EHRs) to investigate health conditions of women with ASD compared to men with ASD as well as compared to men and women without ASD.

Objectives:

The present study examined (1) sex differences in health conditions and burden of disease for 2119 adults with ASD (458 females, 1661 males) and (2) if sex differences for adults with ASD were similar to or different from sex differences in the general population using a comparison group of 21,228 age- and sex-matched adults without disabilities.

Methods:

We utilized EHRs from the Marshfield Clinic population (a large, private, multispecialty group practice with records for over 1 million patients) to characterize health profiles. We selected for autism cases based on a patient having an ICD-9 code of pervasive developmental disorder (299) on at least two occasions (following procedures used by Croen et al., 2015). Based on past research, our initial analyses focused on five conditions: cardiovascular disease, sleep disorders, thyroid disease, constipation, and gastroesophageal reflux. Health conditions (presence=1, absence=0) were defined based on the presence of at least two ICD-9 codes in the health record for the particular condition. For individuals with a given condition, burden of disease was determined by a count of total number of ICD-9 codes, reflecting the number of medical visits, for that condition.

Results:

Preliminary findings found differences between autism and comparison groups in all five of the conditions we investigated. Individuals with ASD had higher rates than controls of cardiovascular disease (23.5% ASD vs 10.2% controls; p=.03), sleep disorders (13.8% ASD vs 3.4% control, p=.05), constipation (5.3% ASD vs 1.0% controls, p=.05), and gastroesophageal reflux (10.3% ASD vs 3.0% control, p=.04). There was a significant group (ASD vs control) by sex interaction for thyroid disease: women with ASD (14.6%) had a higher rate of thyroid disease than men with ASD (5.4%), men without ASD (1%), and women without ASD (4.7%; p=.00). When considering the burden of disease, women with ASD had a greater number of medical visits relative to the other groups for sleep disorder (p=.002), gastroesophageal reflux (p=.047), and constipation (p=.058).

Conclusions:

The present analyses suggest new ways in which women with ASD might be at greater risk than men (relative to their counterparts in the general population). Though both men and women with ASD were at greater risk for a number of conditions (consistent with extant research), our analyses suggest that women with ASD have more medical encounters once a condition is detected. Further analyses will examine other health

conditions, as well as whether sex differences are more apparent at different ages.

11:20 **157.003** Predictors of Self-Determination in Young Adults with Autism Spectrum Disorder

N. C. Cheak-Zamora[1,2] *and A. Maurer-Batjer*[3]*, (1)Health Sciences, University of Missouri, Columbia, MO, (2)Department of Health Sciences, University of Missouri, Columbia, MO, (3)University of Missouri, Columbia, MO*

Background: Young adults with Autism Spectrum Disorder (YA-ASD) have the lowest rates of independence of all young adults. Self-determination, the ability to set and work toward goals, is a prerequisite to independence. Research shows a connection between self-determination, independence, and quality of life. Unfortunately, few studies have examined self-determination within the autism community and have identified which factors promote self-determination in YA-ASD.

Objectives: This study aimed to examine rates of self-determination and contributing factors to self-determination among YA-ASD.

Methods: Caregivers of YA-ASD were recruited from five Autism Treatment Network sites and associated organizations across the U.S. (n=479) to complete surveys about their YA-ASD's transition experiences. Self-determination was examined using two components of the American Institutes for Research (AIR) self-determination assessment. The two components measured the young adults' capacity to be self-determined and the young adults' level of opportunity to be self-determined at home. Both component scores and the total score were used in all analyses.

Univariate analyses examined associations between self-determination and YA-ASD's demographics, ASD severity, and individual caregiver and family-level variables. Linear regression analyses explored whether individual demographics, individual condition severity, or caregiver and family factors were associated with level of self-determination for YA-ASD.

Results: YA-ASD ranged in age from 16 to 25 years old (M = 18.5; *SD* = 2.2), while caregivers ranged in age from 21 to 72 years (M = 49.33; SD=7.068). The majority of YA-ASD were reported to have moderate ASD symptoms (57.4%) and good to excellent verbal skills (74%). Thirty-three percent of young adults had an intellectual disability. Approximately 20% of YA-ASD had paid employment and 18.6% volunteered. The vast majority of caregivers were the young adult's mother (81%). Caregivers were more likely to be married (77%) and had a household income of $75,000 or more (52.4%).

YA-ASD's self-determination total ranged from 12-60-points with a possible score of 60. Caregivers reported their YA-ASD as having moderate overall self-determination (*x* = 38; *SD* = 9.04). Component measures, young adults' capacity and opportunities at home, ranged from the minimum score of 6 to the maximum score of 30 but had very different means. The mean for young adults' capacity to be self-determined were low (*x* = 15.3; SD = 5.67) while the mean for caregiver-rated young adults' opportunities at home was high (*x* = 23.1; *SD* = 4.59).

Barring severity, there were few significantly predictors of self-determination. Regression analyses indicated that YA-ASD's intellectual disability status, symptom severity, verbal communication level, and self-care skills were strong predictors of lower self-determination, whereas demographic and family variables accounted for little variance.

Conclusions: Our findings show a dissociation in self-determination ratings, with a lower mean for YA-ASD capacity and a higher mean for caregiver-rated opportunities for YA-ASD. Additionally, we found significant disparities in self-determination for YA-ASD with increased symptom severity and communication difficulties. Additional research is needed to examine how to most effectively encourage YA-ASD to develop and work towards their goals in school, healthcare settings, and at home.

11:45 **157.004** Physical and Psychological Health and Quality of Life in Adults with Autism: Role of Self-Determination and Autism Identity

T. A. M. McDonald[1]*, R. Fan*[2]*, F. Ye*[2]*, L. Jeradeh Boursoulian*[3] *and B. A. Malow*[1]*, (1)Sleep Disorders Division, Department of Neurology, Vanderbilt University Medical Center, Nashville, TN, (2)Department of Biostatistics, Vanderbilt University Medical Center, Nashville, TN, (3)Department of Pediatrics, Vanderbilt University Medical Center, Nashville, TN*

Background:

The steep rise in ASD prevalence is resulting in a large wave of individuals approaching adulthood. Although these individuals gain skills as they age, many continue to experience challenges in education, employment, social relationships, and other aspects of adult independence (Levy & Perry, 2011). Additionally, autistic adults face challenges with physical and mental health (Croen et al., 2015). While previous work has identified interrelationships of psychological health, quality of life (QOL), stigma, and autism identity (McDonald, 2017), the relationship of these factors with physical health and with self-determination has received limited study.

Objectives:

To understand the relationships between self-determination and autism identity with physical and psychological health and QOL in autistic adults in order to strengthen the design of programs, services, and interventions for this population.

Methods:

Thirty-one adults (20 men, 11 women) ages 18 to 35 years (mean = 24.1, standard deviation = 4.7) participated in a multicomponent self-determination program. Participants completed electronic surveys containing demographic questions and measures of health, wellbeing, autism identity, and components of self-determination at four time-points- two time-points prior to the intervention program and two time-points post-intervention. This presentation focuses on the pre-intervention measures. To identify key variables of self-determination and autism identity and minimize overlap, a cluster analysis incorporating a fast-backward variable selection multiple regression procedure was performed. Models incorporated validated measures of physical health (PHQ15), depression (PHQ9) and the World Health Organization Quality of Life Scale (WHOQOL-BREF) along with key variables of self-determination (e.g., Hope Scale -Agency) and autism identity (Autism Spectrum Identity Scale; ASIS) that were identified by the cluster analysis. The ASIS captures constructs including Spectrum Abilities (endorsing that one has autism-specific positive traits), Positive Difference (endorsing that being on the autism spectrum is a different but equally valid way of being), and Changeability (endorsement of the ability to change negative aspects of being on the autism spectrum).

Results:

Self-determination and autism identity factors accounted for 58% of the variance in scores on the PHQ15. Lower physical health symptoms were associated with higher Agency (p = 0.038), lower ASIS- Spectrum Abilities (p = 0.007) and higher ASIS-Positive Difference (p = 0.001) scores. Self-

determination and autism identity factors accounted for 55% of the variance in WHOQOL-Physical Health, with higher scores in Positive Difference relating to better physical health QOL (p =.006). Self-determination and autism identity factors accounted for 48% of the variance in scores on the PHQ9. Lower depressive symptoms were associated with higher Agency scores (0.0012). Finally, self-determination and autism identity factors accounted for 74% of the variance in scores in WHOQOL-Psychological Health. Psychological health QOL was positively associated with Agency (p = 0.034), ASIS-Positive Difference (p = 0.023), and ASIS-Changeability (p < .001).

Conclusions:

Factors related to both self-determination and autism identity are associated with physical and psychological health and quality of life. Programs, services, and interventions designed to improve physical and psychological health and quality of life for adults on the autism spectrum should consider incorporating elements that enhance aspects of self-determination and positive autism identity.

Panel Session
Biomarkers (molecular, phenotypic, neurophysiological, etc)
158 - The Multiple Powers of Eye Tracking in Early Developmental Research: From Mechanism to Diagnostic, Prognostic, and Clinical Characterization Utility
10:30 AM - 12:30 PM - Room: 517B

Panel Chair: Frederick Shic, *Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA*

Discussant: Declan Murphy, *Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

This panel highlights the multiple uses of eye tracking, from investigations of mechanisms, towards tools of clinical value. The first presentation (n=234) presents on brief, scalable, gaze-contingent eye tracking batteries that tap into social motivational processes and segregate children with and without ASD. The second (n=100) deconstructs factors underlying diminished face looking in toddlers with ASD, highlighting decreased attention to the mouth in ASD in response to speech and its relationship to autism symptoms. The third (n=129) uses a novel gaze-contingent value learning task to examine contribution of value learning to atypical selective social attention in toddlers with ASD, highlighting the potential disruption in the reward system network involved in value learning and signaling value-based attentional priorities during early stages of the disorder. The fourth (n=201) advances scalable eye-tracking-based measures designed specifically for clinical application in ASD, highlighting their strong psychometric properties and links with language ability. Together, these studies cut across the lifespan, inform our understanding of the earliest manifestations of ASD, employ some of the latest paradigms and technologies in both autism and eye-tracking research, help to isolate developmental and cognitive constructs, and bring us closer towards a future of eye tracking as a clinical tool.

10:30 **158.001** Using Gaze Contingent Technology to Characterize a Toddler's Preference for Motherese Speech: Towards Eye-Tracking Based Biomarkers of ASD within the First Years of Life

K. Pierce[1], *A. Moore*[2], *V. Gazestani*[1] *and A. Cheng*[3], *(1)Univeristy of California, San Diego, La Jolla, CA, (2)University of California, San Diego, La Jolla, CA, (3)University of San Diego, San Diego, CA*

Background:

When given a choice, typically developing infants prefer to listen to "motherese" – a speech style characterized by slower tempo and exaggerated speech contours and positive affect. This style is thought to play an important role in enhancing language acquisition, stimulating joint attention, and improving affective reactivity and emotion regulation. One previous study by Kuhl and colleagues (2005) noted that ~70% of 4-year old children with ASD preferred to listen to a computer generated voice rather than to motherese.

Objectives:

The purpose of the present study was to determine if toddlers much younger than the participants in the Kuhl study would also show a reduced preference for motherese speech using a gaze-contingent eye tracking test battery, and, if so, to determine the validation statistics associated with each eye tracking test.

Methods:

Using our general population early detection program, the *Get SET Early Model,* as the main recruitment mechanism, toddlers with ASD and other disorders (mean age 25 months; range 12-43) participated in 1-3 eye tracking tasks using gaze contingent technology wherein a toddler's fixation location controlled what he/she sees and hears. Toddlers were presented with ~60 second videos that depicted a woman engaging in animated motherese speech on one side of the video, in contrast to a non-social sound (e.g., highway traffic sounds) and associated image on the other. In Test 1, a toddler's preference for motherese speech was compared to his/her preference for flat affect speech (N=211; 94 ASD vs 117 non-ASD); in Test 2 versus highway noises (N=234; 109 ASD, 125 non-ASD); and in Test 3 (N=53; 23 ASD, 30 non-ASD), versus music. See Figure 1. Percent fixation within motherese and non-motherese AOIs was the main dependent variable. One-way anovas were conducted and significant findings followed up with t-tests. Validation statistics for specificity and PPV were calculated using traditional formulas, as were ROC curves.

Results:

Surprisingly, when a preference for motherese speech was isolated by comparing fixation towards motherese and flat affect speech while keeping the mother images constant (Test 1), toddlers with ASD performed similar to TD toddlers: they preferred motherese speech (F=1.03, p=.39; ASD mean motherese 63% vs 67% TD). However, when fixation towards motherese was compared to fixation towards non-social sounds and associated images in Tests 2 and 3, toddlers with ASD dropped their preference for motherese in favor of listening to non-social sounds and watching non-social images. Overall F tests were significant for both tests (F=10.5 and 7.6 respectively, p<.05). When cutoff thresholds were used to generate validation statistics (see dashed line in Figure), specificity and PPV were strong at 98% and 88% for Test 2, and 97% and 90% for Test 3, respectively.

Conclusions:

Eye tracking technology can be a powerful early diagnostic tool. Our results suggest that abnormalities in attention patterns in toddlers with ASD are strongly driven by what they see rather than what they hear. The power of combining multiple eye tracking tests and examination of age effects will also be discussed.

10:55 **158.002** Diminished Salience of Speech Underlies Diminished Face Looking in Toddlers with ASD: An Eye-Tracking Study

F. Shic[1,2], *Q. Wang*[3], *S. Macari*[3] *and K. Chawarska*[3], *(1)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (2)Pediatrics, University of Washington School of Medicine, Seattle, WA, (3)Child Study Center, Yale University School of Medicine, New Haven, CT*

Abstract

Background: Under-responsivity to eye contact is considered a hallmark of autism spectrum disorders (ASD). However, real-world face-to-face social interactions often involve both eye contact and speech together. It is not clear whether children with ASD show limited salience for these features, or whether they find them aversive. Similarly, it is not clear how gaze and speech cues independently and synergistically impact looking at the face, eyes, and mouth, especially early in development, in children with ASD. Finally, it is unclear how modulation of gaze patterns in response to gaze and eye cues relate to clinical phenotype in ASD.

Objectives: To systematically examine the independent and emergent effects of direct eye contact and speech on face-looking profiles in toddlers with ASD using eye tracking.

Methods: Gaze patterns of 22-month-old toddlers with ASD (*n*=53) were compared to typically-developing toddlers (TD, *n*=47) on the Selective Social Attention 2.0 Task. This task manipulated direct gaze presence (DG+) or absence (DG-), and speech presence (SP+) or absence (SP-) in 4 randomly interleaved conditions sampled with 8 trials each. The task lasted 6 minutes total. Linear mixed effect models were used to examine group and condition effects. Eye tracking associations with clinical variables were assessed using Pearson's correlation coefficients.

Results: Both groups looked more at faces when DG and SP cues were present, but the increase was less pronounced in ASD (Δ% in DG+SP+) – (%Face in DG-SP-), TD: *d*=2.32, ASD: *d*=.73). Toddlers with ASD differed from TD toddlers in face looking only when the actress was speaking (DG-SP+: *d*=1.03, *p*<.001; DG+SP+: *d*=1.65, *p*< .001). Proportion of time spent looking at the actress's eyes did not differ between groups in any condition, but toddlers with ASD looked less at the mouth relative to TD toddlers when the actress was speaking (DG-SP+: *d*=.94, *p*< .001; DG+SP+: *d*=.81, *p*< .001). Lower responsivity to speech and gaze cues (Δ%Face) was concurrently and prospectively (40 months) associated with greater severity of autism symptoms (r=-.62, p<.001 concurrently; r=-.49, p=<.001 prospectively) and lower verbal (r=.59, p<.001; r=.44, p<.001) and nonverbal (r=.-54, p<.001; r=.31, p=.01) developmental ability. ROC analyses using Δ%Face yielded Sensitivity=88.4%, Specificity=80.0%, PPV=80.9%, NPV=87.8%, AUC=.89.

Conclusions: No evidence for face avoidance was observed. ASD-TD face looking differences were greatest when speech cues were present, suggesting limited salience for speech. Similarly, distribution of attention between eyes and mouth was perturbed in ASD only when speech was present and was indexed by lower attention to speaker's mouth. Responsivity to speech and gaze cues was concurrently and prospectively associated with developmental phenotype and also exhibited good group-discriminative ability, highlighting its potential as a marker for ASD. This study links poor attention to the faces of interactive partners in early stages of autism with the limited salience of speech rather than direct gaze. This work (1) suggests that early intervention in ASD may benefit from increased focus on orienting to audiovisual speech cues, and (2) may provide further motivation for research into the role of speech processing in the emergence of social disability in infancy.

11:20 **158.003** Atypical Value Driven Attention in Young Children with ASD

K. Chawarska *and Q. Wang, Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Poor attention to social targets such faces constitute one of the defining features of ASD in young children and has been documented in the laboratory and real-world contexts. Given the centrality of information conveyed through faces and facial gestures, poor attentional attunement to this class of stimuli during prodromal and early syndromal stages of the disorder, contributes to the variability in social, adaptive, and cognitive outcomes observed in preschoolers with ASD. We hypothesize this phenomenon is linked with disruption in the neural network involved in the signaling of value-based attentional priorities.

Objectives: To examine value learning for face and fractal stimuli and its effect on selective attention in preschoolers with ASD, and in developmentally delayed (DD) and typically developing (TD) controls. We hypothesized that unlike TD and DD controls, children with ASD will show selective impairment in value learning in Face but not in Fractal condition.

Methods: Children with ASD (*n*=55), DD (n=36) and TD (*n* =38) groups underwent value learning (VL) training in social (faces) and nonsocial (fractals) conditions implemented on a gaze-contingent eye-tracking platform. The VL task consists of the Baseline, Training, and Choice Test phases and represents an extension of our prior VL work by our team (Wang et al., 2018). The task measures whether reinforcement for attending to a given stimulus during Training biases visual attention toward the stimulus during subsequent Choice Test. The primary outcome variable was the proportion of looking time at the reinforced (high-value) stimulus during Choice Test.

Results: There were no pre-existing biases for specific stimuli during Baseline in either group and all groups completed a similar number of Training trials. During Choice Test, children with ASD showed evidence for learning in the Fractal (*p*<.001) but not in the Face (*p*=.809) condition. In contrast, the DD and TD groups, showed evidence for learning in the Face (*p*=.001, *p*=.002) but not in the Fractal (*p*=.703, p=.906) condition. Performance on the task was correlated with severity of autism symptoms.

Conclusions: Consistent with our hypothesis, children with ASD showed limited value learning of faces; however their leaning of fractal values was enhanced compared to the mental and chronological age-matched groups. Results suggest that atypical value learning in ASD facilitates attentional selection of nonsocial stimuli and hampers selective attention of faces. This pattern contrasts with that observed in controls matched for chronological age and developmental level. If present early in life, atypical value learning may affect selection for processing of social stimuli that are most relevant to adaptation and thus, may play a formative role in emergence of autism symptoms. The study replicates and extends our prior work and highlights the role of value-driven attentional network in atypical attention to faces in ASD.

11:45 **158.004** A Brief Remote Eye Tracking Paradigm May Enhance Clinical Evaluation of Autism Risk and Language Level

T. W. Frazier[1], *E. W. Klingemier*[2], *E. Youngstrom*[3] *and A. Y. Hardan*[4], *(1)Autism Speaks, New York, NY, (2)Cleveland Clinic Center for Autism, Cleveland, OH, (3)University of North Carolina at Chapel Hill, Chapel Hill, NC, (4)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA*

Background: Brief, scalable, objective measures are needed to inform clinical assessment of children at risk for autism spectrum disorder (ASD). Numerous eye tracking studies have demonstrated social attention differences in people with autism that emerge early are relatively stable across development. Recent research has shown that aggregation of gaze measures across diverse stimuli has the potential to inform autism risk. Remote gaze tracking may also have the potential to rapidly evaluate cognitive functions, such as language ability, adding clinical value where traditional face-to-face testing is difficult to complete. Below we describe validation of an empirically derived autism risk measure and demonstrate how the paradigm can be extended to include rapid evaluation of language level.

Objectives: To evaluate aggregate gaze-based measures informing autism risk and language level.

Methods: Data were collected from 201 youth (ages 1.6-17.6) referred for clinical evaluation of ASD to empirically-derive (train and test) autism risk and symptom indices. After calibration, participants viewed an ~7-min stimulus battery that included 45 dynamic social stimuli from 8 distinct paradigms and 6 static receptive language arrays. Our published data from this sample indicated that autism risk and symptom indices had replicable validity for differentiating youth with ASD from a challenging comparison sample of referred individuals with other developmental conditions. Building on these data, we are collecting a separate validation sample of 30 youth (ages 2-14) referred for ASD evaluation viewed the same stimulus battery as the original cohort. Minor variations in the original procedures and equipment were intentionally implemented to ensure validity would be maintained during clinical implementation.

To develop a gaze-based language index, we evaluated a subset of our original cohort (n=114) that achieved a valid eye tracking and clinical language evaluation. The gaze-based language index was created by standardizing and averaging fixation time percent, fixation count, and average fixation duration to 16 receptive language targets. Analyses evaluated the relationships between the gaze-based language index and clinical language test scores.

Results: Initial results from the independent validation cohort indicated that the autism risk index differentiated ASD from non-ASD cases (AUC=.78). Gaze-based autism symptom indices showed significant correlations with ADOS-2 severity scores (r>.30). Using data from the original cohort, the gaze-based language measure had strong relationships with clinical language scores (Figure 1; r>.47) and good sensitivity to language impairment (Figure 2; AUC=.71; sensitivity=.82 at specificity=.71).

Conclusions: Brief, scalable, objective, eye-tracking measures aggregated across social and receptive language stimuli show strong potential to inform clinical assessment of autism and language level. Future research is needed to validate the gaze-based language measure, potentially adding stimuli to improve measurement across the full range of language levels. Additional studies of the autism risk and symptom indices are needed within clinical trials to evaluate sensitivity to change and in community or population samples to evaluate screening potential. Machine learning approaches may increase the validity of these promising gaze-based autism risk and language measures.

Panel Session
Family Issues and Stakeholder Experiences
159 - Parents As Mediators of Intervention and Functioning of Children and Adolescents with ASD
10:30 AM - 12:30 PM - Room: 524

Panel Chair: Ofer Golan, *Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel*

Discussant: Elizabeth Laugeson, *Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA*

From infancy to adulthood, parents are the key support figures of their children with ASD. However, parents' role in mediating the socialization of their children (Haven, Manangan, Sparrow, & Wilson, 2014), their role in overcoming obstacles associated with the diagnosis and with its comorbid conditions (Hayes & Watson, 2012), and their collaboration with professionals in the promotion of treatment (McConachie & Diggle, 2007), have mostly been studied in toddlers and preschoolers. The current panel examines how parenting practices are associated with the manifestation of their children's social communication and restricted and repetitive behaviors in childhood and adolescence, and how parental involvement with their children, and with therapists, promotes treatment-related progress in children and adolescents with ASD, in both core ASD symptoms and comorbid psychopathology. Taking a closer look into parental mediation of intervention and functioning of children and adolescents with ASD is of importance (Burrell & Borrego, 2012), as it may allow for personalized intervention to be based not only on the characteristics of the child, but also on those of the child's closest support figure – the parent. The nature of these characteristics will be presented and discussed in the panel.

10:30 **159.001** Family Accommodation in Autism

I. Feldman[1], *Y. Duchovni*[1], *E. Ben-Itzchak*[2], *E. R. Lebowitz*[3], *D. A. Zachor*[4] *and* ***J. Koller***[5], *(1)The Hebrew University of Jerusalem, Jerusalem, Israel, (2)Bruckner Center for Research in Autism, Communication Disorder, Ariel University, Ariel, Israel, (3)Yale Child Study Center, Yale School of Medicine, New Haven, CT, (4)The Autism Center/Pediatrics, Tel Aviv University / Assaf Harofeh Medical Center, Zerifin, Israel, (5)Seymour Fox School of Education, Hebrew University of Jerusalem, Jerusalem, Israel*

Background: Family accommodation refers to the ways in which parents modify their behavior to help a child avoid or alleviate distress and negative affect caused by emotional disorders (Lebowitz & Bloch, 2012; Lebowitz, Scharfstein & Jones, 2014). Family accommodation is common among families of children with OCD and anxiety disorders and has been repeatedly associated with greater symptom severity, lower functioning, and poorer treatment outcomes for children, and with elevated distress in parents (Caporino et al., 2011; Lebowitz & Bloch, 2012; Lebowitz, Scharfstein & Jones, 2014; Storch et al., 2007).

The only published study of family accommodation in children with ASD focused on accommodation of anxiety symptoms. Family accommodation was similar to that reported by parents of anxious children without ASD and correlated with the severity of the anxiety symptoms (Storch et al., 2015). The current study, an extension of preliminary results presented at this conference last year, represents the first to examine family accommodation of RRBs and the associations between accommodation and autism symptomatology.

Objectives: To examine the presence of family accommodation of RRBs and its relationship to autism symptom severity and other clinical characteristics at the time of ASD diagnosis.

Methods: Participants include 97 children (24 females; mean age = 6.71, SD = 3.14) diagnosed with ASD at a tertiary autism center in Israel, and their parents. All participants underwent comprehensive assessments including medical, neurological, cognitive, adaptive behavior and diagnostic assessments. Measures include the Family Accommodation Scale for Restricted and Repetitive Behaviors, (developed for this study), Repetitive Behavior Scale-Revised (RBS-R; Bodfish, Symons, & Lewis, 1998), Autism Diagnostic Observation Schedule 2 (ADOS2; Lord, DiLavore & Gotham, 2012), and the Vineland Adaptive Behavior Scales 2 (VABS-2; Sparrow, Balla & Cicchetti, 2005).

Results: Accommodation was prevalent, with 74/97 participants (76.29%) reporting engaging in accommodation at least once a month and 50 (51.55%) reporting daily accommodation of their child's RRBs. Accommodation was positively correlated with RRB severity (r =.823, p <.001), indicating that increased accommodation was associated with increased severity of RRBs. RRB subtypes most highly correlated with family accommodation were ritualistic behaviors (r =.748, p <.001), insistence on sameness (r =.741, p <.001) and stereotypical behaviors (r =.727, p <.001). No significant correlation was found between family accommodation and ADOS comparison score (r =.112, p =.340). We further examined the correlations between family accommodation and the VABS subscales, finding a strong correlation between family accommodation and the VABS adaptive living skills and socialization subscales, respectively (r =-.404, p <.001; r =-.455, p <.001), but weaker correlation between the communication subscale and family accommodation (r =-.257, p =.024).

Conclusions: This study confirms initial evidence that parents of children with ASD commonly accommodate their child's RRBs and that this accommodation correlates with symptom severity. While accommodation of RRBs may follow a similar pattern to those reported in OCD and anxiety disorders, such accommodation may be more associated with adaptive behavior than overall autism severity or communication level. Finally, these findings highlight a heretofore-unexplored aspect of autism symptomatology and an unexamined opportunity for intervention.

10:55 **159.002** Parent-Adolescent Reciprocity in a Conflictual Situation Predicts Peer Interaction in Adolescents with ASD

*[1]. J. Rabin, E. Bamberger[2], I. Mor Snir[3], R. Feldman[2] and **O. Golan**[1], (1)Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel, (2)Center for Developmental Social Neuroscience, Baruch Ivcher School of Psychology, Interdisciplinary Center, Herzliya, Israel, (3)Association for Children at Risk, Givat-Shmuel, Israel*

Background: The development of conflict management skills throughout childhood and adolescence has been shown to impact the individual's social adjustment. Parent-child reciprocity plays a significant role in shaping children's social interaction skills. The increase in conflictual interaction with one's parents during adolescence affects the transformation of parent-adolescent interaction into a more mutual, equal relationship. Adolescents with ASD and their parents may struggle in this type of interaction due to the adolescents' social and regulatory impairments, in addition to their dependence on their parents' involvement and guidance.
Objectives: The current study aimed to evaluate differences in the way adolescents with and without ASD interact with their parents in a conflictual situation. In addition, the association between parent-adolescent reciprocity and the adolescent's social interaction with an unfamiliar peer was examined in the ASD group.

Methods: Thirty adolescents (2 females), aged 12-17, clinically diagnosed with ASD (ADOS-2 validated) without comorbid intellectual impairment (IQ>70), and their parents (27 mothers) were compared to 30 typically developing adolescents, with no reported neurodevelopmental, psychiatric, or intellectual disability, and their parents. Groups were matched on adolescents' age and gender, as well as on parents' gender and education level. Parental (sensitivity, intrusiveness), adolescent's (involvement, withdrawal), and dyadic (reciprocity, negative states) factors were coded using the Coding of Interactive Behavior system (CIB, Feldman, 1998) . In addition, adolescents with ASD took part in a conversation with an unfamiliar peer, based on the Contextual Assessment for Social Skills (CASS, Ratto et al., 2011). Interactions were videotaped and coded by trained raters, (inter-rater reliability >.90 for CIB and >.86 for CASS).

Results: Findings indicate that during the conflictual interaction, compared to TD controls, adolescents with ASD were more involved in the conversation ($F[1,57]=4.41$ $p<.05$, $\eta^2=.13$) and less withdrawn ($F[1,57]=5.43$, $p<.01$, $\eta^2=.16$) from the parent, while their parents were more sensitive ($F[1,57]=5.33$ $p<.01$, $\eta^2=.16$) and less intrusive ($F[1,57]=5.13p<.01$, $\eta^2=.15$) towards them. However, dyadic reciprocity ($F[1,57]=5.27$ $p<.01$, $\eta^2=.16$) was poorer in the ASD group, compared to the TD group.

A regression analysis within the ASD group, predicting CASS scores was significant ($R^2=0.52$, $F[4,25]=6.69$, $p<.001$) revealing that parent-adolescent reciprocity in the ASD group was positively associated with the adolescents' social-conversational skills with a peer ($\beta=0.36$, $p<.05$).

Conclusions: These findings emphasize the different developmental trajectories parent-adolescent relationship take in adolescents with ASD, compared to their TD peers. Our findings suggest that a parent to an adolescent with ASD reacts to his child's deficits when handling an argument with greater encouragement and reduced strain. The adolescent with ASD on his part, responds positively to the parent's support and enhances his own involvement in the conflictual situation. Although both parties were highly involved, the ASD dyad struggled to interact fluently, which could be related to a lack of synchrony. These results also suggest that the relationship individuals with ASD have with their parents continue to promote their social functioning during adolescence.

11:20 **159.003** The Effect of Parenting Style on the Effectiveness of Parent-Mediated Social Skills Intervention for Adolescents with ASD

*[1]. **J. Rabin**, I. Mor Snir[2], E. A. Laugeson[3] and O. Golan[1], (1)Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel, (2)Association for Children at Risk, Givat-Shmuel, Israel, (3)Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA*

Background: Many evidence-based intervention programs for children and adolescents with ASD include a parent training component as part of the intervention. Involving parents, who can coach their children in various daily life contexts, has the potential of assisting in overcoming generalization difficulties that often characterize ASD (Koegel et al, 1992).
However, the effect that parenting style has on the effectiveness of parent-mediated interventions has scarcely been investigated among adolescents with ASD. This should be investigated, mostly because of the nature of parent-adolescent relationships in adolescents with ASD, whose parents continue to play a central role in their socialization during adolescence (Maljaars et al., 2014).

Objectives: The main aim of the current study was to examine how parenting style affects the effectiveness of the parent-mediated Program for the Education and Enrichment of Relational Skills (PEERS; Laugeson & Frankel, 2010), a well-established evidence-based social skills program for

adolescents with ASD.

Methods: Eighty two participants (9 females) aged 12-18 (M= 14.40, S.D=1.75), who were diagnosed with ASD without an intellectual disability (diagnosis validated using the ADOS-2, intelligence assessed using the Wechsler Intelligence Scales) were randomly assigned to an immediate treatment group (IT, n=40) or a waiting-list group (WL, n=42). Parenting style was coded using the parent-adolescent conflict paradigm from the Coding of Interactive Behavior protocol (CIB; Feldman, 1998) and was evaluated at baseline for both groups. Intervention outcomes were assessed using the 'interested' condition from the Contextual Assessment of Social Skills (CASS; Ratto et al., 2011) pre and post intervention (for the IT group) or pre and post a waiting period (for the WL group) . Both interactions were videotaped and coded by trained, independent and blind judges (with inter-rater reliability of .90 for CIB and 0.85 for CASS).

Results: A repeated measures ANOVA revealed a group by time interaction ($F[1,74]=7.07$, $p<.01$, $\eta^2=.09$), showing improvements in social interaction abilities for adolescents in the IT but not in the WL group. In addition, a significant parenting style by group by time interaction ($F[1,70]=4.62$ $p<.05$, $\eta^2=.07$), indicated that within the IT group, adolescents whose parents exhibited low levels of pre-intervention parental sensitivity, improved more than adolescents whose parents exhibited high levels of pre-intervention parental sensitivity. This was not found in the WL group. A regression analysis predicting Post-pre CASS difference scores in the IT group reached statistical significance ($R^2=0.36$, $F(2,32)=9.00$, $p<.001$) and indicated that parents' emotional containment was negatively associated ($\beta=-1.27$, $p<.001$), and parents' supportive presence was positively associated ($\beta=1.01$, $p<.01$) with adolescents' improvement on the outcome measure.

Conclusions: Our study provides valuable information about the extent to which parental style affects the ability of adolescents with ASD to benefit from a manualized parent-mediated intervention, and the nature of parenting practices that may promote or hinder adolescents' intervention related progress. The PEERS protocol, which does not directly target parenting skills, seems to promote parents' ability to socially coach their children, especially for parents who have difficulties in this area pre-intervention.

11:45 **159.004** The Role of Parent Therapeutic Alliance in Cognitive Behaviour Therapy for Children with Autism

P. Burnham Riosa[1]*, M. Khan*[2] *and J. A. Weiss*[3]*, (1)Brock University, St. Catharines, ON, Canada, (2)Ontario Institute for Studies in Education, Toronto, ON, Canada, (3)Psychology, York University, Toronto, ON, Canada*

Background: Therapeutic alliance (TA) (i.e., the collaborative working relationship between a therapist and client) is an important component of treatment success across a range of treatment modalities among both child and adult populations. In empirically supported interventions designed to address emotional and behavioural challenges for children with ASD, TA is currently an under-studied treatment variable, especially parent-therapist alliance.

Objectives: The objectives of this study were to examine: (1) the psychometric properties of a behavioural measure of alliance, the *Therapy Process Observational Coding System–Alliance Scale* (TPOCS-A; McLeod, 2001), and (2) how parent-therapist and child-therapist alliance related to post-treatment outcomes in a sample of children with ASD who participated in a 10-session cognitive behavior therapy program targeting emotion regulation difficulties.

Methods: Twenty children (19 males) ages 8 to 12 years (*M*=9.8; *SD*=1.29) with ASD and their parents (15 mothers, 5 fathers) completed the *Secret Agent Society: Operation Regulation*; Beaumont, 2013), as part of a randomized waitlist controlled trial. Parents and children completed measures of child emotion regulation (*Emotion Regulation Checklist*,Shields & Cicchetti, 1997; *Children's Emotion Management Scale*, Zeman et al., 2010) and psychopathology (*Behavior Assessment System for Children, 2nd Edition*, Reynolds & Kamphaus, 2004) pre- and post-intervention. Trained coders rated early (Session 2), middle (Session 5), and late (Session 9) therapy sessions using the TPOCS-A. Interrater reliability was "excellent" (ICC=.95). Therapist-reported client involvement, alliance, and adherence were also assessed.

Results: Behavioural ratings of parent and child alliance were correlated (*r*=.48, *p*=.04) across sessions. Internal consistencies were "respectable" to "very good". Parent behavioural ratings were correlated with therapist-rated parent alliance (*r*=.63,*p*=.003) and a similar pattern was evident for child behavioural ratings and therapist-rated child alliance (*r*=.58, *p*=.008). Child behavioural ratings were related to therapist-reported treatment adherence (homework completion) (*r*=.69, *p*<.001) and therapist-reported client involvement (*r*=.55, *p*=.01). Regarding associations with child outcomes, higher levels of parent-therapist alliance early in treatment were related to improvements in child emotional inhibition [*F*(1, 17)=5.41, *p*=.03]; higher child-therapist alliance early in treatment was related to improvements in dysregulated expression [*F*(1, 16)=10.48, *p*=.005)]and improvements in internalizing symptoms [*F*(1, 17)=4.36, *p*=.05] post-intervention. Higher levels of child-therapist alliance late in treatment were related to improved emotion coping skills [*F*(1, 15) = 5.35, *p*= .04], improvements in dysregulation [*F*(1, 15)=4.52, *p*=.05], and less internalizing problems [*F*(1, 16)=6.59, *p*=.02]. Higher parent-therapist alliance at the end of therapy was related to improvements in child internalizing problems [*F*(1, 15)=5.36, *p*=.04] and adaptive regulation [*F*(1, 15)=9.72, *p*=.007].

Conclusions: Our findings provide support for the psychometric properties of a behavioural measure of TA and reveal positive associations between TA and improvements in child psychopathology and emotion regulation among a sample of children with ASD following intervention. Research and clinical implications of examining relational processes on child outcomes in empirically supported treatments for children with ASD and their families will be discussed.

Panel Session
Late Phase Drug Development
160 - Outcome Measures in Phase 2/3 Trials in ASD
10:30 AM - 12:30 PM - Room: 518

Panel Chair: Evdokia Anagnostou, *Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

Discussant: Jeremy Veenstra-Vander Weele, *Psychiatry, New York State Psychiatric Institute / Columbia University, New York, NY*

There are many barriers to optimizing clinical trials in ASD. including biological heterogeneity, limited targets, high placebo response, and uncertainty related to selection of outcome measures. Still, both the pharmaceutical industry and several academic networks are taking several compounds through to phase 2 and phase 3 programs. This panel represents an international public-private collaboration to examine the selection of primary and key secondary outcome measures in several current phase 2/3 programs, explore how such decisions get made and then use emerging data to evaluate how these measures have behaved. The panel will discuss lessons learnt, gaps, and future directions.

10:30 **160.001** Evaluation of Outcome Measures and Phase 2 Lessons from the Aberrant Behavior Scale

E. Anagnostou[1], *T. Bennett*[2], *S. Jacob*[3], *R. Nicolson*[4] *and M. Woodbury-Smith*[5], *(1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (3)Department of Psychiatry, University of Minnesota, Minneapolis, MN, (4)University of Western Ontario, London, ON, Canada, (5)Newcastle University, Institute of Neuroscience, Newcastle upon Tyne, United Kingdom of Great Britain and Northern Ireland*

Background: Suboptimal outcome measures have plagued the field of clinical trials in ASD. Measures currently used in trials present limitations in psychometric properties, sensitivity to change, placebo response, among others.
Methods: This abstract will set up the panel by reviewing the recommendations on outcome measures, based on a series of white papers produced by a think tank sponsored by Autism Speaks and NIH. We will then examine how these recommendations behaved in a series of phase 2 clinical trials in ASD in Canada (POND network and related networks)

Results: Sensitivity to change was documented for the ABC-Social withdrawal subscale. However the measure seems to also be associated with significant placebo response. Secondary measures discussed in the white papers will also be presented with data to confirm the limitations presented in the original reports (multiple constructs combined into a singe score, unusual distribution of items).

Conclusions: Some of the originally proposed clinical trials outcome measures by the Autism speaks/NIH think tank show sensitivity to change with a variety of compounds and targets, but are presenting with limitations related to placebo response and construct validity. Further refinement of existing measures and development of new measures is required to optimize endpoint measurement for clinical trials in ASD.

10:50 **160.002** Challenges in Evaluating Improvements in Soars-B: Study of Oxytocin in ASD for Enhancing Reciprocal Social Behaviors

L. Sikich[1], *A. Kolevzon*[2], *J. Veenstra-Vander Weele*[3], *C. McDougle*[4] *and B. King*[5], *(1)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (2)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (3)Psychiatry, New York State Psychiatric Institute / Columbia University, New York, NY, (4)Lurie Center for Autism, Massachusetts General Hospital, Boston, MA, (5)UCSF, San Francisco, CA*

Background: The NIH-funded SOARS-B study was designed to evaluate the safety of six-month, twice-daily oxytocin across the full spectrum of children with autism spectrum disorders and to inform design of a future pivotal efficacy study with regard to inclusion criteria and primary outcome. The study included 277 children: 132 were minimally verbal and ages were evenly distributed between 3 and 17 years. In 2011, as now, there was no consensus about the most appropriate way to assess long-term changes in reciprocal social behaviors. The choice of a primary outcome measure was further complicated by the diversity of the planned sample, use of multiple sites and finite financial resources available for the project
Objectives: We sought a single primary outcome measure that could be reliably assessed across the pediatric age range and the full spectrum of cognitive and communicative abilities. The ideal outcome measure would also have the ability to be repeated multiple times over 24 weeks without learning effects and be sensitive to clinically meaningful changes in reciprocal social behaviors. It would measure positive behaviors as well as problem behaviors related to less well developed social skills interests and abilities.

***Methods*:** Available literature was reviewed to determine the performance of current social behavior measures in prior ASD treatment studies across the age and cognitive range planned for SOARS-B. The National Database for Autism Research (NDAR) was used to study the variability of measures in a broader population of children with ASD. We chose a modified 13 item version of the Aberrant Behavior Checklist (ABC) lethargy subscale (removing the 3 items that were associated with low physical activity and referred to as the ABC-SW) as the primary outcome. Multiple other social measures were also used to assess social behaviors. Descriptive statistics for changes in different social measures over time during the trial and correlations between the changes in these different measures will be provided for the entire sample and key subsamples (e.g. minimally verbal). The changes in these measures also will be correlated with the Clinical Global Impressions Scale Improvement item (CGI-I) and a continuous visual analog scale of change in social behavior to help define the best measure for future studies.

***Results*:** The analyses of the study results are currently in progress. We will report on the characteristics of our primary outcome measure - change in the ABC-SW - during the trial, its relationship with changes in other measures of social functioning including the Social Reciprocity Scale (SRS), the Pervasive Developmental Disorders Behavior Index Screening Version, the Vineland Adaptive Behavior Scales, and the CGI-I.

***Conclusions*:** Choosing a single well-validated measure to assess change in social behavior across a broad range of functional and developmental levels is challenging. Most available measures rely on caregiver report and cover a limited range of social behaviors. More objective social outcomes such as eye gaze tracking, EEG, or behavioral tasks may be limited by stimuli appropriateness across development, multi-site standardization, and cost.

11:10 **160.003** Evaluating Bumetanide in Autism

E. Lemonnier[1] *and Y. Ben-Ari*[2], *(1)centre expert autisme du limousin, CHU de limoges, Limoges, France, (2)Neurochlore, Marseille, France*

Background: Autism spectrum disorder (ASD) is a heterogeneous neurodevelopmental disorder characterized by social communication deficits and the presence of restricted interests and repetitive behaviors. The criteria that can be used are variable including biological ones which are more objective (biological variables, electrophysiological, brain imaging, eye tracking etc) or subjective depending on an evaluation by the treating doctor or the parents (ABC, CARS, BOSCC, SRS, CYBOCS, RRB, Conners, etc.) with some scales centered on developmental level (vineland), alterations of life quality (CGI).
Objectives: determine the efficacy of bumetanide in children with autism

Methods: In our various trials, we used primarily CARS) and CGI and more recently SRS and in parallel more pilot studies eye-tracking and fMRI.

Results: CARS (used as a primary criterion) allowed us to show an improvement on the main symptoms of autism including socialization. CGI revealed a general clinical improvement on the dimension of this improvement albeit not specific. Although limited in scope and number of patients, functional magnetic resonance imaging provided useful information on the activation by emotional faces of early visual areas, and areas involved in emotional, social and attentional processing. SRS was highly efficient to detect global changes.

Conclusions: Our results suggest that a heterogeneous disorder such as autism requires many evaluation criteria and objective measures by eye tracking and imaging studies to validate the working hypothesis. Future trials will include -but with a long duration track- alterations of developmental processes. Our experience with our selected primary and secondary outcome measures will be discussed.

11:30 **160.004** Evaluating Balovaptan for the Core Symptoms of Autism Using Vineland™-II Adaptive Behavior Scales: Present Experience and Future Directions

***K. Sanders**, Product Development Neuroscience, F. Hoffmann-La Roche Ltd., Basel, Switzerland*

Background: Despite the impact of behavioral therapies, interventions for the core symptoms (persistent social communication/interaction deficits and restricted/repetitive behaviors) of autism spectrum disorder (ASD) remain largely unmet. Furthermore, there are limited established assessments for evaluating these core symptoms in clinical trials. The vasopressin system, implicated in modulating social behaviors, is a potential target for addressing communication and social interaction symptoms of ASD. Balovaptan, an orally available, brain-penetrant, highly-selective, competitive antagonist of the vasopressin 1a receptor is being investigated as a treatment for social and communication challenges in adults and children/adolescents. The clinical program has been planned in collaboration with the ASD community, including experts and advocates.
Objectives: To present evidence from the balovaptan development program supporting Vineland™-II Adaptive Behavior Scales (Vineland-II) as an appropriate outcome measure in ASD clinical trials, and the rationale for a socialization and communication composite score as the primary endpoint in an ongoing phase 2 study in children and adolescents (aV1ation; NCT02901431) and phase 3 study in male and female adults (VIADUCT; NCT03504917).

Methods: The first balovaptan trial (VANILLA, NCT01793441) in adult males with ASD and IQ≥70 used the caregiver-rated Social Responsiveness Scale 2 (SRS-2) as the primary endpoint based on available evidence when the study was designed. With validated psychometric properties, inter-rater reliability and age-appropriate norms (0-90 years), Vineland-II was a key secondary endpoint, among others. Vineland-II assesses adaptive behaviors in 3 domains: communication, socialization, and daily living skills and is now recognized by clinical experts, autism advocates and regulatory bodies as a suitable measure of change in social communication within ASD trials. As the socialization and communication domains of Vineland-II are both reliable, independently validated endpoints in ASD trials, the Vineland-II 2-Domain Composite (2DC) score was developed to combine both into a single score.

Results: Consistent with several reports suggesting strong susceptibilities to placebo effects with SRS-2 in multicenter trials, in VANILLA, all groups, including placebo, showed improvement on the SRS-2. However, dose-dependent, significant, and clinically meaningful improvements (exceeding minimal clinically important difference threshold) on the Vineland-II composite score, driven by improvements in socialization and communication domains, were observed for participants treated with balovaptan 4 or 10 mg versus placebo.

The psychometric properties of the Vineland-II 2DC score were further validated using VANILLA data, demonstrating test-retest reliability, validity and sensitivity to change, supporting its use as the primary outcome measure for socialization and communication core symptoms, across the age/gender spectrum, in the balovaptan development program.

Conclusions: In the development program to date, balovaptan has demonstrated dose-dependent, significant, and clinically meaningful improvements on Vineland-II in adult males. This observation supports Vineland-II as an appropriate measure of change in socialization and communication core symptoms of ASD over time. Furthermore, the Vineland-II 2DC score has been chosen as the primary outcome measure enabling comprehensive assessment of these core symptoms in ongoing phase 2 and phase 3 studies of balovaptan in ASD. Balovaptan is being studied as a potential treatment option for ASD core symptoms as an amplifier of social learning, possibly by enhancing social motivation reward systems.

Panel Session
Molecular Genetics
161 - Genetic and Genomic Discovery in Autism: From SNPs, to Exomes and Genomes.
10:30 AM - 12:30 PM - Room: 517A

Panel Chairs: Joseph Buxbaum, *Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY*

Margaret Pericak-Vance, *John P. Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL*

This panel will summarize the state-of-the-art in autism genetics and genomics. Updates on common variant association studies, whole exome sequencing, and whole genome sequencing will be presented, as well as novel approaches aimed at the integration of the different classes of variation into a unified model of genomic risk architecture.

10:30 **161.001** Common Risk Variants Identified in Autism Spectrum Disorder

***J. Grove**[1,2] and .. The iPSYCH-Broad/MGH Autism Working Group[3], (1)Center for Genomics and Personalized Medicine, Department of Biomedicine - Human Genetics, Bioinformatics Research Centre, Aarhus University, Aarhus, Denmark, (2)The Lundbeck Foundation Initiative for Integrative Psychiatric Research, iPSYCH, Aarhus, Denmark, (3)iPSYCH/Broad/MGH, Aarhus, Denmark*

Background: Autism Spectrum Disorder (ASD) is a complex disorder, and the aetiology is largely unknown. The heritability is as high as 80% according to some estimates and common genetic variation is estimated to explain half of the genetic risk. Recently, iPSYCH and Broad/MGH

conducted the largest GWAS of ASD to date comprised of 13,076 cases and 22,664 controls from Denmark and meta-analyzed with 10,610 samples from the Psychiatric Genomics Consortium (PGC).

Objectives: To identify genetic loci associated with autism, derive insight into the underlying biology, and to dissect the polygenic architecture of autism and its clinical subtypes.

Methods: The iPSYCH sample is a population sample comprised of cases with one or more psychiatric diagnoses identified in the Danish Psychiatric Central Research Register and a control sample consisting of a 2% random sample from the corresponding birth cohort. The Danish Neonatal Screening Biobank supplied archived dried blood spot samples and DNA was extracted, whole-genome amplified and genotyped on the PsychChip, a customized HumanCoreExome chip. Quality control, imputation and principal component analyses were conducted using the Ricopili pipeline of PGC, as was the meta-analysis with the summary statistics from the PGC. ASD signals were followed up in a European sample consisting of 2,119 cases and 142,379 mainly from Iceland. Top hits were integrated with data of the 3d structure of the chromatin using the method Hi-C. SNP heritability and genetic correlations was estimated using LD score regression and GCTA, and polygenic risk scores were generated and analyzed in an in-house pipeline. Phenotypes with significantly overlapping genetic architectures (schizophrenia, major depression, and educational attainment) were employed to identify additional putative loci using the recent MTAG method.

Results: We identify 3 genome-wide significant loci in the iPSYCH-PGC sample and additional 2 when including the follow-up sample. Seven extra putative ASD loci were highlighted in the MTAG analysis leveraging data from the related phenotypes of schizophrenia, major depression, and educational attainment. Novel genetic correlations were estimated for eg. ADHD, rG=0.360 (SE=0.051) and major depression, rG=0.412 (SE=0.039). Indications of differences between diagnostic subtyped in genetic architecture was found in both estimates of SNP heritability (ranging from 0.03 for other pervasive developmental disorders to 0.10 for Asperger's syndrome, P = 0.001) and to a lesser extent in genetic correlations between hierarchical subtypes (rG ranging from 0.71 to 1). The differences were confirmed in a novel polygenic risk score (PRS) analysis comparing levels of PRS for various related phenotypes across subtypes.

Conclusions: We identified novel risk loci for ASD highlighting biological insights, particularly relating to neuronal function and corticogenesis. Interrogating the polygenic architecture through different means, we found heterogeneity across ASD subtypes. Overall, these results indicate that GWAS performed at scale will be much more productive in the near term in ASD.

10:55 **161.002** Exome Sequencing Identifies Genes Where Rare Disruptive Variants Confer Risk for Autism

***F. Satterstrom**, Analytic and Translational Genetics Unit, Massachusetts General Hospital, Boston, MA; Stanley Center for Psychiatric Research, Broad Institute of MIT and Harvard, Cambridge, MA*

Background: Rare genetic variants—particularly newly arising, or *de novo*, mutations—are major contributors to individual risk for autism spectrum disorder (ASD). As a class, the most impactful rare variants are those which disrupt gene function. These variants can be identified by exome sequencing, which captures the protein-coding portion of the genome. When individuals with ASD carry rare disruptive variants in a gene more often than expected by chance, it implicates that gene in risk for ASD. In this way, previous study (e.g. Sanders *et al*., 2015, *Neuron* 87:1215-1233) has identified upward of 65 genes associated with ASD at a false discovery rate (FDR) ≤ 0.1.

Objectives: We sought to 1) identify novel genes associated with ASD and 2) learn more about the neurobiology of ASD by analyzing the set of ASD-associated genes. To do this, we conducted the largest exome sequencing study to date focused on rare variation in ASD. We represent the Autism Sequencing Consortium, as well as the iPSYCH initiative for psychiatric research in Denmark, and our collaborative network enabled us to sequence samples from around the world.

Methods: Building upon previous work, our analysis included exome sequences from a total of 35,584 samples. We identified *de novo* variation in 6,430 ASD probands and 2,179 sibling controls for whom we had sequenced both parents, and we identified rare variation in an additional 5,556 ASD cases and 8,809 controls. We integrated the *de novo* and case-control variation using a Bayesian framework called TADA to identify ASD-associated genes. We improved the TADA model used in previous work by incorporating pLI score as a metric for weighting protein-truncating variants and MPC score as a metric for weighting missense variants. We then analyzed our list of ASD-associated genes in the light of multiple external datasets.

Results: We identify 102 genes associated with ASD at an FDR ≤ 0.1. Of these risk genes, 48 show higher frequencies of disruptive (i.e. protein-truncating or MPC ≥ 1 missense) *de novo* variants in individuals from a separate cohort ascertained for severe neurodevelopmental delay, while 51 show higher frequencies in individuals from our study ascertained for ASD, and comparing our ASD cases with disruptive mutations in the two groups of genes shows differences in phenotypes like IQ and age of walking. Expressed early in brain development, most of the risk genes have roles in neuronal communication or regulation of gene expression, and 12 fall within recurrent copy number variant loci. In human cortex single-cell gene expression data, expression of the 102 risk genes is also enriched in both excitatory and inhibitory neuronal lineages, implying that disruption of these genes alters the development of both neuron types.

Conclusions: Our identification of 102 ASD-associated genes represents a significant step forward from previous work. Next, we plan to jointly analyze our data with exome sequences from SPARK, the Simons Foundation study of ASD whose recent data release will nearly double our sample size. A few preliminary results may be ready to discuss at the meeting.

11:20 **161.003** Whole Genome Sequencing in Autism

***S. W. Scherer**, The Hospital for Sick Children, Toronto, ON, Canada*

Background:

Autism Spectrum Disorder (ASD) is heterogeneous, both phenotypically and in its genetic architecture. There are now hundreds of genes found associated with ASD, with risk contributed by multiple types of rare and common genome-wide variation. Some individuals carry single rare (*de novo* or inherited) penetrant gene alterations. Others have multiple variants, and for these and others with ASD, a whole host of (poly)-genic risk factors may be involved.

Objectives:

Whole genome sequencing (WGS) technology has been launched worldwide by large-scale projects to study thousands of families from ASD

cohorts and biobanks (e.g. AGRE, SFARI). The goal of this research is to decode entire genome sequences including all their genetic variants, link to available phenotype data, and make these massive genomic/phenotypic datasets available for scientific study. Before this, to find the complete spectrum of variants has required the incremental technologies of karyotyping, microarray, panel-sequencing and exome-sequencing. With WGS, an experiment costing about US$1000 can complete the task in a single comprehensive step.

Methods:

WGS is usually performed on DNA from whole blood (or sometimes other tissues), typically using 'short-read' sequencing technologies. Other useful data are arising from 'long-read' technologies. Bioinformatic pipelines are applied to raw sequence data to enable the robust identification of constitutional single nucleotide variants (SNVs), small insertion/deletions (indels), as well as copy number variants (CNVs), structural variants (SV; including short repeats), and mitochondrial variants. New algorithms further differentiate mutations occurring somatically from those present in all cells. Following approval of a Data Access Committee, primary and processed genomic data are then placed into different cloud- and web-based formats, to be accessible to the community.

Results:

WGS sequencing has identified new variants in protein-coding and non-coding (e.g., lncRNA, regulatory) regions, in or near genes missed by other technologies. A more complete view of the entire genome can increase the yield of findings relevant for ASD or its co-morbidities and provide context for their interpretation. Smaller CNVs and more complex SVs, often missed by other technologies, also contribute significantly in the etiology of ASD. Approximately 100 gene and CNV regions currently have value for testing in ASD diagnostics. Through data consistent across studies, we find genes involved in synaptic and neural adhesion, neural transcriptional regulation, and RNA processing to be involved in ASD, offering new entry points for drug development. Hundreds of scientists from around the world are using WGS data to enable their research studies.

Conclusion:

WGS data with accompanying phenotype information can greatly enable basic and clinical research in ASD. As the costs continue to decrease and WGS eventually moves into the diagnostic setting - supplanting microarray and exome-testing - thousands of additional genomes will become available for comparative analysis. The presentation will provide an overview of results of the major published studies, the data and resources available, and the most significant scientific advances, all based on WGS.

11:45 **161.004** Rare De Novo and Common Variations Affect Liability to Autism

***K. Roeder**, Statistics and Data Science, Carnegie Mellon University, Pittsburgh, PA*

Background: Early researchers hypothesized that Autism Spectrum Disorder (ASD) arises from polygenic inheritance. Subsequent results, however, such as the identification of mutations in certain genes that are responsible for syndromes associated with ASD, led others to propose that rare variants and *de novo* mutations of major effect would account for most cases. There is now ample evidence that both rare *de novo* and inherited variation play a role in risk for ASD. It is also well documented that common variation plays a substantial role in liability. How these two forces combine to determine liability in any particular individual is not yet well understood.
Objectives: I will discuss the current state of understanding of the interplay of rare and common variation.

Methods: We will integrate data and results from whole exome and genome wide association studies (GWAS), as well as a family studies, to describe statistically the relationship between rare and common variation and their relationship to heritability.

Results: While rare variation confers risk, both rare *de novo* and inherited variation acts within the context of a common-variant genetic load, and this load accounts for the largest portion of ASD liability. Even among individuals who carry rare highly damaging variants, there is often evidence for substantial common risk variation, a result that is contrary to popular beliefs.

Conclusions: "*Although clinical geneticists have told parents for years that a certain mutation found in the DNA of their offspring was likely the cause of ASD, we can no longer ignore some elephants in the room: for the typical person with ASD, their genetic load of common variation accounts for a substantial portion of their liability, and even for individuals known to carry a damaging mutation associated with ASD, the load of common variants they carry appears to be high. We need a way to accurately quantify this load, because this information will be useful for clinical geneticists who offer advice about recurrence risk to families.*" (Chaste et al., 2017, Annu Rev Genomics Hum Genet).

Panel Session
Service Delivery/Systems of Care
162 - Effectiveness of ASD Evidenced-Based Practices for End-Users: Examination of Child Outcomes in Multiple Community Service Settings
10:30 AM - 12:30 PM - Room: 516ABC

Panel Chair: Aubyn Stahmer, *Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA*

Discussant: Lauren Brookman-Frazee, *Psychiatry, University of California, San Diego, San Diego, CA*

The purpose of this panel is to describe research examining the community effectiveness of evidenced-based interventions (EBIs) for youth with ASD implemented in multiple community-based settings. These studies share a common focus of examination the effectiveness of several EBIs developed to enhance child outcomes in routine care settings, with an additional focus on key moderators (e.g., age, race/ethnicity). Focused on early intervention settings, the first project described the impact of a parent-mediated naturalistic developmental behavioral intervention adapted for use with toddlers at risk for ASD on child and family outcomes. The second project describes the impact of an adapted behavioral intervention designed for implementation in school settings. The third project examines the effectiveness of a behavioral EBI implemented in publicly-funded mental health settings. Finally, the fourth project examines the measurement of clinical outcomes across several community care settings. Dr. Lauren Brookman-Frazee (discussant) will draw on her expertise in implementation and evaluation of EBIs to synthesize the results and offer recommendations for the use and examination of EBI implementation to improve community service settings, especially among diverse populations.

10:30 **162.001** Project Impact for Toddlers: Pilot Outcomes of Community Adaptation of an Evidence-Based Intervention for ASD Risk

K. S. Dickson[1,2], *S. R. Rieth*[1,2], *A. C. Stahmer*[3], *K. L. Searcy*[4,5], *J. Feder*[6] *and L. Brookman-Frazee*[7], *(1)Child and Adolescent Services Research Center, San Diego, CA, (2)San Diego State University, San Diego, CA, (3)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA, (4)Speech & Language, San Diego State University, San Diego, CA, (5)TERI Crimson Center for Speech & Language, San Diego, CA, (6)Child and Family Psychiatrist Tertiary Outpatient and Neurobehavioral Medicine Private Practice, Solana Beach, CA, (7)Psychiatry, University of California, San Diego, San Diego, CA*

Background: Parent-mediated naturalistic developmental behavioral interventions (NDBI) have demonstrated positive child and family outcomes for young children with ASD (Zwaigenbaum et al., 2015; Burrell & Borrego, 2012). Intervening at the first signs of ASD risk, prior to a formal diagnosis, may be a powerful option and prevent the onset of symptoms for some children (Dawson, 2008; Lavelle et al., 2014). Despite demonstrated benefits, however, there has been little dissemination of parent-mediated NDBI into community settings, where the majority of children receive services (Stahmer et al., 2016). Community providers with expertise in both the NDBI strategy use and partnering with parents are needed to effectively deliver NDBIs. Based on the range of funding mechanisms and agencies through which children with ASD may receive services, however, community providers have variable educational backgrounds and ASD specific experience. As communities struggle to serve the growing number of young children with ASD with effective interventions, more information is needed about whether community implemented parent-mediated NDBI leads to improved family outcomes.

Objectives:

The objective of this presentation is to demonstrate parent and child outcomes from a community effectiveness pilot study of an evidence-based, parent-mediated NDBI (Project ImPACT for Toddlers or *PI*^{T}; Ingersoll & Dvortscak, 2010).

Methods:

A quasi-experimental design was used to examine effectiveness of *PI*^{T} implemented in low-intensity, public early intervention. Families of children with social communication challenges and/or risk for ASD were assigned by the early intervention coordinator to a provider trained in *PI*^{T} or to usual care (UC), based on typical referral practices. The final sample included 25 caregiver/child dyads (*PI*^{T} n=12; UC n=13). Measures included an ADOS and Mullen Scales of Early Learning to characterize the sample. Parent outcome measures included objective ratings of parent use of *PI*^{T} strategies with their child, general positive parent-child interaction, satisfaction, social support, and intervention engagement. Child outcomes included the Infant Toddler Checklist, MacArthur Bates CDI, and Vineland Adaptive Behavior Scales. Dependent measures were collected at intake, post intervention, and at a 3-month follow up.

Results:

Children were 68% male, averaged 23 months of age at intake, and had average developmental scores of 72.14 (SD=16.97). Caregivers were all mothers. were 48% Hispanic/Latinx and 28% received services in Spanish. Mothers represented a wide range of maternal education and employment. Groups were comparable at intake. Parents in the *PI*^{T} group had higher engagement in the intervention compared to UC ($t(21)=-2.66$, $p<.02$), but similar rates of parent satisfaction and social support. Significant differences were seen in favor of the *PI*^{T} group in all areas of parent-child interaction. Children in the *PI*^{T} group had significantly greater words produced and CSBS Symbolic Composite and had generally larger effect sizes in many areas. Most changes maintained or improved at follow up.

Conclusions:

This study represents one of the first demonstrations of effectiveness for an adapted evidence-based practice in community early intervention programs. The results indicate promise for use of parent-implemented interventions in community early intervention to support children and families, even prior to an ASD diagnosis.

10:55 **162.002** Examining Effectiveness of Classroom Pivotal Response Teaching in Public Schools

A. C. Stahmer[1], *J. Suhrheinrich*[2], *S. R. Rieth*[2,3], *K. S. Dickson*[3], *S. F. Vejnoska*[4] *and S. Roesch*[2], *(1)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA, (2)San Diego State University, San Diego, CA, (3)Child and Adolescent Services Research Center, San Diego, CA, (4)University of California, Davis, Sacramento, CA*

Background:

Autism interventions that are shown to be efficacious in controlled research settings are often not well integrated into schools, demonstrating the need for translation or adaptation for classroom use. These practices can be systematically adapted to ensure a fit with student and classroom characteristics while maintaining the active ingredients of the intervention. Such adaptations should improve teachers' use of the strategies and thus facilitate better outcomes for students (e.g., Durlak & DuPre, 2008; O'Donnell, 2008; Sanetti & Kratochwill, 2009; Stahmer & Gist, 2001). Classroom Pivotal Response Teaching (CPRT) is a behavioral intervention for children with ASD adapted from Pivotal Response Training through an iterative process in collaboration with researchers, teachers, and school administrators (Stahmer, Suhrheinrich, & Rieth, 2017).

Objectives:

This presentation will provide child outcomes from a large-scale community effectiveness trail of CPRT in schools.

Methods:

The study used a randomized waitlist-control design with 108 classrooms over three years. Teachers (n=108) and students (n=256) from 17 school districts participated. Training procedures included 12 hours of small group didactic instruction, including goal setting, supervised exercises and role-playing. Individual coaching followed at weekly, then monthly intervals upon completion of didactic training. During coaching, teachers worked with their own students during regular classroom activities. Each teacher enrolled two students in their classroom to follow for the duration of the study. Child measures included the Autism Diagnostic Observation Schedule- 2nd Edition (ADOS-2), student educational goals, cognitive assessment, Vineland Adaptive Behavior Scales (VABS) and Pervasive Developmental Disability Behavioral Index (PDDBI). The VABS and PDDBI were collected from both parent and teacher respondents.

Results:

A diverse sample of students with ASD who were 35% Hispanic/Latinx, with a mean age of 5.8 years (r=3-11) participated. Student data indicate that overall students made significant progress in distal measures of cognitive and adaptive skills, but no differences were seen by group. However, results indicate significantly greater change on PDDBI scales of core ASD symptoms, including sensory/perceptual approach behaviors

(p=.004) and repetitive/ pragmatic problems (p=.07) for students with CPRT-trained teachers versus observation classrooms. Scores on some scales were moderated by student age, teacher experience and classroom quality. Additionally, significant differences in student active engagement were identified between the observation year and the CPRT training period (p=.002), and this increased engagement maintained during a follow-up year (after CPRT training; p=.001). Students in the CPRT group demonstrated significantly more progress on social goals (t (64)=3.60, p<.001) than the observation group. Additional moderators, including the impact of race/ethnicity, are currently being examined.

Conclusions:

Results indicate CPRT training for teachers can lead to improved student outcomes, especially in the area of student engagement and social development, for students with ASD. Classroom quality and teacher experience may moderate outcomes, providing recommendations for potential prerequisite training needed prior to EBP implementation.

11:20 **162.003** The Impact of Training Community Mental Health Providers to Deliver a Mental Health Intervention for Children with ASD on Caregiver Outcomes

C. Chlebowski[1], *M. Villodas*[2,3], *K. S. Dickson*[3] *and L. Brookman-Frazee*[4], *(1)National Institute of Mental Health, Bethesda, MD, (2)Psychology, San Diego State University, San Diego, CA, (3)Child and Adolescent Services Research Center, San Diego, CA, (4)Psychiatry, University of California, San Diego, San Diego, CA*

Background: Publicly-funded mental health (MH) services play an important role in caring for school-age children with ASD. AIM HI ("An Individualized Mental Health Intervention for ASD," Brookman-Frazee and Drahota, 2010) is a package of parent mediated and child-focused behavioral strategies designed to reduce challenging behaviors for children with ASD in MH settings. The current study examined the impact of training community therapists to deliver AIM HI. Data were drawn from a large-scale randomized community effectiveness trial of AIM HI conducted in 29 publicly-funded outpatient and school-based MH programs from 2012-2017. Initial examination of parent report of child outcomes (ECBI) indicate statistically significant GroupXTime interactions for the ECBI Intensity and Problem scales, with significantly larger decline in ECBI Intensity in the AIM HI group relative to the UC group.Therapist fidelity mediated these intervention effects (Brookman-Frazee et al., under review). The current study was designed to expand on these child outcomes to look at caregiver outcomes for caregivers involved in the AIM HI with their child and a participating therapist.

Objectives: Test the effectiveness of training therapists to deliver the AIM HI intervention on associated caregiver outcomes over 18 months.

Methods: A total of 202 client/therapist dyads were enrolled in the trial. Children were 84% male (M age =9.13 years). Caregivers were 94% female and 52% Hispanic; 30% identified Spanish as preferred language. Therapists were 86% female and 48% were MFTs. Session-level therapist fidelity was collected over the 6 month training period during which video recordings of 1,153 psychotherapy sessions were coded for adherence to AIM HI active teaching strategies. Data collected at baseline, 6 months (post), and 12 and 18 month follow up included caregiver reported outcomes using the Parenting Sense of Competence scale (PSOC) and the Caregiver Strain Questionnaire (CGSQ).

Results: Multilevel analyses of caregiver outcomes showed significant group X Time interactions for linear (B = 3.52p = .009) and quadratic (B = -.94p =.029) trajectories of Parenting Sense of Competence Scale. The increases in PSOC over 18 months were greater when therapists receive AIM HI training, but decelerated over time. There were no significant differences in linear (B=1.55, p=.106) or quadratic (B=-.381, p =.178) trajectories by group for the PSOC. Results indicate child clinical and parent sociodemographic characteristics moderated outcomes. The effects of the AIM HI intervention on reducing caregiver strain were stronger for families with children with higher cognitive abilities, as measured by the WASI-II. Caregiver preferred language was a moderator of PSOC outcomes as AIM HI moderated increases in parental feeling of competence for English speaking caregivers, but not caregivers who identified Spanish as a preferred language.

Conclusions: Findings build on initial child outcome findings and add to the empirical support for the effectiveness of AIM HI when delivered by community mental health providers. Moderation analyses provide important information for refinement of the intervention and are consistent with current work developing a toolkit to supplement the AIM HI intervention for Latinx families.

11:45 **162.004** Comparing Child-Directed and Parent-Mediated Interventions Delivered in Community Care Settings with Diverse Children with ASD

M. Baker-Ericzen[1], *M. O. Mazurek*[2] *and S. Kanne*[3], *(1)Rady Children's Hospital San Diego, San Diego, CA, (2)University of Virginia, Charlottesville, VA, (3)Thompson Center for Autism and Neurodevelopmental Disorders, Columbia, MO*

Background:

There has been increasing support for the efficacy of both child-directed and parent-mediated interventions to improve skills in children with Autism Spectrum Disorder (ASD)(Kasari et al., 2010). There continues to be a need for effectiveness intervention studies when implemented in diverse community settings (e.g., National Advisory Mental Health Council, 2018; IACC, 2013). Thus, this study examines the effectiveness of 4 evidence-based intervention models implemented in ethnically diverse community-based settings.

Objectives:

The purpose of this study was to evaluate change across multiple distinct well-established treatments delivered in community care settings including 2 child-directed and 2 parent-directed interventions. Using a longitudinal repeated measures design, this study examined the degree to which specific autism symptom domain scores changed over time in response to separate treatments delivered in community care.

Methods:

This sample includes 264 children (82% male) ages 2-9 years (*M* = 4.4 years; *SD* = 2.2) and their primary caregivers. All children had a diagnosis of Autism Spectrum Disorder (all cases validated by positive ADOS-2), and 63% identified as racial or ethnic minority. The treatment groups included: ImPACT; *n*=69 (parent-mediated), PBS/PRT; *n*=33 (parent-mediated), EIBI; *n*=122 (child-directed) and PLAYC; *n*=40 (child-directed preschool program). All participants were assessed at baseline and approximate 6-week intervals over the course of treatment. Participants receiving the briefest intervention (ImPACT=3 month tx) were assessed at 3 time points, those receiving medium-term interventions (PBS/PRT=4.5 month tx) were assessed at 4 time points, and those receiving ongoing long-term interventions (EIBI & PLAYC=7.5 months tx) were assessed at 5 time points. The primary outcome measure, Autism Impact Measure (AIM), was collected for all participants at each assessment time point. The AIM is a

parent-report questionnaire that includes 41 items rated on corresponding 5-point scales regarding the frequency and includes the following 5 domains: Repetitive Behavior, Atypical Behavior, Communication, Social Reciprocity, and Peer Interaction (Mazurek et al., 2018). To examine the degree to which AIM scores changed over time in response to treatment, the study focused on AIM domains and the nature of change over time across all individuals. Measurement models of growth were built separately for each AIM domain using the mixed model procedure in SAS 9.4. In addition, the model estimated average T-score for AIM domains at both baseline and final time points which are presented along with the average difference in T-scores between baseline and final time point, and the effect size of this difference.

Results:

Each model found significant treatment effects. Parent-mediated treatments (ImPACT and PBS-PRT) showed greater change T-scores and effect sizes on 3 of the 5 domains including repetitive behaviors, atypical behaviors and social reciprocity. The PBS-PRT group also showed the greatest gains in the communication domain and ImPACT showed the greatest gains in peer interaction domain. The PLAYC preschool group revealed the least gains in most domains. Refer to Tables.

Conclusions:

Overall, the current study provides the first large-scale examination of change across well-established treatments delivered in community care. The results indicate that parent-directed interventions outperform child-directed treatment modalities delivered in a community setting.

Poster Session
163 - Technology Demonstration / Devices
10:00 AM - 1:30 PM - Room: 710

152 **163.152** A Digital Health Solution to the Wait Time Crisis for ASD

D. Grodberg[1], *C. Campbell*[2] *and R. Glynne-Owen*[3], *(1)Yale Child Study Center, Yale School of Medicine, New Haven, CT, (2)Blue Sky Autism Project, Stirling, United Kingdom, (3)Blue Sky Autism Project, London, United Kingdom*

Background: The average age of autism spectrum disorder (ASD) diagnosis is after 4 years despite the fact that children with ASD can be diagnosed as early as 2 years old and despite evidence that parents may detect developmental concerns in children with ASD before 12 months. Barriers to timely diagnosis include the large time burden and cost of comprehensive assessments, shortage of providers, and lack of resources in primary care settings. Delayed diagnosis results in delayed entry into early intervention programs and in many parts of the United States, parents wait over 1 year for services. Moreover, in many parts of the world, there may be no diagnostic assessment and no intervention services available at all. To address the problem of delayed access to intervention services, we developed a digital health platform that supports the delivery of parent-mediated Naturalistic Developmental Behavioral Interventions (NDBI)[7]. This scalable tool is intended to help parents and caregivers learn how to implement evidence-based interventions with their children while they are on lengthy wait lists for services. The tool uses microlearning approaches powered by an artificial intelligence (AI) framework that supports structured conversation, natural language processing and real time analytics. The tool supports training and practice, coaching, and measurement of fidelity as well as target goal identification and tracking. Training content comprises critical skills and strategies that are considered universal to all NDBI's.
Objectives: This technology presentation aims to 1. Report on a Quality Improvement project that utilizes this system; and 2. To demonstrate this technology to audience members at INSAR. Specifically, audience members will interact with a chatbot that will teach them critical skills required to implement NDBI's.

Methods: We initiated a quality improvement project in an autism provider network in the United Kingdom (Blue Sky Autism Project) to assess 1. The ease of technical and clinical workflow integration; 2. Acceptability and feasibility among clinicians who served as coaches for the families. As part of the QI project, we determined completion rates of users and collected feedback from clinicians who served as coaches.

Results: Integration of the system into the provider network's workflow was uneventful and successful. Provider network clinicians trained in the system rated it as acceptable, feasible, and described high user satisfaction.

Conclusions: Scalable digital health tools hold promise to deliver evidence-based training for parent-mediated interventions for autism spectrum disorder. This approach of large-scale dissemination of evidence-based practice may allow parents to develop the capacity to start using basic interventions while they wait for clinic-based services.

153 **163.153** A Virtual Reality-Based Interactive System with an Assistive Avatar to Influence Visual Attention in Children with ASD

A. Amat[1], *A. S. Weitlauf*[2], ***A. Swanson***[3], *N. Sarkar*[4] *and Z. Warren*[5], *(1)Electrical Engineering, Vanderbilt University, Nashville, TN, (2)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, Nashville, TN, (3)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, NASHVILLE, TN, (4)Adaptive Technology Consulting, Murfreesboro, TN, (5)Vanderbilt University Medical Center, Nashville, TN*

Background:
Individuals with ASD often spend less time looking at another person's facial features (particularly the eye region) compared to non-facial areas. Reduced eye gaze during social interaction negatively impacts social skills development, facial expression processing and information sharing. Virtual reality platforms, which can present social games while tracking performance and recording continuous quantitative measures, may offer a promising avenue for eye gaze detection and training.

Objectives:

This study developed and implemented an assistive avatar system that autonomously tracks and responds to participants' gaze patterns in a game-like setting to influence visual attention to eyes. The system, which uses a virtual avatar with head and eye animation control, provides a closed loop interaction, gives users performance feedback, adaptively changes task difficulty level, and tracks eye gaze in real-time.. System objectives were to 1) improve ability to follow the avatar's gaze, 2) improve ability to identify gaze cues in social tasks settings, and 3) study the effect of gaze sharing and gaze following on emotion recognition.

Methods:

20 participants (10 ASD, 10 TD) ranging from 7 to 12 years of age completed three visits (pre- and post-tests and 33 training tasks). Participants provided input to the system using a Tobii eye tracker which monitored their gaze shifts and told the system to respond accordingly. Training tasks consisted of a virtual avatar surrounded by grayed out puzzle pieces, each of which corresponded to a colored target image at the bottom of the screen. The avatar's eye gaze shifted to the target piece, requiring the participant to follow the avatar's gaze to select a piece and finish the puzzle,

The game was developed in Unity v5, using finite state machines to model the system (game-, avatar-, and puzzle- states). Avatars were developed using Maya Autodesk and displayed 7 distinct gaze directions (positions on screen) at 3 different levels: head/eyes moving together, moderate eye movement only, minimal eye movement. Adaptive difficulty levels added challenge as skills improved (e.g., speed of avatar's gaze at object; time for participant to respond). The pre- and post-test was a bubble popping game using the same game architecture as the training tasks.

Results:

Preliminary analyses on eye gaze data between pre- and post-test gaze tasks showed significant improvement in performance and gaze following skills in participants with ASD after completing the training games (improvement in time to complete games, response time to avatar's gaze cues, gaze fixation on eye region). No significant improvements were observed in the TD group. Data from training games will be analyzed to obtain the gaze fixation patterns and duration. Results of analysis for the ASD vs TD groups will be compared to evaluate differences in visual interaction processing.

Conclusions:

We developed a virtual-reality based assistive avatar embedded in an interactive system that monitors participant eye gaze to assess visual attention as part of social tasks. Pilot results indicate that after completing training sessions, children with ASD show improvement in joint attention skills.

154 **163.154** Advancements in Automated Visual & Speech Analysis of ASD Symptom Domains

*L. Soorya[1], **Z. Tősér**[2], Z. Arnold[1], E. V. Ocampo[1], M. Pollack[1], A. Wainer[1], A. Lorincz[3], R. Bellon[4], M. Csakvari[3], M. Olasz[4] and A. Sarkany[4,5], (1)Department of Psychiatry, Rush University Medical Center, Chicago, IL, (2)Argus Cognitive, Inc., Lebanon, NH, (3)Department of Software Technology & Methdology, Eotvos Lorand University, Budapest, Hungary, (4)Argus Cognitive, Inc., Budapest, Hungary, (5)Eotvos Lorand University, Budapest, Hungary*

Background: The enormous promise of emerging machine learning applications in clinical/research settings relies on the prioritization of both technology and clinical science. This exhibit presents advancements in our application of automated AI methods to detect and monitor social-communication behaviors associated with ASD and related neuropsychiatric conditions.

Objectives: To evaluate feasibility (e.g. detection), data processing (e.g. time, variables) requirements, and clinical correlates of automated visual and speech analytic tools during clinical evaluations. This presentation expands the prior evaluation of eye gaze and facial expressions to additional domains including gestures, repetitive behaviors, and speech.

Methods: Data are presented on 48 individuals with ASD (mean=9.3 years, SD=3.1). Stimuli were collected with off-the-shelf 2D cameras and microphones, and Tobii Pro Glasses 2 worn by the examiner during the ADOS-2 (Modules 1-3). Software estimated facial, body, and speech landmarks, identified patients, analyzed target behaviors and generated detailed behavior metrics. For the purposes of this analysis, metrics included frequency, duration, initiation, responsiveness, and percentage of time. These metrics were collected for gaze, facial expressions of emotion, nodding, pitch, touching, and mouthing. For pitch, standard deviation was used as a metric of monotone, "robotic" speech. Additionally, data on recently added metrics which includes pitch, nodding, and sensory stimulation were compared in age matched, verbally fluent children with and without ASD (n_{ASD}=8; n_{TD}=8).

Results: Metrics derived from visual and speech analysis software were associated with respective item level data on the ADOS2. In the ASD sample, negative valence emotions were moderately and significantly correlated with Facial expressions directed to examiner (Spearman's rho=-.393, p=.018). Several gaze metrics were significantly correlated with Unusual Eye Contact including responsive gaze (Spearman's rho=-.436, p=.011), patient looking at clinician with (Spearman's rho=-.457, p=.007), and initiated gaze (Spearman's rho=-.419, p=.015). Comparisons across developmentally matched controls suggest machine learning methods identified unusual and atypical behaviors, and these behaviors distinguished ASD from matched TD samples. Specifically, higher levels of repetitive behaviors including touching (z=-2.17, p=.030) and mouthing (z=-1.852, p=.064). Of interest, results suggest reduced pitch range in the ASD sample relative to age-matched peers.

Conclusions: Computerized assessments are engaging, adaptive, and provide nuanced output. Our results continue to support the promise of training machine learning models to not only identify behavioral signatures characteristic of ASD but also measure novel phenotypic markers (e.g. pitch). In addition to capturing social communication skills, these results support the software's capacity to capture repetitive behaviors. Overall, findings support initial feasibility of a minimally intrusive protocol for automated analysis of core ASD symptoms with potential to support identification, treatment monitoring, and biomarker investigations of NDDs.

155 **163.155** Choreografish: A Virtual Reality Game Developed with Young Adults with Autism

***E. Handman**[1], R. Altizer[2], G. Bayles[3], C. Wright[4], T. Russell[5] and V. D'Astous[6], (1)Dance, University of Utah, SLC, UT, (2)GApp Lab, University of Utah, SLC, UT, (3)Entertainment Arts and Engineering, University of Utah, SLC, UT, (4)University of Utah, Salt Lake City, UT, (5)Biology, University of Utah, SLC, UT, (6)FCS, University of Utah, SLC, UT*

Background: This virtual reality game was developed in full collaboration with 17 young adults with autism. From our first meeting exploring what the game should be about, these students provided input and as the game was developed they regularly evaluated the content and provided critical evaluation.

Objectives: One focus of the game was anxiety reduction. The purpose of this *pilot research was* to determine if Choreografish had the potential to decrease anxiety in young adults with ASD.

Methods: This research used the VR game called *Choreografish*, which was developed by an interdisciplinary research team and students with ASD. Participants choose their own music to choreograph the swim patterns of virtual fish within the VR environment.

To measure anxiety levels, we created three similar assessments based on the *Generalized Anxiety Disorder questionnaire* (GAD-7). The GAD-7*

provides 7 questions regarding anxiety and a subject ranks his/her responses according to a 4-point scale; 1 being “Not at all” and 4 being “Nearly every day.”

Seven young adults with ASD were recruited to evaluate the game Choreografish and participant in the research related to anxiety reduction. These students provided a baseline of their anxiety and a pre-assessment of anxiety prior to playing the game. After playing the VR game, participants were asked to take a post-assessment and provide feedback on how the game could be improved and/or modified to further the development of anxiety reduction

- Results: Overall, our collected data shows a *trend of decreasing anxiety* among the participants after playing the VR game Choreografish. These results *support our hypothesis* and suggest VR gaming as a potential method of anxiety reduction due to its controlled environment, soothing color scheme, and predictable pattern

Conclusions: The preliminary results in anxiety reduction are promising. And equally important is the empowerment of these young adults with autism as part of our research and development team. They were an important part of the team and their ideas and suggestions were incorporated into the game design.

156 **163.156** Connected Robot Platform for Children with Autism Spectrum Disorders

X. Jin[1], *Z. Tan*[1], *W. Cao*[1], *H. Zhu*[2] *and J. Chen*[1,3,4], *(1)South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou, China, (2)Child Developmental & Behavioral Center, Third Affiliated Hospital of SUN YAT-SEN University, Guangzhou, China, (3)Chalmers University of Technology, Gothenburg, Sweden, (4)School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm, Sweden*

Background: Children with autism spectrum disorders (ASD) often show certain barriers to language and behavior compared to typical developing children. By introducing real-time human-robot interactions, social robots could be applied for language and behavior training for children with ASD in daily life. However, data processing, such as emotion and gesture recognitions, can be computing-intensive tasks, which might be difficult to be realized with high quality if only using limited computation power offered by the robot itself.

Objectives: We aim at building cloud computing enabled social robot platform for children with ASD. Specifically, we are adding emotion and gesture recognition modules on top of the existing platform. Such functions could greatly help recognize children’s emotion states and gestures, based on which the robots could react in a real-time manner to children with ASD.

Methods: As shown in Figure 1, we use the social robot NAO as a front end to interact with the participants. NAO can record the audio and video data together with the surrounding equipment, including microphones, high-definition video cameras, motion sensing input devices (e.g., Kinect produced by Microsoft), and eye-trackers. Emotion recognition can be either carried out by local processing at NAO or a third-party cloud platform, e.g., FACE++, which is a commercially-available facial recognition and image recognition service platform (https://www.faceplusplus.com.cn/). Local processing means NAO runs emotion recognition locally to identify the participants' emotions. Participants' emotions can be obtained via NAOQi interface, which is a hardware interface to control Nao using a web client. NAO can also upload its collected image data to FACE++ through Internet for emotion recognition. Apart from a third-party cloud platform, video and audio data can also be sent to our own data center for gesture recognition and other services.

Results: We measured the accuracy and total waiting time of emotion recognition, 10 times for each tested emotion. The total waiting time here is defined as the time duration from the moment of taking pictures by NAO to that Nao receives emotion information. The results for each emotion are listed in Table 1. The accuracy of emotion recognition carried out by Nao directly is not as good as FACE++, although the average total waiting time is much lower in local processing compared to using a third-party cloud platform. It is because the total waiting time is greatly affected by network delay when using a third-party cloud platform.

Conclusions: We have been working on adding emotion and gesture recognition functions on top of our existing cloud computing enabled social robot platform. The results revealed that using cloud computing certainly helped improving the quality of emotion recognition but suffering from higher response time. Improving Internet connection or pushing computing facility close to the user end (referred to as edge/fog computing) can be a potential solution to address the latency issue in our connected robot platform.

157 **163.157** Development of an Augmentative and Alternative Communication Mobile App for Facilitating Communication in the Speech Impaired Children with Autism Spectrum Disorders

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Background: Mobile Touchscreen devices are currently being used as Speech Generating Devices(SGDs) and have been shown to promote the communication skills in the speech impaired particularly the communication skills of the children with autism spectrum disorders. The mobile based App aims to empower individuals afflicted with speech problems to carry out the communicative functions of their day-to-day lives i.e. communicating personal needs, thoughts, ideas, feelings and emotions. This App accommodates the individual needs of the user or learner. The ease of access facilitates use in different situations-at school, home, shopping, traveling, hospitals, recreational activities.

Objectives:

To Develop the Prototype of a Mobile Based Alternative and Augmentative Communication App for Facilitating Communication in the Speech Impaired.

Methods:

Mata Bhagwanti Chadha Niketan, a special school, launched the Prototype of an AAC, mobile phone based App, called VAAKYA (The Sentence) in 2017 to facilitate communication among the non-verbal students. Technology used for programming VAAKYA was Hybrid PhoneGap language. The App uses picture and corresponding spoken sentences for teaching communication. The prototype accesses the pictures from the phone library and spoken sentences corresponding to the picture can be recorded simultaneously. The unique features of the app are flexibility of recording spoken sentence in any language, customization to individual user, multiple users for single download and free download from android play store

worldwide. A structured training protocol, preceded by training the trainers and parents, was used for promoting requesting behavior among 40 students with speech impairment. Out of these 25 were with ASD between ages 8-12 years . The App was introduced in a phased manner among the speech impaired students. Students were initiated into the app at different times over the course of the year. The app was customized for each student by using the picture of the students doing the request activity. The students were trained to use the app to convey at least 5 personal needs or requests.

Results: A year after the app was first introduced, the trainers were asked to fill a feedback questionnaire to delineate the problems in use, suggestions for improvement for the iteration and evaluate student's response to the app. The educators found the App easy to use. 10 ASD students who had been using the app for a period of 11 months were at different levels in use of the app. 2 learnt to use the app independently to convey personal needs. For the remaining 8 the app had to be opened and then they pointed to the request picture without prompt. The 15 students who have been using the app for less than 7 months require physical prompts to point to the request picture. The training in the App is still continuing. The educators observed reduction in hyperactivity, temper tantrums and improvement in eye contact and attention span in these children.

Conclusions: Our data suggests that VAAKYA is a useful tool for speech impaired children with ASD to communicate personal needs. The App can be upgraded to next version.

158 **163.158** Development and Evaluation of an Augmentative and Alternative and Communication Mobile App for Facilitating Communication in the Speech Impaired Children with Autism Spectrum Disorders

ABSTRACT WITHDRAWN

Background: Mobile Touchscreen devices are currently being used as Speech Generating Devices(SGDs) and have been shown to promote the communication skills in the speech impaired particularly the communication skills of the children with autism spectrum disorders. A prototype of an Augmentative and Alternative Communication, mobile phone based App, VAAKYA (The Sentence) was developed in 2016 by Mata Bhagwanti Chadha Niketan, a special school, to facilitate communication among the non-verbal students. The unique features of the app, which relies on images and recorded sentences, are flexibility of use in any language, vast picture library, customization to individual user, multiple users for single download and free download from Google store. The App once configured doesn't require internet connection. The App aims to empower individuals afflicted with speech problems to carry out the communicative functions of their day-to-day lives i.e. communicating personal needs, thoughts, ideas, feelings and emotions. This App accommodates the individual needs of the user or learner. The ease of access facilitates use in different situations-at school, home, shopping, traveling, hospitals, recreational activities.

Objectives: To develop an Alternative and Augmentative Communication App for facilitating communication in the Speech Impaired.

To develop an App which has flexibility of use in any language

To develop an app which can be customized to individual user

To ensure easy access by developing it on mobile interface and download from online App stores

To evaluate the benefits of the App

Methods: The trial of the prototype towards the first iteration was conducted among 30 speech impaired students with autism at MBCN Special School. The Trainers (special educators) were first trained in the use of the App and then they proceeded to train the 30 student and parents. The students were trained to use the app to convey personal needs. Six months after the introduction of the App the trainers were asked to fill a feedback questionnaire to delineate the problems in use and suggestions for improvement. The student's response to the app was also evaluated through a questionnaire filled by the special educators.

Results: the students with mild intellectual disability easily learnt the use of the app as compared to students severe level of intellectual disability. There was an improvement in attention span and level of communication, some students moved from being non verbal to verbal. Improvement were observed in maladaptive behaviours such as hyperactivity, temper tantrums of the students with autism.

Conclusions: Our date suggests that VAAKYA is a suitable App for helping children with autism spectrum disorders to communicate

159 **163.159** Development of a Health Care Social Stories App

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Background: The communication impairments and sensory sensitivities of patients with autism spectrum disorder (ASD) can make medical care particularly challenging (Bultas et. al, 2016). Social stories, short stories that use text and pictures to break down processes into smaller, understandable steps, are one way to mitigate the communication difficulties. They help patients better understand what to do in specific situations, such as getting a flu shot. Social stories may reduce patients' disruptive behaviors (Scattone et al., 2002), ease anxiety, and set expectations about what will happen.

Objectives: We aimed to develop a free, publicly available mobile application that contains social stories about the experience of accessing care at Boston Medical Center to better prepare our patients with ASD for upcoming encounters.

Methods: We conducted a review of the available social story apps, and found that many either were not free, or did not focus on medical encounters. To better understand the specific needs of our patients and families, we involved parents who are members of the Parent Leadership in Autism Network (PLAN) at BMC. In addition to parent and patient feedback, we collected perspectives from the Steering Committee of the Autism Friendly Initiative, which includes stakeholders from nursing, security, and developmental and behavioral pediatrics among other departments. A BCBA also provided guidance on the language for the social stories. Our needs assessment informed the design of the app.

Results: The app contains seven social stories including measuring height and weight, measuring blood pressure, getting a shot, getting blood drawn, doing a physical exam, visiting the dentist, and navigating to a doctor's office on the campus of Boston Medical Center (BMC). The social stories that describe medical procedures are illustrated using Picture Exchange Communication System (PECS) images, since this is a format often used by education professionals, and would likely be familiar to many of our patients.

For the social story about navigating to the doctor's office, we wanted to enable patients to preview the experience of coming into Boston Medical

Center. This story has photos of actual locations on campus, such as building exteriors, building lobbies, individual floor hallways, and each department's front desk and waiting area. To customize the experience further, the social story allows the user to select the desired starting point, building, and department. Then, each step is its own screen that has a descriptive sentence paired with a picture, enabling the patient to virtually "walk" from the parking lot, through elevators and corridors, all the way to the actual exam room. After each step there is a "reward screen" that depicts a rotating star to commend the user for completing the step to make for a positive and engaging user experience.

Conclusions: Social stories are valuable in supporting patients with ASD with preparing for medical encounters. Our app is designed to increase access to social stories, and to enable our patients to be better prepared for medical encounters, and ideally to have a better experience.

160 **163.160** Creating a Socially Inclusive Environment for Autistic Children with the Cozmo Robot

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Background:

Recent research has shown that autistic children can demonstrate a preference for interacting with social robots and that socially assistive robots placed within the home can result in tangible social benefits in autistic children. However, any benefits diminish when the robot is removed from the home after the intervention. In addition members of the autistic community have questioned whether social robots are an appropriate methodology for modelling human social skills. To address this concern, the approach in this study used robots to create a socially-inclusive environment within which autistic children can be motivated to engage in social communication.

Objectives:

This study used an affordable commercially available robot 'Cozmo', which was developed with the capacity to model social-emotional processing during interaction with humans. We aimed to explore robot-child interaction in addition to child-child interaction elicited in autistic and non-autistic pairs of children while they played with two Cozmos.

Methods:

We analysed the social and informational interactions between two pairs of autistic children and two pairs of non-autistic children. The children, aged 9-11 years, took part in two play sessions with Cozmo, one unstructured (free play) session and one structured (task-based) session. The children played in pairs to enable analysis of child-robot and child-child interactions. The sessions were video recorded and independently analysed by two researchers.

Results:

All children rated playing with Cozmo as 'excellent'. Video analysis revealed that autistic children initiated social communication with both Cozmo and the other child, see Table 1. Both groups directed more social communication at Cozmo in the unstructured play session and more social communication at the other child in the structured session. While autistic children initiated less social communication than non-autistic children, these differences were markedly reduced in the structured play session. See Table 1.

Conclusions:

This study was not designed to be an intervention, rather to explore the social interaction that can be spontaneously elicited whilst playing with Cozmo. Autistic children enjoyed this and engaged with Cozmo and the other child in a social manner. Structuring the play environment can markedly reduce social communication differences between autistic and non-autistic children whilst playing with Cozmo. Future work can focus on how autistic children's play with robots can best be structured and supported to maximise the benefits for child-child social communication. This initial study was small, and in addition to increasing numbers, future research can explore mixed pairs of autistic and non-autistic children. Overall, this research demonstrates initial support for the approach of using robots to create a socially-inclusive environment (rather than focusing on socially assistive robots teaching social skills to autistic children). The commercially available nature of the robot also means that any benefits can extend beyond discrete research projects.

The Demonstration will provide a poster of the findings, a Cozmo and a film of two autistic children playing with the robot.

Declaration: This research was funded by Anki who produce Cozmo. All children were allowed to keep a Cozmo as a thank you for participating.

161 **163.161** Development of an Interactive, E-Learning Tool to Support Parent Implementation of an Executive Function Intervention

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Background: Research has shown that parenting an autistic child is often characterized as complex (Hayes & Watson, 2013), requiring particular vigilance (Woodgate et al., 2008) and advocacy (Boshoff et al., 2016), as parents leverage available resources to overcome barriers and manage constraints, notably those related to time, finances, and discontinuous service provision (Brown, Ouellette-Kuntz, Kelley, & Cobigo, 2012). Parents of autistic children work to promote success in daily life while remaining highly future-oriented in their pursuit to optimize long-term outcomes. Research has also shown that parents are effective at using professional guidance to teach their autistic children specific skills (Wong et al., 2015). Web-based learning can be a cost-effective way to manage the constraints parents frequently encounter while preparing them to teach specific skills.

Executive function (EF) skills are a promising skill acquisition target because of their impact on adaptive behavior, successful participation in daily life, and long-term outcomes. A recent home- and school- based EF intervention, *Unstuck and On Target* (UOT; Cannon et al., 2011; 2018) has been shown to be effective in two RCTs (Kenworthy, et al. 2014; Anthony, et al., in prep) at improving EF skills and classroom behavior. *E-Unstuck* adapts essential UOT intervention components into e-learning modules. Should research find that *e-Unstuck* is effective, it would also need to be an acceptable, appealing, and valuable product in order to elicit intervention uptake. Therefore, product evaluation data is a critical step in the development process.

Objectives: Develop an interactive, e-learning program for parents of autistic children using a stepwise process.

Systematically evaluate product quality, value, and usability.

Methods: Parents (n=44) of children on the autism spectrum without an intellectual disability (mean age=10.0 years; mean IQ=103.6) participated in *e-Unstuck* learning modules. Parents also completed an online product evaluation, providing feedback on aspects including quality, value, usefulness, and appeal through 5-point Likert scale items (1= strongly disagree to 5= strongly agree) and open-ended questions. Parents were also invited to provide additional product evaluation feedback through focus groups.

Results: The quality, value, and usability of *e-Unstuck* were all rated highly by parents (M ≥ 4 on a 5-point scale). Furthermore, parents reported that they would use *e-Unstuck* again (M = 4.68, SD = .53) and recommend *e-Unstuck* to a friend (M = 4.54, SD = .77). They also indicated that *e-Unstuck* would make UOT training more accessible to parents of children with ASDwoID (M=4.49, SD=.65). A consensus of parent responses to open-ended product evaluation questions and focus group discussions showed important positive feedback related to the flexibility and convenience of self-paced module completion. Parents also reported a primary barrier related to the difficulty in setting aside time to complete each module; however, this is a potential barrier for any intervention.

Conclusions: These findings indicate that *e-Unstuck* is an e-learning tool of high quality, value, and usability. Parent experiences also support that *e-Unstuck* can help make intervention more accessible to parents, offering flexibility that accommodates time constraints while providing useful information.

162 **163.162** Feasibility and Preliminary Efficacy of Gazefinder Eye-Tracking Technology for Use with Infants Showing Early Signs of Autism

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Background: Identification and diagnosis of autism currently relies on the appraisal of overt behavioural difficulties. Manufactured by JVCKENWOOD Corporation, *Gazefinder* is a bespoke eye-tracker which may support accurate and efficient autism identification across the lifespan. *Gazefinder* includes an infra-red eye-tracker, short 2-minute stimulus sequence, and automated visualisation of results and data extraction. Stimulus trials target referential attention to pointed-at objects (vs. distractors), and preferential attention to eyes (vs. mouth), people (vs. geometry) and biological motion (upright vs. inverted point-light displays). Previous studies – all conducted in Japan – suggest *Gazefinder* differentiates people with and without autism in childhood (Fujisawa et al., 2014) and adolescence/adulthood (Fujioka et al., 2016). The short stimulus sequence is also well tolerated by young, typically developing children (Nishizato et al., 2017). However, the efficacy of *Gazefinder* to support early identification of autism in infants has yet to be evaluated.
Objectives: To trial the feasible use of *Gazefinder* – by an independent team, in a Western country –including evaluating preliminary efficacy for supporting the early identification of autism.

Methods: Participants were 54 infants (75% boys) aged 9-16 months (*M*=12, *SD*=2) who were eligible for the study on the basis of showing early behavioural signs of autism according to the Social Attention and Communication Surveillance (SACS) protocol (Barbaro and Dissanayake, 2010). Specifically, we recruited infants showing ≥3 (of 5) key markers on SACS 12-month checklist (i.e., absent/atypical eye-contact, response to name, imitation, pointing, and other gestures – for which Barbaro et al. (2018) have reported 72% positive predictive value for later autism diagnosis. We assessed infants with *Gazefinder*, the Autism Observation Scale for Infants (AOSI; Bryson et al., 2008) and the Mullen Scales of Early Learning (MSEL; Mullen, 1995).

Results: *Gazefinder* captured tracking data ranging from 0% (*n*=3; no data due to examiner error) to >99% (*M*=72, *SD*=28), including rates >80% for half of the sample. Among the 51 infants with some tracking data, referential attention to pointed-at objects (vs. distractors) and preferential attention – toward eyes (vs. mouth) of a human face, and to people (vs. geometry) – were as expected, suggesting ecological validity of the stimulus sequence. Variation in attention to pointed-at objects was associated with MSEL verbal skills (*r*=.33, *p*=.020). Further, greater attention to geometry (vs. people) was associated with poorer verbal skills (*r*= -.39, *p*=.008) and with more behavioural signs of autism (AOSI; *r*= -.42, *p*=.002) suggesting potential utility for *Gazefinder* to aide early identification.

Conclusions: Tracking rates captured by *Gazefinder* exceeded the standard often accepted by researchers conducting eye-tracking studies with infants at high-risk for autism using other technologies (i.e., ~30%). The large majority of infants tolerated the *Gazefinder* procedure very well. Researchers more familiar with behavioural assessments found the apparatus easy to use. Initial evidence suggests that some gaze data automatically exportable from *Gazefinder* may be associated with concurrent behavioural signs of autism and language skill among 9-16-month-old infants referred with early social-communication atypicalities. *Gazefinder* may facilitate the early identification and diagnosis of autism in clinical settings, warranting a larger scale trial.

163 **163.163** Free Choice Response Assessment Reveals Basic Cognitive and Sensorimotor Properties in Autism Spectrum Disorders

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Background: Orienting response is associated with motivation and cognitive functions and can give insight into peculiarities of mental processes in ASD and be instructive for planning education and interventions. Unfortunately, most psychophysiological protocols require cooperation from subjects. We introduced a method that does not rely on verbal instruction and measures parameters reflecting basic sensorimotor and cognitive functions. A series of simple intuitive tasks are presented on a touchscreen, and within several minutes a comprehensive set of data is collected. Earlier studies showed high levels of correlation of acquired basic parameters with results of psychological testing, including adaptive behavior in typically developing individuals (TD).
Objectives: We tested the applicability of Free-Choice Response software (patent pending) to assess basic cognitive and sensorimotor functions in children with ASD and compare the results with TD and other clinical groups.

Methods: 20 children with ASD (16 boys, age 3 to 10 years) participated, two outliers with average response time over 10 sec were excluded. The TD group included 47 children 5 to 10 years of age (21 boys). All children were silently or verbally encouraged to “play” with the touchscreen. No

detailed instruction was given, the adults in the room did not comment on the performance. During the first series the subject touched the colored disc on the screen so that it disappeared and appeared at a different location. The exposure was not limited. Free response time (FRT) and number of misses were recorded. In subsequent series the exposure time reduced progressively, the disc changed color, the disc of one color did not disappear after touching. In the last series, an array of discs was presented with only one color sensitive for touch. Corresponding changes in performance were recorded.

Results: Children with ASD demonstrated longer FRT (first series 2654 ms vs 945 ms, second series 2320 vs 742 ms; 2376 ms vs 886 ms; all $p<0.00001$) compared to TD children. Analysis of individual data revealed that longer FRT in ASD is controlled not by general slowness, but rather speed inconsistency and distraction periods. Children with ASD had on average more misses (in four series: 24 vs 1, 23 vs 8, 38 vs 11, 29 vs 10 respectively; all $p<0.00001$) Similar results, reported elsewhere, were obtained from comparison of ASD and other clinical groups (ADHD, learning disabilities, fragile X syndrome – each with a distinct profile). They reflect differential diagnostic potential of the method. The stereotypic behaviors called for a higher number of repetitive responses in ASD.

Conclusions: Free-Response Choice method can collect a large amount of relevant information within a short period of time. The obtained data translate into terms of basic sensorimotor and cognitive functions as well as level of motivation. It is one of few tools not requiring verbal instruction and in such a manner can be used with all populations including individuals with extremely low IQ and very limited cooperation.

164 **163.164** Knowledge Trainings on Autism Spectrum Disorders for Teachers in Tanzania: The Mobile Phone Solution.

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Background: In Tanzania, there is emerging awareness of Autism Spectrum Disorders (ASD) in the general population and few resources dedicated to serving the needs of children with ASD (Manji & Hogan, 2013). The use of distance learning interventions has emerged as a feasible option for promoting ASD knowledge. Tanzania has a mobile phone penetration rate close to 70 percent and counts telecommunications as its fastest-growing sector (Reuters, 2016), so this intervention specifically capitalizes on the fast developing technology infrastructure in the country.
Objectives: The current project delivers a sustainable alternative to face to face ASD knowledge trainings for teachers in Tanzania. This project is the first virtual ASD training conducted in the country and is unique in that it has enabled participants to use their phones to access trainings with flexibility of completion time and location.

Methods: The training launched in July 2018 with 100 teachers in Arusha, Tanzania. The training will be available online until December 31st 2018. Seventy nine users have accessed the training to date with 35 users completing the entire training (female, N=27; male, N=8). The training was developed by clinicians from a U.S. based social benefit orgranization, (OMPACO). The content of the training is based on live trainings the organization currently provides in Tanzania. The training included information about ASD in seven modules and is available to teachers in English and Swahili. Teachers access the training through a website and the training is formatted to be viewed on both SMART phones and feature phones. A pre-test measure established baseline autism knowledge, and five-item quizzes at the end of each module that assessed user learning of information from each module.

Results: Reliability results for the pretest measure were fair (Cronbach's alpha=.542) and the mean pretest score for all users was 35.72 correct out of a possible 48 items. The training modules with the highest user participation were Etiology (English, N=28; Swahili, N=22) and Assessment and Diagnosis (English, N=24; Swahili, N=24). The highest average quiz scores was on the module related to IEP development (English, N=96%; Swahili, N=73%).

Conclusions: Total user participation was high (79 users out of 100). On the section quizzes, there was a high completion rate and high scores across the modules. The mean pretest score of 35.72 indicated fair to high baseline autism knowledge among teachers who completed the training (74% score on the measure). Future research could explore the possibility of providing trainings to the general community as a way of scaling up the intervention to a larger populatoin. For a pilot launch, these results provide an encouraging step towards bringing awareness of ASD to the teacher community in Tanzania via the use of mobile phone technology.

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165 **163.165** Loris Platform for Automating Clinical Workflows and Multimodal Data Management

ABSTRACT WITHDRAWN

Background:
The growing quantity and diversity of data collections in autism research require robust data systems for harmonizing multi-modal cohorts across large-scale distributed collaborations. Enabling researchers to query and manage diverse brain, behaviour and genotypic data types in one comprehensive platform is pivotal to the future of neurodevelopmental research. By leveraging the computational customizability of specialized neuroinformatics platforms, research teams can optimize labour-intensive clinical workflows and accelerate the return of results.

Objectives:

LORIS is an open-source web-based data management software developed at the Montreal Neurological Institute (MNI). Its modular design aims to automate high-value processes and tasks from data capture, quality control, visualization and analysis workflows. Embedded tools for normalized scoring and data verification provide computational validation for labour-intensive tasks otherwise requiring clinical expertise.

Native clinical and imaging workflows are customizable and extensible across other data modalities supported by LORIS, including electrophysiological (EEG), biobanking and summary genetic data types. Coupled with the CBRAIN processing platform and embedded BrainBrowser visualization tool, this combined neuroinformatics environment endeavors to address the challenges of large-scale, multi-modal data collection analysis.

Methods:

Complex instrument scoring using norms tables and scales can be computed automatically in LORIS during data entry, reducing error and time-cost in manual scoring. Clinical algorithms can be updated and re-calculated to validate accuracy and reproducibility of results.

Multi-modal querying of longitudinal cohorts using the Data Querying Tool enables users to build, save and export queries across timepoints. At-a-glance data summaries are visualized in interactive Dashboard graphs, and detailed in the Statistics module.

Salient demographic variables are easily accessed and queried along with longitudinal data. The Candidate Profile module transparently captures top-level enrolment, demographic, and consent information at every stage of a study. Related participants are cross-linked through the Family Information sub-module.

Results:

In autism and neurodevelopmental research, projects such as the IBIS network, the Baby Connectome Project, and the NIHPD database use LORIS as a combined gene-brain-behaviour longitudinal data platform. In such instances, clinical norm algorithms are embedded in behavioural forms, providing instant return of results to clinicians. No external calculations or manual checks are needed to validate complex scores. These initiatives have also contributed significantly to the data standards and interoperability of the NIMH Data Archive (NDA).

For large, multidisciplinary data collections, this native ability to link and query participant data across modalities in one system conserves time and expertise that would otherwise be spent coordinating and maintaining multiple data systems in parallel.

Recent integrations of EEG data and interoperability with the BIDS data structure increase the global utility of LORIS. Interoperability with processing platforms such as CBRAIN facilitates the flow of data from storage platform to analysis toolkits.

Conclusions:

Customizable for large-scale multi-modal collections, the LORIS platform allows investigators to amplify the translational impact of data assets in autism and neurodevelopmental research. Equipped with powerful tools for cross-modal querying of longitudinal datasets, verifiable scoring of complex algorithms, and multi-level data validation and review, research teams can reduce error and efficiently utilize clinical expertise via a single neuroinformatics platform.

166 **163.166** Myway Employability: Enhancing Independence, Job Readiness and Inclusion for Young People on the Autism Spectrum

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Background: In 2012, Australians on the autism spectrum had a 41% unemployment rate; over three times that of people with disability and almost six times the rate of people without disability. Only 44% of autistic adolescents are likely to attend post-secondary education and training which is significantly less than their peers with other disabilities. Unsuccessful transition to work increases the risk of labour-force and social exclusion, as well physical and mental health issues.

A better transition from school to adult life can lead to earlier potential for employment, higher job satisfaction and productivity in the workplace, and greater capacity for independent living. Better Outcomes and Successful Transitions for Autism (BOOST-A) is an online transition-planning tool for adolescents on the autism spectrum to plan for life after school. BOOST-A was developed collaboratively with young people on the spectrum and the adults who support them, and provides a step-by-step guide to career exploration, goal setting, creating work experiences, and developing networks for employment. An Australian-wide controlled trial found that high school students on the spectrum who used BOOST-A had more confidence and self-determination to achieve their employment goals, than students involved in generic transition-planning (N=94 young people on the spectrum). Our challenge was to incorporate the evidence-based BOOST-A into a holistic career planning and employability service, accessible and engaging for young people on the spectrum.

My Way Employability is a mobile-first web application to empower young people to plan and prepare for future study, training and employment. We adopted a five-stage process to design this holistic service: (i) Discovery; (ii) Problem exploration; (iii) Solution exploration; (iv) Market validation; and (v) Preparation for growth and scale. We engaged over 250 stakeholders through interviews, workshops, user testing sessions, and informal conversations to co-design and validate a service that supports young people transitioning from school to adulthood. This involved young people on the spectrum, parents, and allied health and education professionals.

Objectives: In this interactive demonstration, we will conduct live user testing of the MyWay Employability prototype; gathering important feedback to inform the ongoing refinement of user experience.

Methods: The 90-minute demonstration will include:

1. An overview of stakeholder engagement at various touchpoints in the design process
2. A summary of universal design principles and engagement strategies identified by young people on the spectrum that were central to our technology solution
3. Live user-testing and feedback on the MyWay Employability prototype
4. Explanation of the knowledge translation and service design processes used that may have future relevance and utility for audience members

Results: We will present key findings and insights from the design phase of the project, and explain how these recommendations were translated into content and design features to engage young people on the spectrum with MyWay Employability.

Conclusions: Through our reflections of our journey to develop MyWay Employability we will challenge the research community to consider how they might engage key stakeholders in a knowledge translation process and find market opportunities to turn their research outputs into a service that is beneficial and valued by the community.

167 **163.167** Neurofeedback of the Event Binding EEG Rhythm (40 Hz.) Improves Autistic Issues

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Background: Forgotten research from the early '90s by Rudolpho Llinas found a 40 Hertz (cycles/second) MEG and EEG rhythm which binds together inputs and memories to form an event. It originates in the intralaminar nucleii of the thalamus and scans the brain 40 times a second, bringing the most relevant information back to the thalamus to be integrated (bound) into an event.
I hypothesize that disorders of this event binding system, which vary individually, are the basic flaw leading to many autistic issues.

We call this system "Neureka!" due to its role in discovery and new learning. We have developed a measurement of the particular 40 Hertz rhythm, the Neureka! Protocol, which isolates it from other 40 Hertz rhythms and EMG artifact, and developed a professional brainwave biofeedback system, the Peak BrainHappiness Trainer. This uses neurofeedback designs which combine training to enhance control of Neureka! and single pointed Focus—the InhibitAll protocol. The Neureka! level controls the size of the video or DVD playback, while Focus enhances the brightness. Low levels of either stop the playback.

Objectives: We tested its effectiveness in autistic teenagers in several studies. Its success led us to simplify the Trainer and create a home and clinical training system, the Socialize ACE, for the PC, which I will demonstrate. This provides the advantages of more frequent, less expensive sessions, which should improve learning.

Methods: The most recent study built on previous published work, and tested the design's effectiveness as part of our Peak BrainHappiness Trainer, training two to three times a week during the summer instead of once in previous studies. It is ongoing at the University of South Carolina in Greenville.

Results: After 18 sessions of training, the first 8 subjects showed very significant improvements of parent ratings on the Achenbach scales for problems with Depression (p = .009), Attention (p = .001), Oppositional Defiant Behavior (p = .002), and p = .09 for Anxiety. The group average for each of these scales started out in the abnormal range and finished below the normal cutoff. The mean total score on the Social Responsiveness Scale-2 decreased very significantly (p = .006), or 51% toward the normal zone boundary of 59. These results appear to be better than the previously published work.

The training improves the user's mood and they are very motivated to continue.

Conclusions: There is mounting evidence that the combination of 40 cycle Neureka! training and the InhibitAll Focus Training produces real and rapid improvements in several autistic issues. Also, a published study in normal subjects found significant gains in their memory and attention, and a significant improvement in happiness that lasted at least four months after only 12 sessions.

The results of the studies support the hypothesis that disorders of the 40 cycle Neureka! system, as well as focusing problems, may be important in the etiology of ASD.

168 **163.168** Providing Professional Development through Interactive, Game-Based, E-Learning Modules

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Background:
Over recent years, there has been an increase in paraprofessionals providing service to students with disabilities. The literature suggests that training for paraprofessionals about evidence-based practices (EBPs) for students with ASD has been minimal, and when it does occur it tends to be in the form of workshops with little follow-up. The Supporting paraprofessionals-teachers Use of Evidence-base practices with Learners having Autism (STELA) research development grant focuses on developing a professional development model for elementary paraprofessionals working with students with ASD. In Phase 1 of the project, the STELA research team conducted a survey and classroom observations of paraprofessionals to guide initial development of the STELA model.

Objectives:

1. Determine professional development needs and preferences for elementary paraprofessionals working with students with ASD.
2. Examine frequency and fidelity of use of foundational evidence-based practices (EBPs) of paraprofessionals working with students with ASD.
3. Describe how data informed the development of the STELA modules
4. Demonstrate the use of STELA e-learning modules

Methods:

Mixed methods were used to address these questions and inform the iterative development process of the STELA professional development model. The research team collected survey data from 209 elementary paraprofessionals working with students with autism that represented 24 different states/territories across the United States. Research staff observed 20 paraprofessionals' use of foundational EBPs. They used partial interval coding during a 2-hour observation, noting the presence or absence of each EBP and rating the fidelity of EBPs. The research team examined descriptive data including means, standard deviations, and ranges.

Results:

See Table 1 for a summary of key data from the survey. The survey results showed that 93% of paraprofessionals identify a need for professional development on specific EBPs, but identified limited time (25%) and lack of offered training (22%) as barriers.

Based on proportion of intervals, the paraprofessionals used least to most prompting (mean=51%) and reinforcement (mean = 36%) the most. Paraprofessionals used visual schedules (mean=3%) and visual cues (mean=6% of intervals) less. Time delay was not used by any of the observed paraprofessionals. The paraprofessionals rarely collected data (mean = 3%) or facilitated peer interactions (mean < 1%).See Table 2 for a summary of key data from the classroom observations.

Conclusions:

The research team analyzed the data to develop the initial protocol for the STELA model and prototypes for the targeted EBPs. The STELA model consists of (1) in-person workshops for paraprofessionals and supervising teachers (overview of autism, roles and responsibilities, teaming and communication), (2) e-learning modules that introduce foundational EBPs, and (3) performance feedback cycles between paraprofessionals and

supervising teachers. For example, the survey data indicated that e-learning modules needed to be brief, and thus were designed to take 30 minutes. Also, the team used the observation data to determine which EBP steps may have needed more support (e.g., data collection).

Discussions will focus on creating e-learning modules using an iterative, instructional design process through negotiating the balance between feasibility and efficacy and the challenges associated with incorporating feedback while maintaining project timelines.

169 **163.169** Scalable Mobile Apps for Active Closed-Loop Behavioral Coding in Autism Spectrum Disorders

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Background: Observational behavior analysis of children plays a key role for the evaluation, monitoring, and discovery of behaviors related to Autism. To date, these analyses are done in-person by a trained clinician who administers assessments and manually codes the children's behaviors. With emerging technology and methods in computer vision and machine learning, new scalable and objective methods of behavioral elicitation and analysis of children are feasible. These include designing and displaying specific (for example) visual, auditory, tactile, and memory stimuli on mobile devices while simultaneously recording the child with the device and coding behaviors of the child while they are interacting with the device.

Objectives: To develop and deploy an all-in-one mobile-paradigm that incorporates questionnaires and movie stimuli designed to elicit behaviors relevant to ASD screening while simultaneously capturing and coding the child's behavior in an unsupervised manner.

Methods: This work is an interdisciplinary collaboration between mental health professionals, computer vision and machine learning scientists, and app developers. Caregivers are able to digitally fill out demographic questionnaires and parental reports on the device. Additionally, multiple short video stimuli (<1 minute) designed to elicit specific social and emotional responses are displayed on a mobile-device, while at the same time the front facing camera records a video of the child's face. Computer vision algorithms detect and track the child's face throughout the video recording. Automatically computed facial landmark are used to compute the child's head pose, whether the child turns their head, the degree to which the child is attending, and the movement of the child's head. Image regions around key facial landmark points are used to estimate the child's facial affect. The facial landmarks are also used to estimate the eye regions of the child, which, along with the face image, are fed into a neural network to estimate the child's gaze locations on the screen.

Results: The data collected from our developed mobile applications contain features related to ASD risk behaviors. For example, we are able to assess total time child is attending to a given stimulus; number of times child disengages their attention; detecting a name-call prompt; whether or not a child performs a head turn; how quickly the child performs a head turn; the probability a child is displaying a positive/negative/neutral facial affect and the range of facial affect; gaze fixation patterns; preferential gaze; and postural sway. Our apps have been used in in-clinic and at-home studies.

Conclusions: We developed mobile applications that displays visual and interactive stimuli designed to elicit behaviors relevant to ASD and incorporates digital questionnaires. The mobile applications also record the child's face with the front facing camera, and with our developed computer vision and machine learning algorithms we are able to automatically extract ASD relevant behaviors from the child. Applications such as the one presented here could lead to new or refined behavioral risk marker assessments, and novel screening and monitoring methods outside of clinical settings.

170 **163.170** Tabatha: A Mobile Health Platform to Evaluate Stereotypical Behaviors in Autism

ABSTRACT WITHDRAWN

Background: Children with Autism Spectrum Disorder (ASD) face challenges in undertaking daily activities if they have stereotypical behaviors, such as hand flapping, head banging, repetitive movement, and vocal protest. Accurate detection of these behaviors through wearable devices and other sensing technologies can allow researchers to characterize their nature objectively and identify triggers for their occurrence. Sensing technologies can also be used to monitor therapeutic interventions and assess their efficacy in an unbiased manner.

Objectives: Our primary objective is to create an end-to-end mobile health (mHealth) platform (called TABATHA) to support research on challenging behaviors in ASD. Researchers can use TABATHA to collect and store sensor readings, validate physiological parameters, and analyze the data to discover novel biomarkers and triggers for vocal protest and motor stereotypy. Our secondary objective is to ensure that the data collection approach complies with human subject regulations, such as subject privacy.

Methods: The TABATHA platform consists of a commercially available smartwatch (Motorola Moto 360), Android tablet, Hyperledger Blockchain, and IBM Cloud. The smartwatch collects raw sensor data sampled at high frequency: accelerometer (96 Hz), gyroscope (48 Hz), photoplethysmogram (24 Hz), Heart rate (1 Hz), and the acoustics (44.1 kHz). To minimize the re-identification risk, we have developed software within the smartwatch to anonymize the sensed samples right at the source. We obfuscate the identifiable traits captured by acoustic sensing by computing and storing time and frequency domain speech features. The anonymized streaming data is sent to the tablet on which researchers note the occurrence of stereotypical behaviors; both the anonymized data and identified behavioral occurrences are sent to the IBM Cloud, where we can apply machine learning algorithms. TABATHA also uses Blockchain to support privacy and security. Prior to enrollment, consent information, collected from subjects, are securely stored on the immutable ledger. Study data ownership, access rights, and secondary data usage are enforced by smart contracts written into the Blockchain.

Results: The design of TABATHA can facilitate six central roles within an ASD research environment: subject (uses a wearable); parent (who provide consent); primary investigator (monitors, manages, and approves the ongoing activities), study coordinator (recruits subjects, acquires informed consent, and administers study sessions), auditor (evaluate the protocol compliance), and third-party collaborator (access anonymized study data).

We have validated TABATHA by conducting a feasibility study to detect stereotypical motor behaviors in the presence of other confounding child-type playing activities, such as card matching and drawing. We obtained a nearly 93% accuracy in a cross-subject evaluation. Moreover, we hand-

curated a speech dataset on vocal protest (defined as sensory overload induces crying or screaming among children with autism) and developed neural network-based detection models with accuracy over 93%.

Conclusions: We have developed a novel mHealth platform to collect research data on stereotypical behaviors of children with ASD. The developed platform facilitates consent management, annotation, anonymized datasets, and summaries of the occurrence of behaviors. Future work will involve using TABATHA to conduct a field study on children with ASD and identify triggers for challenging behaviors.

171 **163.171** The Global Reach of Autism Navigator® Mobile Technology to Improve Early Detection

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Background: Advances in research have documented that ASD can be diagnosed by trained professionals at 18-24 months of age, and yet the median age of diagnosis in the US still hovers at 4 years. There is currently a research-to-practice gap in high-resource countries, and this gap widens for professionals and families in low-resource countries. Autism Navigator® is a collection of web-based courses and tools that has used an implementation science framework to promote coordinated change to support community uptake and sustained utilization in medical, social service, and early intervention systems. Access to mobile technology is increasing worldwide and offers one potential solution to bridging the research-to-practice gap that offers the potential for rapid access globally.

Objectives: This technology demonstration will showcase the web-based Autism Navigator for Primary Care that uses extensive video and offers a new online screening tool with links to our *Seamless Path for Families* to lower the age of detection and referral and report on the deployment.

Methods: The Autism Navigator collection of web-based resources was developed by the FSU Autism Institute. Autism Navigator for Primary Care is an 8-hour online course using interactive slides with narration, closed captions, and illustrative video clips of two-dozen toddlers with ASD. Providers who complete the course can use the online automated Smart ESAC (*Early Screening for Autism and Communication*) screening tool with provider and family portals linking to 5 resources. Families of all children are invited to the 16-by-16 Lookbooks and Social Communication Growth Charts. Families of children with a positive autism screen are invited to About Autism in Toddlers, ASD Video Glossary and the How-To Guide for Families. Input from advisory boards and focus groups involving stakeholders informed the development of content built through an iterative process of feedback, review of material for cultural appropriateness, and revolving enhancements to the portal.

Results: We will describe the deployment of the courses and family resources over the past 4 years beginning in Florida and expanding to other states in the US and other countries including South Africa. About Autism in Toddlers was first launched in April 2015 and enrollment has increased incrementally to 29,713 unique users from 152 countries to date. Autism Navigator for Primary Care was launched in 2016 and has 1,690 unique users enrolled from 6 countries. The How-to Guide for Families was launched in 2017 and has 562 unique users from 10 countries. Strategies to engage physicians, community health workers, and childcare providers in the US and South Africa and lower the age of referral will be highlighted. Tablet computers will available to experience the screening tool and web-based resources.

Conclusions: Innovative models to increase the number of culturally and ethnically diverse professionals who can deliver evidence-based services are vital to improving global competence in early detection and intervention. Autism Navigator provides a highly-needed cost-efficient platform for professionals and families, using mobile technology to combine an automated screening tool, parent and provider portals, and links to interactive resources that are built for rapid scalability.

172 **163.172** The Use of Immersive Virtual Reality to Teach Safety Skills to Children with Autism Spectrum Disorder

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Background: Individuals with autism spectrum disorder (ASD) experience impairments across a wide range of skill domains, including safety skills. Teaching safety skills to individuals with ASD is critical, given the potentially dangerous and fatal consequences. Although several methods (e.g., video training, mock simulations, natural environment training) have been used to teach street-crossing skills to children with ASD, these methods have largely been ineffective in teaching generalization of skills to real-life street-crossing scenarios. While natural environment training poses the lowest barriers to teaching generalization, it often proves to be the most difficult to implement due to safety and logistical challenges (i.e., the ability to present both safe and unsafe conditions in an efficient manner). Virtual reality (VR) technology may be a solution to teaching safety skills to individuals with ASD, such that VR environments provide immersive, realistic scenarios in a safe, efficient, and controlled manner.

Objectives: The objectives of this study were to determine if (1) safety skills could be taught in the VR environment and (2) safety skills learned in the VR environment could be generalized to the natural environment.

Methods: The current study used a multiple baseline design to teach three children with ASD (5-8 years old) street-crossing skills. All natural environment pre-treatment, post-treatment, and probe sessions were conducted in-vivo, in uncontrolled traffic areas. All immersive VR probe and training sessions were conducted using the Oculus Rift headset and sensors. The training sessions were conducted in a 10'x12' therapy room equipped with a table that contained the Oculus Rift headset and sensors. The primary investigator used a laptop connected to the Oculus Rift to monitor what the participant was seeing in the VR environment, in order to present the questions and to score the participants' responses. The video clips were hosted on YouTube and accessed through the Oculus and Steam software.

Following completion of the pre-treatment baseline and probe sessions, participants began immersive VR training using short, 10-second video clips of safe (i.e., no car present) or unsafe (i.e., car present) conditions. Depending on the participant's progress after VR training using the short clips, they either proceeded to training using 10-second video clips with added audio distraction (e.g., dogs barking, lawnmowers, etc.) or directly to long, 3-5-minute uncut clips of a street.

Results: During the pre-treatment baseline sessions, all three participants averaged below 50% on their identification of safe and unsafe conditions in the natural environment. Following treatment, all three participants scored 100% in the post-treatment probe sessions. Participants 2 and 3 only needed the short clip and long clip training video types to reach mastery criterion in the natural environment, while participant 1 needed training in all three training video types.

Conclusions: The current findings suggest that immersive VR training may be a safe and viable method of teaching safety skills to individuals with ASD.

173 **163.173** Vrsensory: Developing Virtual Play Spaces Based on Sensory Preferences

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Background:
Assistive and therapeutic technologies have traditionally been aimed at recognizing or correcting atypical behavior, teaching skills, and prompting—thus addressing only the behavioral and cognitive aspects of the condition. A more limited set of efforts have explicitly considered the core challenge of sensory processing. Sensory processing patterns and challenges impact activities of daily living not only for people with autism but also for those with ADHD, dyslexia, and typical development. By addressing sensory needs first in design, we not only aim to support users with autism, but also other neurodiverse conditions, as well as neurotypical children in a way that promotes the inclusion of diverse children in mainstream leisure activities. Addressing multiple abilities that include both users with and without disabilities results in better design for all users. As "similar sensory subtypes are present in the general population of children, addressing sensory needs is a mainstream need as well as an assistive need. As an assistive need, focus on sensory processing needs to be increased as many best- practice therapeutic interventions and assistive technologies for autism and ADHD view sensory processing challenges as secondary to social and learning challenges. This work shifts this thinking by focusing on underlying sensory needs supported by customized virtual environments that are tailored to these needs as well as the end user's leisure interests.

Objectives:

By addressing the user's often hidden sensory needs as system requirements, we translate the recent findings of neurologists who argue sensory differences are the basis for differences in social behavior and learning. Sensory factors impact many aspects of daily life such as social participation, cognition, temperament, and participation. This approach directs us to shift to supporting foundational skills of learning by addressing sensory preferences before addressing social or functional skills.

Methods:

We employed a user-centered design process in which we conducted a series of paper and digital prototyping session with the three participants. We analyzed the data we collected via interviews with family and children, direct observations during use, video recording in use, and screen capture. As the final multi user study evolved into a game, we employed a framework borrowed from game design research as a lens for that analysis.

Results:

We designed three custom virtual reality applications based on extant occupational therapy research regarding four distinct sensory patterns. Specifically, we employ the concept of sensory quadrants described in the Sensory Profile 2 (W. Dunn 2014). Dunn's theory of sensory information processing explains how modulating oneself to the environment is inherent in engaging in activities. All participants were comfortable and played in each module independently and they were socially engaged in the most passive play module.

Conclusions:

This work demonstrates that by using sensory preferences to guide design interaction styles and virtual environmental features, we can support comfortable and engaging virtual space in which neurodiverse children can play together.

174 **163.174** Visualization-Guided Analysis of Eye Movements in Children with Autism Spectrum Disorder: Results from the ABC-CT Interim Analysis

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Background: Biomarker discovery in neuropsychiatric disorders often employs automated, statistical, data-driven, high-throughput machinery. Less explored are the ways human insight can be rapidly, scalably, and effectively leveraged. Computer visualization techniques can transform raw data into intuitive representations accessible by those without data expertise. An appropriate match between data and visualization can provide a common ground for allowing clinical insights to be utilized in facilitating data explorations associated with biobehavioral biomarker discovery. One area where visualization technology has advanced rapidly, and where the role of visualizations in bridging clinical insights with data mining expertise has great potential, is in the use of eye tracking for studying gaze differences between individuals with autism spectrum disorder(ASD) and typically-developing(TD) individuals.
Objectives: (1)To identify visualization strategies of promise that are appealing, accessible, and informative to autism clinical experts without significant data analysis or eye-tracking expertise. (2)To show visualizations of gaze patterns during an eye tracking experiment to clinicians, to obtain their feedback regarding between group or questions of clinical phenotype, to distill this feedback into testable hypotheses through qualitative data extraction, and then to statistical test these hypotheses as a template for a visualization-guided analysis of eye movements in children with ASD.

Methods: Visualizations:(1)gaze points represented by participant identifier; (2)300 ms historical gaze trajectory; (3)"heatmap" color representation of groups (i.e. gaze points convolved with Gaussian kernels); (4)combination of (1)+(3); (5)thresholded version of (3). Visualizations were applied to Activity Monitoring(AM) eye-tracking data from the interim dataset (Summer 2018; 6-to-12-year-old children(TD:n=64; ASD:n=161)) of the Autism Biomarkers Consortium for Clinical Trials (ABC-CT). AM-gaze visualizations were presented to clinicians at a metropolitan autism

center (ARNP/RN *n*=11, BCBA *n*=2, MD *n*=1, Clinical Psychologist/Therapist *n*=8, Family services/CRA *n*=2; combined clinical experience= 287 years), and feedback regarding visualization preferences, as well as clinical insights from visualizations aimed at describing (1)ASD-TD between-group differences; and (2)Lower(LIQ; IQ<85) from Higher(HIQ; IQ>85) IQ, were requested.

Results: 14 out of 15 clinicians favored the "Threshold-HeatMap" visualization (5), see Figure. Qualitative data extraction revealed the following insights by clinicians, some of which were investigated statistically:

1. in TD vs ASD,

- TD>ASD on looking at people/faces on overall (p<.001,d=0.97),
- TD>ASD on looking at peoples when
    - People reached for the object (p=.001,d=0.94),
    - Actors were not talking and/or in anticipation of speech or activity (p<.001,d=.91),
- ASD>TD on looking at toys and the central activity(p<.001,d=-1.07;p<.001,d=-1.06 during speech;p<.001,d=-1.09 during non-speech),
- ASD seemed more likely to reference faces after speech,
- ASD was slower to disengage from objects/people.

2. Comparing lower versus higher IQ in ASD,

- LIQ>HIQ on looking at distractors(p<.001,d=.76),
- LIQ responded to conversation less in overall (p<.001,d=.82), and more slowly,
- LIQ showed more scattered gaze patterns,
- LIQ spent more time looking at background objects(p<.001,d=.59).

Conclusions: Results indicated that a simplified, thresholded visualization was preferred by clinicians. Clinicians were able to identify multiple hypotheses which were then confirmed analytically. This process may provide a template for future explorations that will increase accessibility to experimental data, allowing clinical expertise to be leveraged in biomarker discovery, moving us to a future where crowdsourcing may help us identify new analytical and data insights.

Poster Session
164 - Animal Models
11:30 AM - 1:30 PM - Room: 710

1 **164.001** A New Objective Electrophysiological Technique As a Measure of Central Auditory Processing in a Rat Model of Autism Spectrum Disorder

A. A. Eshraghi[1], *R. Mittal*[2], *M. M. Perdomo*[2], *T. Yassa*[2], *J. Mittal*[2] *and J. Bohorquez*[3], *(1)Otolaryngology and Neurological Surgery, University of Miami Miller School of Medicine, Miami, FL, (2)University of Miami School of Medicine, Miami, FL, (3)University of Miami School of Medicine, 33136, FL*

Background: Gaps embedded in noise (GIN) have been used as acoustic stimulus to evaluate the auditory temporal processing of different study populations such as in subjects with central auditory processing disorders (CAPD). Since GIN are very short as miliseconds (ms), they have been used to evaluate temporal resolution which is defined as the ability to detect small changes in sound over time, or slight discontinuities in ongoing stimuli. Poor temporal resolution has been shown to correlate with speech recognition difficulties. The gap detection threshold (GDT) is defined as the shortest gap that can be perceived in an otherwise continuous background stimulus. Electrophysiological assessment of GIN has focused mainly on Late Latency Responses requiring awake alert subjects (humans or animals). As rat models are commonly employed to understand the molecular mechanisms underlying auditory and neurological disorders, there is a need to develop techniques to determine central auditory processing (CAP) in experimental animal models.
Objectives: One of the most commonly reported sensory processing impairments in individuals with autism spectrum disorder (ASD) is the abnormalities in CAP. ASD patients consistently exhibit atypical behaviors in response to auditory stimuli and CAPD, which refers to a complex and heterogeneous group of auditory-specific disorders. There is still not a reliable electrophysiological technique to determine CAPD in ASD patients. The aim of this study was to develop an electrophysiological technique that can be used as an objective measure of CAP in anesthetized rat model.

Methods: We developed a method to determine the Objective Gap Detection Threshold (OGDT) in rats. QSSR elicited by noise modulated by 40Hz gaps of different durations were analyzed in time and frequency domains using wild-type (WT) and rat model of ASD. The detection was performed in frequency domain, by applying the Hotelling';s T2 test to the 40Hz complex fundamental frequency component. The OGDT is estimated by analyzing the confidence ellipses of the 40Hz spectral component.

Results: When the confidence ellipses (p=0.05) contain the origin of the complex plane, we observed that the subject is not significantly detecting the noise gap. We observed that the rats were detecting noise gaps of 12, 10 and 8ms and not detecting the 6ms gap. We also observed the "vanishing" of response into the background noise when a 4ms noise gap is applied. The 5ms OGDT result was verified by the statistical T2 test and is consistent with the previous animal studies with awake rats. The OGDT values were significantly increased in our rat model of ASD in agreement with findings observed in humans having ASD.

Conclusions: We have developed an electrophysiological method to determine GDT as a measure of CAPD in an anesthetized rat model. This technique eliminates the need for being alert and awake during the test bringing a new dimension especially in animal experiments regarding central auditory evaluation. The availability of novel objective techniques to determine CAPD will help in its early detection in patients diagnosed with ASD or suspicion of being on the spectrum leading to early intervention and hence better clinical outcomes.

2 **164.002** A Novel Posner-Style Cueing Task to Assess Attention Orienting in Mouse Models of Autism

S. Li[1,2], *C. May*[2], *A. J. Hannan*[2], *K. A. Johnson*[1] *and E. L. Burrows*[2], *(1)School of Psychological Sciences, University of Melbourne, Parkville, VIC, Australia, (2)Florey Institute of Neuroscience and Mental Health, University of Melbourne, Parkville, VIC, Australia*

Background: A deficit in attention orienting may be one of the earliest features in people with Autism Spectrum Disorder (ASD). Attention orienting is comprised of two components - exogenous and endogenous orienting. Exogenous orienting of attention is a stimulus-driven process in which one's attention is drawn automatically to salient external stimuli. Endogenous orienting of attention represents a goal-directed process in which expectations and/or knowledge of an individual determine where and when one's attention is given. To date, the neural mechanisms underlying the atypical attention orienting in autism remain unclear.

Genetic mouse models are useful tools to investigate the neurobiology of cognition, but a well-established assessment of attention orienting in mice is missing. The Posner cueing task is a widely used visual-spatial orienting task in humans. It has been adapted in studies of rats and fish, but rarely used in mice. It is important to develop a mouse version of the Posner cueing task before investigating the association between attention orienting and ASD-associated genetic mutations.

Objectives: Our objective was to adapt the human Posner cueing task for use in mice using recently developed touchscreen technology. This mouse paradigm will be used to investigate attention orienting in mouse models expressing ASD-associated genetic mutations.

Methods: Thirty-two C57BL/6 mice were trained and tested in automated touchscreen chambers. Several versions of the exogenous and endogenous cueing tasks were piloted. The mice were randomly assigned to the exogenous (n = 16) and endogenous task (n = 16).

Mice were trained to sustain their nose-poke to a central dim square until the display of a peripheral target (a bright square). They were rewarded with strawberry milkshake for nose-poking the target. The targets were either validly or invalidly cued. In the exogenous tasks, the cue was a flash of light in the peripheral square. In the endogenous tasks, the cue was a centrally-presented spatially-predictive grating – 145 degree gratings predicted the target on the left, while 45 degree gratings predicted the target on the right. The validity of cues were 50% in the exogenous tasks, and above 80% in the endogenous tasks.

Results: In both the exogenous and endogenous tasks, mice showed higher accuracy and shorter response times in the validly cued trials, compared to invalidly cued trials. This effect is consistent with results in the human Posner task. While mice were able to maintain their nose-poke at centre, this was negatively correlated with increased stimulus-onset asynchrony (SOA).

Conclusions: In this study, we have successfully adapted the human Posner task to mice. Mice responded faster to validly cued stimuli, in line with results in humans. This mouse Posner task can be used to assess attention orienting in mice containing ASD-associated genetic mutations. This approach will enable a greater understanding of neural mechanisms underlying deficits of attention orienting in ASD.

3 **164.003** ARID1B Haploinsufficiency Reveals Early Divergent Neuroanatomical Phenotypes through Development and Sex

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Background: Haploinsufficiency of ARID1B, the chromatin remodelling AT-Rich Interactive Gene 1B, has been implicated in autism spectrum disorder (ASD), intellectual disability and Coffin-Siris syndrome (O'Roak et al., 2012; Fitzgerald et al. 2015; Celen et al., 2017). Although ARID1B haploinsufficiency is implicated in multiple neuropsychiatric disorders, little is known about its effect on neuroanatomical development.

Objectives: This study explores the structural neuroimaging phenotypes associated with the ARID1B mutation using *in vivo* magnetic resonance imaging (MRI) in mice. Our aim is to elucidate any developmental and sex differences in neuroanatomical phenotypes associated with haploinsufficiency of ARID1B.

Methods: A novel *Arid1b* mouse model was generated in-house at the Toronto Centre for Phenogenomics. The sample consists of 11 males and 11 females, 5 of which were mutants and 6 of which were wildtype controls of each sex. Male and female *Arid1b* mice were scanned longitudinally over 5 early postnatal day (p) time-points: p4, p6, p8, p10 and p17. A 7.0 Tesla MRI scanner with cryocoils was used to acquire images of the mouse brains with a resolution of 75 um isotropic. Scan data was analyzed using image registration and deformation based morphometry approaches described in Qiu et al (2018). From this, the volumes of 182 distinct regions were calculated (Dorr et al 2008, Ullmann et al 2013, Steadman et al 2014). We used linear mixed effects models to determine the effect of genotype, sex and their interaction on the volumes of each region of interest over time.

Results: We found both age and sex to have a significant interaction with genotype. A significant interaction with age was discovered, showing that mutants demonstrate different growth rates, mainly decreased growth rates in the cerebellum. Upon further investigation, a significant interaction between sex and genotype demonstrated a divergent neurodevelopmental pattern in males and females. Male mice showed a stable developmental pattern of a smaller cerebellum and larger cortex over development. Female mice showed the opposite pattern initially (larger cerebellum and smaller cortex) and then demonstrated a reversal of this pattern around p12 to match male developmental patterns.

Conclusions: We plan to replicate this finding and extend the timepoints past p17 to gain a better understanding of this sex-dependent neurodevelopmental trajectory. This work demonstrates, for the first time, that structural neuroanatomical phenotypes are different for male and female *Arid1b* mice early in development but this divergence dissipates before p17. Given the sex differences in the prevalence of ASD and Coffin-Siris syndrome, these findings suggest that ARID1B's interaction with neurodevelopmental patterns may be one underlying cause of this disparity.

4 **164.004** Autistic Phenotype in the N-Ethylmaleimide Sensitive Factor Gene Lacking Mice

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Background: Autism, characterized by profound impairment in social interactions and communicative skills, is the most common neurodevelopmental disorder. Many studies on the mechanisms of autism have focused on the serotonergic system but its underlying molecular mechanisms remain controversial. In our previous report, we reidentified *N*-ethylmaleimide-sensitive factor (NSF) as new serotonin transporter (SERT) binding protein (Iwata et al 2014).
Objectives: In this study, we generated the *NSF*$^{+/-}$ mice and investigated their phenotypes.

Methods: As previous report has already shown that NSF is necessary for AMPA-type ionotropic glutamate receptors (AMPARs) location in the synapse, we examined SERT and AMPAR location in the synapse of the *NSF*$^{+/-}$ mice by using freeze-fractured replica-immunolabeling study at first. In next, we assessed behavioral test including the social interaction behaviors by the three-chambered task and the social communication by ultrasonic vocalizations. Finally, we examined whether hippocampal long-term depression (LTD) deficits can be restored in the *NSF*$^{+/-}$ mice for checking the excitatory/inhibitory (E/I) synaptic balance.

Results: We found the membrane expression of SERT half-reduced in the raphe and the significant decrease in postsynaptic expression of AMPAR in CA1 of the hippocampus of the *NSF*$^{+/-}$ mice, compared with wild mice. Then, we found that the spending time near the chamber with a newly introduced mouse (stranger), were significantly reduced in the *NSF*$^{+/-}$ mice, and found that the ultrasonic vocalizations significantly reduced in the *NSF*$^{+/-}$ mice, compared with wild mice respectively. Field electrophysiology performed on brain slices confirmed that NSF gene lacking significantly reduced dorsal CA1 hippocampal LTD in mice.

Conclusions: The present results suggest that cellular trafficking turbulence of synaptic molecules by lacking NSF gene might be related to the pathophysiology of autistic properties.

5 **164.005** CRISPR/Cas9 Induced shank3 Zebrafish Mutants Display Autism-like Behaviors

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Background:
Human genetics and genomics studies have supported a strong causal role of *SHANK3* deficiency in autism spectrum disorder (ASD). The molecular mechanism underlying *SHANK3* deficiency causing ASD is not fully understood. Recently, zebrafish become a popular organism to model ASD because of its high efficiency of genetic manipulation and robust behavioral phenotypes. However, a stable ASD zebrafish mutant model for *shank3* has not been reported. Human *SHANK3* is duplicated in zebrafish genome and has two homologs: *shank3a* and *shank3b*. Previous studies have reported *shank3* morphants in zebrafish using morphlino method. Here we report generation using CRISPR/Cas9 genome editing technique and characterization of *shank3* mutant zebrafish at larva and adult age.

Objectives: N/A

Methods:

We used CRISPR/Cas9 to generate a *shank3* loss-of-function mutant (*shank3a*$^{-/-}$, *shank3b*$^{-/-}$ and *shank3a&b*$^{-/-}$) in zebrafish. A series of morphological measurements, behavioral tests and molecular analyses were performed to systematically characterize the behavioral and molecular changes in *shank3* mutant zebrafish.

Results:

shank3a$^{-/-}$, *shank3b*$^{-/-}$ and *shank3a&b*$^{-/-}$ zebrafish exhibited abnormal morphology at early developmental stage. They displayed reduced locomotor activity both at larva and adult age. They also showed multiple autism-like behaviors in adulthood, including reduced social interaction, reduced time spent near conspecifics, loose schools and significant repetitive behaviors. Additionally, the levels of both postsynaptic homer1 and presynaptic synaptophysin were significantly reduced in the adult brains of *shank3* deficient zebrafish.

Conclusions:

We generated the first inheritable *shank3* mutant zebrafish model (*shank3a*$^{-/-}$, *shank3b*$^{-/-}$ and *shank3a&b*$^{-/-}$) using CRISPR/Cas9 gene editing approach. All *shank3* mutant zebrafish displayed robust autism-like behaviors and altered synaptic proteins of homer1 and synaptophysin. The versatility of zebrafish as a model of studying neurodevelopment and conducting drug screen will likely have a significant contribution to future studies of examining human *SHANK3* function and ASD.

6 **164.006** Cardiac Comorbidities and Their Effect on Brain Structure

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Background: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder with an occurrence rate greater than 1%, characterized by high heterogeneity in etiology and symptomology (Kim et al., 2014). It is associated primarily with neurodevelopmental and behavioural deficits, but has various associated comorbidities, amongst which cardiac comorbidities are common (Kohane et al., 2012). Cardiac abnormalities range from mild cardiac defects to severe congenital heart disease (CHD) (Doshi-Velez, et al., 2014). Accumulating evidence suggests that severe cardiac abnormalities are present and also contribute to the observed neurodevelopment (Ortinau, et al., 2012).
Objectives: Here we explore the association between anatomical brain characteristics and cardiac abnormalities, in a diverse set of prominent ASD mouse models.

Methods: Fixed (ex-vivo) brains of 66 prominent ASD mouse models were scanned using a 3D T2-weighted MRI protocol on a 7 Tesla Agilent scanner (Santa Clara, CA). MRI data were analyzed using image registration and deformation-based morphometry to obtain anatomical volumetric information on 336 brain structures. Data from 19 models (224 females, 497 males; 378 wild-types, 340 mutants) for which a cardiac annotation was found in literature were used. Each model was assigned a normal (7 models) or abnormal (12 models) cardiac phenotype. For example, Arid1b gene is associated with ASD and CHD (Homsy, et al., 2015). So, the Arib1b knockout mouse model was assigned an abnormal cardiac phenotype. We further examined 12 of those models having either normal or CHD-related abnormal cardiac phenotype (134 females, 290 males; 223 wild-types, 201 mutants). Appropriate controls were used, all assigned a normal cardiac phenotype.

Statistical analysis using a linear mixed effects model was performed to test for the effect of cardiac phenotype on the volumetric differences between mutant and wild-type mice, for each mouse model across 336 brain regions. FDR correction for multiple comparisons was performed.

Results: At 5% FDR there was no significant effect of abnormal cardiac phenotype on the volumetric differences between mutants and wild-types. At 20% FDR, however, there was a significant effect of CHD-related cardiac abnormalities in the left trabenular commissure (FDR = 20%, T=3.54).

Conclusions: Cardiac dysfunction is an ASD comorbidity (Memari, et al., 2012). Additionally, CHD newborns show abnormal brain development (Limperopoulos et al., 2010). For a set of prominent ASD mouse models, an effect of abnormal cardiac phenotype on neurodevelopment would be expected. Preliminary results did not show a significant effect at an FDR of 5%. The inability to observe an effect may be a result of two factors, both related to cardiac phenotype being a binary variable. Firstly, the type of cardiac abnormality may influence the strength and direction of the neurodevelopmental effect. Then, with a group-wise analysis these patterns would disappear or cancel out. Secondly, the lack of measurement-based cardiac phenotyping may have resulted in low sensitivity. However, at an FDR of 20%, a trending effect of CHD-related cardiac abnormalities was observed for the left trabenular commissure. To address the above limitations, we will obtain measurements assessing cardiac function for each model and perform further analysis possibly using a more powerful model.

7 **164.007** Characterization of a Novel Mouse Model of DDX3X Syndrome, a Recently Identified Neurodevelopmental Disorder

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Background:

DDX3X syndrome, first described in 2015, is a rare genetic neurodevelopmental disorder that accounts for up to 2% of unexplained intellectual disability (ID) in females, attributable to *de novo* mutations in *DEAD box helicase 3, X-linked* (*Ddx3x*). However, there have been a few reported cases of males with DDX3X syndrome, where a pathogenic *Ddx3x* mutation is inherited from an unaffected mother. The neurobiology of *Ddx3x* underlying this sex specificity is unexplored, leaving pharmacological treatment for this disorder currently intangible. Individuals diagnosed with DDX3X syndrome are characterized by developmental delay/ID, neurological anomalies, motor impairments, and atypical behavior, such as Autism Spectrum Disorder (ASD). Despite clinical classification, there are no mouse models characterized for DDX3X syndrome.

Objectives:

We aim to assess the effect of DDX3X deficiency on neurodevelopment and behavior, while establishing a pre-clinical mouse model for DDX3X syndrome. The animal model will be essential in advancing knowledge regarding this disorder, revealing critical data that may advise successful treatment plans for DDX3X syndrome and, more broadly, ID and ASD.

Methods:

We have generated a mouse line with construct validity for DDX3X syndrome, where *Ddx3x* is ablated only in embryonic tissues using a Sox-Cre driver line. Neurodevelopment and behavior of these mice is assessed by a battery of physical, sensory, and motor milestone tasks between postnatal days 1-21. Innate anxiety, motor coordination, memory, sociability, and fear conditioning is assessed on adult mice to characterize cognitive and behavioral abnormalities. During postnatal development, brain morphology and microanatomy is assessed using Nissl staining and mouse MRI brain imaging.

Results:

We have found that *Ddx3x* ablation in males is lethal, as no Ddx3x null male mice ($Ddx3x^{-/y}$) are born. Also, female mice heterozygous for *Ddx3x* ($Ddx3x^{+/-}$) are born less frequently. We show that $Ddx3x^{+/-}$ females have reduced protein expression in total cortex and cortical synapses. Behavior and development assessments show that $Ddx3x^{+/-}$ mice have various delayed developmental milestones—physical, such as reduced weight; sensory, such as delayed auditory startle response; and motor, such as delayed surface righting—as well as motor impairments, such as gait anomalies. These results are consistent with clinical features observed in DDX3X syndrome, supporting face validity of the mouse model. Additionally, we have found no gross differences in brain morphology between adult $Ddx3x^{+/-}$ and control mice and are investigating morphology during earlier development.

Conclusions:

We have generated a mouse model with construct validity for DDX3X syndrome and initial evidence, from observations of developmental delay, for face validity. This model is useful to understand the mechanisms underlying DDX3X syndrome and develop future therapies for DDX3X syndrome that might be applicable to the broader ID and ASD populations.

8 **164.008** Cntnap2-KO Autism Model Mice Exhibit Perturbed Parvalbumin-Positive Interneuron Input and Output in Primary Visual Cortex V1

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Background: Sensory processing dysfunction is a key feature and common challenge in autism. The refinement and maintenance of sensory processing depends on GABAergic inhibition. Studies in humans and animals suggest that altered excitatory/inhibitory balance or impaired inhibition could underlie the development of autism, and altering inhibitory circuitry can change the neuronal response to sensory stimulation. Low-level sensory processing alterations could exert larger downstream effects on higher-level behaviors relying sensory input. Changes in genes related to synaptic function and connectivity are risk factors for autism. *Cntnap2* encodes CASPR2, a neurexin-family cell-adhesion molecule expressed throughout the brain. *Cntnap2* knockout (KO) mice are an established model of autism that exhibit phenotypes including repetitive/stereotyped behavior, hyperactivity, reduced social interaction, seizures, synaptic spine instability, and changes in excitatory and inhibitory transmission, but the role of *Cntnap2* in visual processing remains unknown.

Objectives: We sought to investigate the effects of *Cntnap2* deletion on inhibitory circuitry in primary visual cortex, V1. Because we have previously demonstrated that *Cntnap2* deletion leads to a developmentally-dependent reduction in tonic inhibitory currents and decreased spontaneous IPSC frequency in layer 2/3 pyramidal cells, we set out to investigate the impact of *Cntnap2* deletion on the function of fast-spiking parvalbumin-positive (PV+) interneurons within V1.

Methods: We used whole-cell patch-clamp electrophysiology to record from L2/3 pyramidal cells and PV+ interneurons in slices made from V1 of *Cntnap2*-WT and -KO mice at 8 weeks of age. AAV injection was used to express fluorophores and/or ChR2 in PV+ interneurons in $Cntnap2^{-/-}$×PV^{Cre}

mice, for identification and optogenetic stimulation.

Results: We have previously shown that L2/3 pyramidal cells from 8-week-old *Cntnap2*-KO mice exhibit lower spontaneous IPSC frequency and reduced tonic inhibitory conductance mediated by δ-subunit containing $GABA_A$Rs. Stimulation of the feed-forward L4 to L2/3 pathway to evoke monosynaptic EPSCs and disynaptic IPSCs in pyramidal neurons resulted in a higher E/I ratio in KO mice compared to WT controls, indicating reduced inhibition. We did not observe an effect of genotype on intrinsic somatic properties of PV+ interneurons of V1, but optogenetic stimulation of PV+ terminals to evoke IPSC trains in pyramidal cells in L2/3 revealed increased paired-pulse depression at these inhibitory synapses. We again used stimulation of feed-forward L4 to L2/3 synapses to measure the NMDA/AMPA ratio in PV+ interneurons, and found that KO cells exhibited a significantly reduced NMDA/AMPA ratio.

Conclusions: Attenuated $GABA_A$R tonic currents and spontaneous IPSC frequency indicate fewer GABAergic synapses in *Cntnap2*-KO animals. Changes in evoked E/I balance and PV+ interneuron-generated IPSCs in V1 pyramidal cells suggests deficits in inhibition by fast-spiking interneurons. While PV+ interneuron properties were largely unaffected by the deletion of *Cntnap2*, the reduction of the NMDA/AMPA ratio suggests major deficits in neuronal information processing and integration in the cortical inhibitory circuit. Increased paired-pulse depression at PV-IN inhibitory synapses suggests higher initial GABA release and could indicate axonal dysfunction. Future studies should investigate the cellular/molecular mechanisms that bridge the gap between *Cntnap2* mutation and inhibitory dysfunction, as well as the effects of diminished inhibition on the function of the V1 cortical circuit.

9 **164.009** Contribution of Severity of Autism and Age on Dog Attraction to Children with Autism Spectrum Disorder

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Background: Positive effects of pets at home on children with autism spectrum disorders (ASD) are well known (Grandgeorge et al., 2012; Viau et al., 2010). These benefits are linked to the strength of the bond established between the child and the animal (Carliste, 2014; 2015). However, we do not know what are the antecedents or variables that would facilitate or limit the effects of the dog's assignment at home.
Objectives: The present research aims to identify indicators of attraction for dogs observed in ASD children before introducing the animal into the family, and to determine if and how this attraction is influenced by factors such as severity of ASD, sex and age.

Methods: This project was realized in collaboration with Mira Foundation, a non-profit organization involved in the training and donation of assistance dogs since 1987. All participating families have an ASD child and applied to receive a dog from the Foundation. As a first step in the evaluation of families' application by the Foundation, all families must participate to a videorecorded assessment session, in which child and parents interact freely with a trained dog for approximately 20 minutes. Those videorecording are then coded using two evaluation instruments, (1) the Childhood Autism Rating Scale (CARS; Schopler et al., 1988) and (2) an observation grid assessing 12 behaviors related to the attraction for the dog (grid created by MIRA's team and research collaboration). A total of 748 ASD children (17.5% of girls) and their families were involved in the study. ASD children were aged between two and sixteen years old (Mean age: 7.2 ±3.4) and were diagnosed with ASD by independent teams of physicians and professionals based on DSM-IV criteria.

Results: Preliminary results highlighted the reliability of the two instruments (Cronbach alpha: .90 for each). Factor analyzes with varimax rotation identified 2 main factors (53,4% of the total variance) for the CARS associated with: (1) the deficits in social communication, (2) the child emotional reactivity (anxiety, emotion, adaptation). This result partially replicated the factor structure reported in previous researches (DiLalla & Rogers, 1994; Park & Kim, 2015). Furthermore, analysis on the attraction grid revealed two factors (60,5% of the total variance) associated with: (1) the child's behaviors toward the dog (look, proximity, contact, manipulation), (2) the type of interactions expressed in presence of the dog (facial, verbal, playful). When crossing the two evaluation instruments, our main findings revealed a strong correlation between social communication (CARS) and physical engagement of the child (attraction grid) (r= .43 **). Sex did not have any influence on these covariations. In addition, child's age was significantly related to the first factor of attraction for the dog (r= - .33 **). ASD severity and child's age had an independent influence on the attraction toward dogs (all $p<0.05$).

Conclusions: Our study may provide relevant information for predicting which ASD children could be attracted by dogs and would benefit the most from the dog assignment at home.

10 **164.010** Development of Gaze Following in Infant Rhesus Macaques (Macaca mulatta)

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Background:
Gaze following represents a foundational behavior for establishing joint attention and higher-level social cognition (Emery, 2000). Atypical gaze following has been reported in children with Autism Spectrum Disorder and Williams Syndrome (Riby et al., 2013; Lord et al., 2012; Mundy, 2017). To advance our understanding of mechanisms underlying the development of gaze following, rhesus macaques offer an ideal model system: they develop rich and complex social behaviors from infancy onward, similar to humans, and their behavior may help elucidate sensitive periods in the development of gaze following and its neural substrates. Although studies have shown gaze following in older primates living in natural habitats (Maestripieri & Wallen, 1997; Redican, 1975), and a study of semi-free-ranging animals suggests that gaze following emerges by 6-7 months (Rosati et al., 2016), the development of this skill and of its neural underpinning is not well understood.

Objectives:

To study the longitudinal development of gaze following in mother-reared infant rhesus macaques raised in semi-naturalistic groups that allow for typical emergence of rich social behavior.

Methods:

Twenty-three infant male rhesus macaques were tested every 2 weeks from 2-24 weeks to obtain densely-sampled measures. Gaze following was

measured via eye-tracking technology with procedures similar to those used in human infant eye-tracking studies, facilitating interspecies comparisons (Jones & Klin, 2013). Infants viewed semi-naturalistic videos of unfamiliar adult and juvenile male and female macaques. Gaze following comprising of an initial look to the eyes of the onscreen monkey—a moment of "mutual eye contact" when the onscreen monkey was looking directly at the viewer (see Figure 1A)—followed by a gaze shift in the direction in which the onscreen animal subsequently looked (see Figure 1B).

Results:

At 1 month, infants looked at the eyes during 22% (±2) of presented mutual gaze cues (mean (±sem)), then engaged in gaze following 57% (±5) of the time. By the 3rd month, infants increased attention to mutual gaze cues, looking at 36% (±2) of presented cues, and engaged in gaze following 57% (±4) of the time. Attention to mutual gaze cues and subsequent gaze following reached a peak at 4 months, looking at 41% (±3) of mutual gaze cues and following gaze 70% (±4) of the time. Thereafter, attention to mutual gaze cues and gaze following decreased to 30% (±7) and 46% (±3) at 5 months.

Conclusions:

Steady increase in attention to mutual gaze cues suggests important changes in infants' awareness of the social saliency of conspecifics' eyes. At 4 months, the peak in attention to mutual gaze cues and subsequent gaze following suggests significant maturation in social-visual attention and social motivation. The decrease in these skills after 4 months coincides with the beginning of the weaning process (Fooden, 2000), leading to higher reactivity to mutual gaze (a threatening gesture in macaques) and increase in appeasement gestures (i.e. gaze avoidance). In future research, neuroimaging data obtained in the same animals will allow us to connect these shifts with changes in brain development.

11 **164.011** Developmental Trajectory of Sleep Disturbances in a Shank3 Mouse Model

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Background: Sleep problems affect a higher proportion of children with autism spectrum disorder (ASD) compared to typically developing children and are a strong predictor of severity of ASD core symptoms as well as behavioral problems. Children with ASD have difficulty falling and staying asleep from very young ages, resulting in chronic sleep deficiency throughout the developmental period. Studies in animal models suggest that sleep is important for brain development and function, but little is known about what causes sleep disturbances in ASD.
We focused our studies on *SHANK3*, a high confidence ASD gene candidate. Individuals with Phelan-McDermid Syndrome (PMS) carry deletions in chromosome 22q13.3, a region that includes *SHANK3*. Approximately 85% of PMS individuals have an ASD diagnosis and about half report chronic sleep problems, but the link between *SHANK3* mutations and poor sleep is not understood. Sleep is a homeostatic process, in that sleep need accumulates with time awake and discharges during sleep. Typically, insufficient sleep (high sleep need) increases drive to fall asleep, but in ASD insufficient sleep and problems falling asleep co-occur. During development, both sleep need and the brain's response to sleep loss change significantly. We hypothesize that loss of SHANK3 during development disconnects sleep need from sleep initiation, leading to problems falling and staying asleep.

Objectives: Determine the developmental emergence of sleep problems in Phelan-McDermid syndrome, and in *Shank3* mutant mice.

Methods: In this study, we used questionnaire data to guide our studies in mouse models to understand how sleep problems develop in ASD. We obtained sleep questionnaire data from PMS individuals with *SHANK3* mutations from the PMS Foundation International Registry. Sleep loss in mice and humans elicits specific changes in electroencephalographic (EEG) activity patterns that can be used to track sleep need. In Shank3ΔC and control mice, we collected EEG and electromyographic (EMG) data to determine sleep-wake patterns, and used sleep-deprivation to induce periods of high sleep need.

Results: We find that *SHANK3* mutations are associated with sleep disturbances in both humans and mice. Children with PMS develop sleep problems between 5-12 years of age, including problems falling asleep, repeated awakening, and reduced sleep time. Similarly, we find that adult Shank3ΔC mutant mice have reduced sleep time, delayed sleep initiation following sleep deprivation, and reduced low-frequency EEG activity in non-rapid eye movement (NREM) sleep relative to littermate control mice. We find that adult responses to sleep deprivation emerge during adolescence in mice. Prior to this transition, low-frequency EEG activity during NREM sleep is normal in juvenile Shank3ΔC mice.

Conclusions: We show that sleep problems in PMS individuals emerge during early childhood. Sleep problems in Shank3ΔC mice also change across development. Adult Shank3ΔC mutant mice sleep less but have difficulty falling asleep following sleep deprivation. Changes in NREM EEG activity in Shank3ΔC mice are present in adults but not juveniles, suggesting that they are the result of abnormal post-natal development. Overall, our study shows that SHANK3 is an important modulator of sleep during development.

12 **164.012** Dysregulation of Insulin Receptor in Fragile X Mouse Model

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Background: Fragile X syndrome (FXS) is the most common monogenic cause of autism spectrum disorders (ASD) and hereditary intellectual disability (ID). FXS is caused by silencing of the *FMR1* gene and subsequent loss of the fragile X mental retardation protein (FMRP). Fmr1 knockout mice (*Fmr1*$^{-/y}$) recapitulate many of FXS phenotypes, such as increased repetitive behaviors, impairment in social novelty, macroorchidism, increased general protein synthesis (mRNA translation), exaggerated LTD and abnormal dendritic spine morphology. Impaired translational mechanisms represent one of the features of FXS. Insulin, a pancreatic hormone, is the main regulator of glucose levels in the blood. Insulin acts by binding to insulin receptors (IR), stimulating their autophosphorylation and activation. Dysregulated insulin signaling has been shown in diabetes and cancer, and has recently been implicated in cognitive dysfunctions in neurodegenerative disorders such as Alzheimer's disease. Recently, dysregulated insulin signaling has been shown to underlie cognitive deficits in Drosophila FXS model.
Objectives: The objective of this study is to investigate aberrant insulin and insulin receptor β in the brain and periphery of FXS mice in order to understand its role in the pathophysiology of the disease.

Methods: We have collected tissues of the brain areas implicated in autism etiology (prefrontal cortex and hippocampus), as well as peripheral tissues (liver, white adipose tissue and serum) from adult male wild-type (WT) and *Fmr1*$^{-/y}$ mice. We measured the protein levels of IRβ in four

above-mentioned tissues by Western blot (N= 6 per group). FMRP and GAPDH were used as a genotype and loading controls, respectively. To measure gene expression, the levels of IR mRNA in the prefrontal cortex and hippocampus were measured by quantitative RT-PCR (N= 6 per group). Insulin levels in the serum were measured by ELISA (N= 8 per group).

Results: We discovered that the expression of IRβ protein is upregulated in the *Fmr1*$^{-/y}$ mice compared to WT, not only in the brain (hippocampus and prefrontal cortex), but also in peripheral tissues (liver and white adipose tissue). The levels of IR mRNA are not changed in *Fmr1*$^{-/y}$ compared to WT mice. Insulin levels in the serum of *Fmr1*$^{-/y}$ are decreased compared to WT mice.

Conclusions: The results from this study will provide knowledge in the dysregulated insulin receptor signaling that contribute to translational control in FXS, and might introduce new pharmaco-therapeutical directions for the prevention of phenotypic impairments in FXS.

13 **164.013** Eye-Tracking As a Translational Tool to Study Social Development in Preclinical Nonhuman Primate Models of ASD

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Background: Deficits in social behavior are prominent features of neurodevelopmental disorders (NDDs) such as autism spectrum disorder (ASD) and schizophrenia (SZ). Eye tracking studies provide insight into how individuals with ASD and SZ process social information and have consistently documented atypical gaze patterns to social stimuli in these patient populations. Similar eye-tracking methods can be applied to preclinical animal model systems to explore social impairments relevant to symptoms observed in people with NDDs. Like humans, rhesus macaques (*Macaca mulatta*) use vision as their primary sensory modality and display complex social signals such as facial expressions, gestures, and vocalizations. Given the complexity behind potential causes and behaviors affected by NDDs, the use of eye-tracking paradigms in concordance with other measures in rhesus macaques may serve to bridge the gap between translational research efforts in rodent animal models and patient populations.

Objectives: In order to apply eye-tracking technology to animal models for human disease, it is first essential to understand the typical development of visual attention and social cognition in rhesus macaques. Using longitudinal social development data, we investigated the relationship between how young rhesus macaques view social stimuli in an eye-tracking paradigm and how they interact with their mother and similar-aged peers.

Methods: We studied 14 male rhesus macaques that serve as a control group for a nonhuman primate maternal immune activation study. Monkeys were mother-reared, received access to social groups, and participated in assessments throughout development such as eye-tracking and behavioral observations using a standard ethogram of social and nonsocial behavior. Eye-tracking data were collected using a modified incubator box that allowed for opportunistic sampling from unrestrained monkeys. We presented the monkeys with the same naturalistic monkey social stimuli across multiple time points from 1 month through 6 months old with additional preliminary data at 2 years old. The social development data presented here span from approximately 1 month of age through 2 years old.

Results: In our eye-tracking paradigm, monkeys viewed the social stimuli for a significantly longer time when they were 6 months old than in their first three months ($p<0.05$). Furthermore, preliminary analyses suggest that there is a significant positive correlation between monkeys' looking time duration for social stimuli in the eye-tracking paradigm and the number of initiated social interactions with their peers ($p<0.05$).

Conclusions: Our results suggest that rather than habituation to stimuli presented during the eye-tracking paradigm, monkeys may develop an increased interest in social stimuli during this early critical period of social development. Furthermore, this propensity to view social stimuli may be related to similar propensities to interact with their peers. Continued analyses of how other measures of social behavior and cognition relate to visual attention can help to both understand the development of social cognition in rhesus macaques as well as how eye-tracking in monkeys can maximize the translational utility of preclinical models of NDDs.

14 **164.014** Genotype:Phenotype Correlations of Social Deficits of Relevance for Autism Spectrum Disorder (ASD) in an NHP Model

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Background:

Despite the important mechanistic information on neurodevelopmental processes provided to date by genetic rodent models of autism spectrum disorder (ASD), it is necessary to examine those processes in nonhuman primate (NHP) models with social behaviors and brain anatomy, function and development that more closely resemble that of our species. One NHP well-suited to such analyses is the macaque [rhesus monkey (*M. mulatta*)], where both typical and atypical social behaviors can be observed in complex social groups and genomic similarity to humans is much higher than in rodents. The macaque Social Responsiveness Scale (mSRS) has also been adapted to adult macaques from the human SRS used for clinical ASD assessments. Both genotypic and phenotypic analyses, particularly during development, are critical to further develop a NHP animal model of genetic risk for ASD of high translational value to humans.

Objectives:

The purpose of the present study is to identify genetic variants in a clinically relevant juvenile macaque NHP model housed in a semi-naturalistic environment, and compare variants to social behavioral phenotypes of relevance for ASD. We focused first on correlations between social phenotypes and variants identified in a list of 87 genes of interest in ASD in humans.

Methods:

We made behavioral observations by two methods: first, at the Yerkes National Primate Research Center breeding colony, we collected 30-minute behavioral observations on 4 different days using a detailed and well-established ethogram for rhesus monkeys based on published methods. In addition, social impairments were assessed using a modified version of the adult mSRS adapted to juvenile macaques. For genomic analyses on 91 individuals, we enriched rhesus macaque DNA samples for exome sequences using the Rhexome v2 capture reagent and sequenced using the Illumina NovaSeq system. Reads were aligned to the rhesus Mmul_8.01 (rheMac8) reference genome using BWAmem. We called genomic variants

using GATK and annotated them with VEP; associations with social phenotypes were made with PLINK and FaST-LMM. We further examined variants of interest by lifting the rhesus positions over to the orthologous human position and performing CADD analysis that predicts the functional impact of variants.

Results:

Our behavioral observations, including the mSRS, identified outliers on the social behavior spectrum in our macaque colony. Exploratory exome sequencing yielded a total of 169,240 SNVs and 7,201 indels in the 91 individuals. This includes 1,350 SNVs and 95 indels in the 87 genes of interest. We saw single-hit SNVs in several genes of top interest in humans (Satterstrom et al. 2018, https://www.biorxiv.org/content/early/2018/12/01/484113), including *KDM6B* and *ASH1L*, and these corresponded to observable changes in social behavior. We also observed individuals with combinations of common variants in a number of the 87 genes of interest.

Conclusions:

Our pilot study indicates that we are able to identify juvenile macaques on extreme ends of a social behavior phenotype spectrum using different behavioral approaches. We also saw correlations between behavioral phenotypes of several animals and variants in genes associated with ASD in humans, particularly when the variants were also predicted to be damaging in the macaques.

15 **164.015** In Vivo Magnetic Resonance Imaging and Spectroscopy Detect Alterations of Brain Metabolites in a Rat Model of Maternal Autoantibody-Related Autism

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Background:

Dysregulation of the maternal immune system has been linked to various neurodevelopmental disorders in offspring, particularly Autism Spectrum Disorder (ASD). A number of recent studies, by our group and others, have focused on the relationship between the presence of specific autoantibodies found in the maternal circulation and the diagnosis of ASD in children. We previously characterized a set of antigenic epitopes on proteins, known to be important for neurodevelopment, which serve as targets for these maternally-derived autoantibodies and are present in up to 25% of mothers whose children go on to be diagnosed with ASD. Our work, and that of collaborators, has found ASD-relevant behavioral and cellular alterations in response to maternal autoantibody exposure during gestation in mouse, rat and non-human primate models. Specifically, embryonic studies suggest that the autoantibodies are able to bind radial glial cells in the developing cortex of rodents and influence progenitor cell migration, proliferation and subsequent neuronal cell size in adulthood.

Objectives:

We sought to examine the structural changes associated with the presence of maternal autoantibodies in our novel rat model of maternal autoantibody-related (MAR) ASD rat model. Further, as neurochemical imbalances are linked to ASD and these neurotransmitters and metabolic signals play an important role in brain development and function, we also aimed to evaluate the neurochemical profile in our rat model.

Methods:

To develop our model, we first immunized rat dams with MAR-ASD specific peptides from LDHA, LDHB, CRMP1 and STIP1 to generate autoantibodies to these peptides in dams prior to breeding. Once offspring were born, we performed *In vivo* longitudinal magnetic resonance imaging and spectroscopy (MRI/S) in the frontal cortex of offspring to evaluate differences in levels of metabolites between MAR autoantibody exposed (n= 8) and control rats (n= 8) at pre- and post-pubertal time points (postnatal days 30 and 70, respectively).

Results:

Treatment of rat dams with MAR-ASD specific peptides resulted in high serum titers of antigen-specific peptides throughout and following gestation, as quantified by ELISA. Magnetic resonance spectroscopy analysis of frontal cortical neurometabolites in MAR-ASD exposed rat offspring evidenced altered levels of Taurine and Choline. Significant increases were seen in Taurine, alongside significant decreases in Choline levels at both 30 and 70-day time points. No specific differences were seen when evaluating sex as a variable.

Conclusions:

As taurine is an abundant amino acid in the brain and choline-containing compounds are critical components of cell membranes and myelin, it is likely that altered levels of these metabolites in the frontal cortex may contribute, either directly or indirectly, to the ASD-relevant phenotypes seen in our MAR-ASD rat model.

16 **164.016** Investigation of the Function of ASD-Associated Gene Neurexin in Drosophila and C. Elegans

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Background: Mutations in a gene encoding a synaptic cell adhesion molecule, *NEUREXIN1* (*NRXN1)*, are significantly enriched in individuals with Autism spectrum disorder (ASD), indicating that *NRXN1* may play a role in the pathophysiology of ASD, albeit through an unknown mechanism. In mammals, there are three *NRXN* genes (*NRXN1-3),* each of which has two promoters for two main isoforms: α-NRXN (long isoform) and β-NRXN (short isoform). *NRXN1* is also subject to extensive alternative splicing, resulting in potentially thousands of variants. Invertebrates such as *Drosophila melanogaster* and *Caenorhabditis elegans* have only one *neurexin-1* gene that encodes a protein that is structurally similar to α-NRXN in vertebrates. Therefore, *Drosophila* and *C. elegans* serve as useful systems to study *NRXN1* involvement in ASD due to the reduced complexity and highly conserved nature of *neurexin-1*.

Objectives: The goals of our current studies are to identify conserved ASD-related behavioral phenotypes, such as sleep and stress responses, in both flies and worms and to determine the underlying mechanism(s) by which *neurexin* may regulate these behaviors.

Methods: To monitor sleep and activity we utilize the Drosophila Activity Monitoring system (DAM) and the WorMotel for *Drosophila* and *C. elegans,* respectively. For starvation stress experiments, the same activity monitoring systems are used except animals are given only water.

Results: To date, we have observed conserved defects in sleep and in behavioral responses to starvation stress. We find that *neurexin*-null mutants show decreased activity and fragmented sleep when compared to control animals. Fragmented sleep in *neurexin*-null *Drosophila* has been shown previously (Larkin et al., 2015; Tong et al., 2016), and thus our findings confirm these results and reveal that this is a conserved defect across species in both flies and worms. Additionally, we have identified decreased responding to starvation stress in *neurexin*-null *Drosophila* and *C. elegans*. When put under starvation conditions both *Drosophila* and *C. elegans* become hyperactive, with *Drosophila* also suppressing their sleep, which is thought to promote acquisition of food. *Neurexin*-null flies and worms however, show abnormalities in this stress response, wherein they display delayed, decreased hyperactivity and a failure to suppress sleep during starvation.

Conclusions: Our findings show that *neurexin*-null flies and worms show conserved deficits in sleep and stress response behaviors, both of which can be affected in individuals with ASD. Future studies will investigate the spatial and temporal sufficiency of *neurexin* in promoting sleep and starvation-stress response behavior using genetic techniques to restore neurexin expression in specific neuronal subsets during adulthood. These studies will have an impact on how we think about the ability of treating individuals with *NRXN1* mutations after early developmental periods have ended. Additionally, we would like to investigate how *neurexin* may regulate octopamine, which is a neurotransmitter that has been shown to be required for starvation hyperactivity. By using two model organisms we have the unique ability to study *neurexin* functioning in simpler neural systems, and our consistent phenotypic observations between both systems provide confidence that the mechanisms by which *neurexin* functions to promote ASD-related behaviors are conserved across species.

17 **164.017** Maternal and Offspring Mthfr Deficiency As a Risk Factor for Social Deficits and Alternation in Cortical Interneurons Populations in Rodents.

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Background:

A significant environmental risk factor for autism spectrum disorder (ASD) is prenatal environment. Methylenetetrahydrofolate reductase (MTHFR) shows high prevalence of polymorphism in ASD patients and their mothers. Excitation – inhibition imbalance has been suggested in the pathogenesis of ASD, supported by significant alternations in the GABA pathway. In a previous study, we showed both maternal and offspring Mthfr+/- genotype predisposes mice toward ASD-like behavior. Therefore, it is possible that these mice present alterations in cortical interneurons, as shown in human and mouse models of ASD.

Objectives:

To investigate the interaction between maternal and offspring Mthfr+/- genotype, ASD-like behavior and cortical interneuron distribution were examined

Methods:

Mthfr+/+ and Mthfr-/+ female mice on a Balb/cAnNCrlBR background were mated with male tg-GAD65-tdTomato on a C57/Bl6 background to generate Mthfr+/+(WT) and Mthfr+/-(HT), all carrying GAD65-tdTomato. Three groups representing maternal:offspring genotypes were created: 1.WT:WT 2.HT:WT 3.HT:HT. Six male mice per group were evaluated for ASD-like behavior using the following tests: Nest building, Marble burying and Social proximity (pairs with similar maternal and offspring genotype). Tests were recorded and analyzed offline by an observer blind to mouse identity. After the last test, mice were anesthetized and perfused with 4% PFA. Immunofluorescent staining was performed on sagittal brain sections for the detection of GAD, NeuN and Parvalbumin positive neurons.

Results:

A social deficit was found in the social proximity test where maternal HT genotype was associated with shorter sniffing time by mice of the HT:WT and HT:HT groups (51% and 41%, respectively), compare to WT:WT ($F_{1,13}$=10.35, p<0.01). In addition, offspring HT genotype suppressed dominant behavior, represented by whisker trimming ($F_{1,14}$=9.6, p<0.01). Mice were categorized as social or asocial, on the basis of their behavior (sniffing and non-aggressive behavior), regardless of their genotype, in order to evaluate the relation between phenotype and interneuron laminar distribution. Social phenotype correlated with GAD/NeuN ratio, so that social mice had higher GAD/NeuN ratio in deep layers of the cingulate cortex (layers 4-6, for example, 0.38 vs. 0.12 for layer 6), as represented by the interaction between layer x social phenotype ($F_{1,13}$=10.43 p=0.007). Mice with repetitive behavior phenotype differed in the laminar distribution of parvalbumin neurons in the cingulate cortex (layer x repetitive behavior phenotype, $F_{1,13}$=4.4 p=0.05). Mice presenting the repetitive behavior phenotype had a high density of parvalbumin neurons in layers 2-3 compared to mice that did not have this phenotype.

To further evaluate the excitation–inhibition balance associated with maternal and offspring genotype, seizure susceptibility was tested. Maternal genotype increased susceptibility to seizures induced by PTZ (50mg/kg, i.p). WT:HT pups exhibiting a greater amount of convulsion episodes in response to PTZ injection ($F_{1,33}$=13.25 p=0.001). Moreover, an interaction between genotype x maternal genotype was found ($F_{1,33}$=19.76 p<0.001).

Conclusions:

The interaction found between laminar distribution of interneurons and behavioral phenotype emphasizes a possible causal relation between cortical circuit organization and the pathophysiology of the social deficit seen in *Mthfr+/-* mice.

18 **164.018** Placental Infection By Group B Streptococcus Induces Sex-Specific Maternofetal Inflammatory Responses Associated with ASD-like Behaviors in Males

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Background: Clinical and preclinical evidence support relationships between placental infection and inflammation (chorioamnionitis), preterm births and brain damage, contributing to disorders including autism spectrum disorder (ASD). Group B *Streptococcus* (GBS) is isolated in 15% of chorioamnionitis. Changes in placental histology may impact fetal outcomes by altering nutrient transport, hormone production, as well as inflammatory factor releases in fetal circulation. Dysregulation of proinflammatory cytokines in maternofetal tissues has been associated with

higher risks of having a child with ASD. Placental infection by GBS in rats has been shown to induce a histological chorioamnionitis - characterized by an increased density of polymorphonuclear cells (PMN) in male compared to female placentas - and led to ASD-like behavioral impairments in males (Allard et al., *Autism Research*, 2017). In human, males are known to be more sensitive to maternal infection, which convey increased risks for long-term cognitive and behavioral deficits. We hypothesized that placental infection by GBS will induce sex-specific inflammatory processes associated with increased PMN infiltrates in male *versus* female placentas.
Objectives: To map out the PMN recruitment and expression profiles of PMN-associated cytokines and chemokines within GBS-infected placentas, and comparing this immune profile between male and female tissues.

Methods: Lewis rats were injected intraperitoneally on gestational day 19 with β-hemolytic serotype Ia GBS (10^8 CFU) or saline (controls). Caesarean-sections were performed at 24, 48 and 72 h post-injection to collect maternofetal tissues (placenta, maternal and fetal blood). Placental GBS and PMN infiltrates, the PMN chemoattractant CINC-1/CXCL1, the alarmin S100A9, and proinflammatory (interleukin(IL)-1β, tumor necrosis factor (TNF)-α, IL-6, IL-18) and anti-inflammatory (IL-10) cytokines' expressions were measured by ELISA and immunohistochemistry.

Results: At 72 h post-inoculation, GBS-exposed male placentas presented increased PMN densities compared to same-sex controls and a 3.0-fold increase compared to litter-matched GBS -exposed females. GBS-infected placentas associated with males – but not females – presented increased CINC-1 titers at 72 h. Both male and female placentas exposed to GBS displayed increased titers of S100A9, although levels were higher in males compared to females at 72 h. GBS-infected placentas displayed increased titers of IL-1β, TNF-α, IL-6 and IL-10 in both sexes at 48 and 72 h, and sole IL-1β titers were higher in males compared to females at 72 h. The detected levels of IL-1β were correlating positively with levels of CINC-1 in GBS-exposed male placentas. At 72 h, an increased concentration of IL-1β was detected in the sera of GBS-exposed male – but not female – fetuses. At 48 and 72 h, increased titers of IL-1β, TNF-α, IL-6, and CINC-1 were detected in GBS-exposed maternal sera.

Conclusions: Our results suggest the implication of IL-1β - triggering the production of CINC-1 - in the induction of sex-specific PMN infiltrates. The sex-specific placental and fetal inflammatory responses we uncovered are interesting in regard to the higher susceptibility of the male population for preterm birth, brain injuries and ASD. Innovative insights into the mechanistic underpinning the pathophysiology of pathogen-induced placental injuries are needed to identify prenatal maternal biomarkers, and to develop appropriate novel therapeutic interventions.

19 **164.019** Pre-Attentive and Cognitive Sensory Processing in Rats Lacking the Autism Candidate Gene CNTNAP2

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Background: Pre-attentive and cognitive processing of sensory information is necessary for appropriate interactions with our environment. In individuals with autism spectrum disorder (ASD), impairments in lower-level sensory filtering and processing can impact higher-order functions that rely on the ability to decipher complex sensory signals. For example, sensory disturbances have been suggested to contribute to social communication weakness in the autism population, with central auditory processing and audiovisual temporal acuity being linked to auditory hyper- and hypo- sensitivities and language deficits. However, at present, the neural basis for these behavioural deficits remains unresolved. Preclinical animal models could help to reveal the mechanisms of altered sensory processing if they can first show high face validity for ASD-related behavioral deficits.
Objectives: To assess both 1. sound intensity and 2. multisensory processing on the pre-attentive and cognitive level in rats lacking the autism candidate gene *CNTNAP2* (*Cntnap2*$^{-/-}$ rats) using translational behavioural paradigms.

Methods: In male and female adult Sprague-Dawley *Cntnap2* homozygous knockout, heterozygous knockout, and wildtype rats, pre-attentive processing was examined utilizing the acoustic startle response (ASR; 20 ms, 110 dB SPL) and its modulation by a stimulus (i.e. prepulse) which occurred before the acoustic startle-eliciting stimulus. Prepulse conditions included an acoustic noise burst at varying intensities (A; 10 ms, 62 – 92 dB SPL in 3 dB steps), a visual LED flash (V; 10 ms, 70 lux), or a combined audiovisual stimulus (AV; 10 ms, 68 dB SPL, 70 lux). For cognitive testing, two-alternative forced choice, appetitive paradigms assessed the rats' ability to discriminate the relative sound intensity of acoustic noise bursts (71 dB SPL – 89 dB SPL in 3 dB steps) or the relative timing (temporal order judgement – TOJ) of audiovisual stimuli (stimulus asynchronies used: A400V, A200V, A100V, AV, V100A, V200A, V400A) consistent with studies on humans. Moreover, discrimination training on sound intensity was conducted to determine the differential plasticity of pre-attentive and cognitive loudness processing.

Results: As expected, the *Cntnap2*$^{-/-}$ rats exhibited a general impairment in prepulse inhibition of the ASR compared to age-matched wildtype controls. Interestingly, *Cntnap2*$^{-/-}$ rats, like wildtypes, showed a greater level of prepulse inhibition when the audiovisual (AV) prepulse was presented compared to the unimodal (A or V) prepulse conditions; findings which indicate that the brainstem of knockout rats was still able to integrate auditory and visual stimuli. *Cntnap2*$^{-/-}$ rats showed no deficit in loudness discrimination or temporal order perception. Upon training, genotypic differences arose in the plasticity of acoustic discriminations.

Conclusions: The general PPI deficit observed relates to research suggesting pathological sensory processing underpins the emergence of ASD-related phenotypes. While the audiovisual results are consistent with previous studies in the autistic population performing the TOJ task with simple flash-beep stimuli, the lack of differences in loudness discrimination appears contrary to reports of moderate sound intensities being reported as distressing. However, discrimination ability is not homologous to the objective perception of acoustic stimuli. Taken together, these results highlight the validity of *Cntnap2*$^{-/-}$ rats as a preclinical model for studying sensory processing associated with ASD.

20 **164.020** Shank3 Modulates Sleep and Expression of Circadian Transcription Factors

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Background: Autism Spectrum Disorder (ASD) is the most prevalent neurodevelopmental disorder in the United States and often co-represents with sleep problems. Sleep problems in ASD predict the severity of ASD core diagnostic symptoms and have a considerable impact on the quality of life of caregivers. Little is known, however, about the underlying molecular mechanisms. We investigated the role of Shank3, a high confidence ASD gene candidate, in sleep architecture and regulation.
Objectives: To better understand the mechanisms underlying sleep problems in ASD, we use an animal model that can closely recapitulate sleep phenotypes observed in clinical populations.

Methods: Sleep questionnaire data from Phelan-McDermid syndrome (PMS) patients with Shank3 mutations was obtained through the PMSIR foundation. To assess the sleep-wake behavior in Shank3$^{\Delta C}$ mice, we surgically implanted mutant mice and their wild type littermates with electroencephalographic (EEG) and electromyographic (EMG) electrodes. The EEG/EMG data was used to determine sleep architecture. Genome wide gene expression was performed to assess the differences in gene expression sleep deprivation induces in the prefrontal cortex of Shank3ΔC mice and wild type littermates. Continuous running wheel behavior of Shank3$^{\Delta C}$ mice and wild type mice was monitored to assess circadian rhythms in constant darkness.

Results: Through examination of sleep in PMS patients with Shank3 mutations we show that PMS patients have trouble falling and staying asleep similar to what is observed in the general ASD population. We also show that mice lacking exon 21 of Shank3 have problems falling asleep even when sleepy and sleep less deeply. Using RNA-seq we show that sleep deprivation increases the differences in gene expression between mutants and wild types, downregulating circadian transcription factors Per3, Dec2, Hlf, Tef, and Reverbα. Shank3 mutants also have trouble regulating wheel-running activity in constant darkness. Overall our study shows that Shank3 is an important modulator of sleep and clock gene expressions.

Conclusions: We show that both PMS patients and Shank3$^{\Delta C}$ mutant mice have trouble falling asleep. Shank3$^{\Delta C}$ mice have problems falling asleep when sleep pressure is high at the end of their active period or following sleep deprivation. They also sleep less deeply, but show no gross abnormalities in sleep homeostasis or circadian rhythms which suggests that the sleep deficit is due to difficulty with sleep onset. Our molecular studies show that sleep deprivation increases differences in gene expression between Shank3$^{\Delta C}$ mice and wild type mice, with differences pointing to the downregulation of circadian transcription factors. Shank3$^{\Delta C}$ mice do not show a disruption in circadian rhythmicity but a large reduction in wheel-running activity in response to constant darkness. This suggests the mutant sleep phenotype involves clock gene function outside their central time-keeping role.

21 **164.021** The Role of the E3 Ubiquitin Ligase Cul3 in Brain Development and Neurodevelopmental Disorders

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Background: The past decade has seen a rapid development of technological advancements in genetics and genomics, allowing unprecedented precision in the identification of mutations underlying neurodevelopmental conditions. Neurodevelopmental disorders, such as autism spectrum disorders (ASDs) and intellectual disability (ID), affect more than 3% of children worldwide, yet for the majority of the cases there are no curative therapies and the underlying molecular causes remain elusive. Here we analyze the molecular and behavioral changes of a mouse model haploinsufficient for the high risk ASD gene *Cul3*. *Cul3* encodes a E3 ubiquitin ligase, involved in the recognition and recruitment of target proteins for ubiquitination.

Objectives: We chose to analyze Cul3 in brain development and function, because of its strong link to the ASDs and its putative role in dynamically regulating brain protein composition. Our aim is to uncover the pathological pathways causing the observed behavioral abnormalities in *Cul3*$^{+/-}$ animals.

Methods: We first assessed *Cul3* expression throughout mouse development and in the adult brain by western blot and qPCR analysis. Furthermore, we employed a large battery of histological, molecular and behavioral assays in *Cul3*$^{+/-}$ adult animals (2-4 month old) and their sex-matched littermates (n > 10). Additionally, we investigated the effect of forebrain specific *Cul3* homozygous deletion in embryos and newborn animals, making use of *Cul3*^{flox}/*Emx1-Cre* double transgenic animals.

Results: *Cul3* haploinsufficient animals display mild but significant motor defects, abnormal behavior in the three chamber sociability test and aberrant freezing behavior in the contextual fear conditioning task. Phenotypes that were previously also described in mouse models for ASD and ID. In addition, *Cul3*$^{flox/flox}$/*Emx1-Cre* transgenic animals present severe brain abnormalities at postnatal day 1 and do not survive into adulthood. To investigate the effects of Cul3 loss on the protein composition of the brain, whole quantitative proteomic analysis is ongoing for different timepoints and on multiple brain regions.

Conclusions: Currently, there are no effective pharmacological therapies for autism spectrum disorders. Many factors contribute to this absence of effective treatments, not least the lack of a clear understanding of their neurobiological causes, genetic and phenotype heterogeneity. *Cul3*$^{+/-}$ adult animals present with ASD relevant phenotypes linked to abnormal brain development and regulation of protein composition in the brain. Our findings indicate a pivotal role of the E3 ubiquitin ligase Cul3 for normal brain development and function.

22 **164.022** The Transgenerational Effects of Prenatal Maternal Voluntary Wheel Running on Autistic Characteristics in BTBR T+ Itp3 Tf/J Mice

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Background: Autism spectrum disorder (ASD) is a group of neurodevelopmental disorders that are characterized by deficits in social communication and restricted, repetitive patterns of behavior, interests, or activities. Prenatal exercise is thought to be beneficial for fetal brain development and was examined in the BTBR T^{+} Itpr3 ^{tf}/J (BTBR) inbred strain of mice that is often compared to the more typical C57BL/6J (B6) mice. The BTBR mice exhibit reduced sociability and high levels of repetitive behaviors compared to the B6 mice. The transgenerational effects of prenatal paternal voluntary exercise have been examined briefly in the B6 mice, but prenatal maternal voluntary exercise has not been studied in either strain.

Objectives: To determine if maternal voluntary exercise perinatally leads to lessened autistic-like behaviors in the BTBR offspring.

Methods: In this study, female B6 and BTBR females were given access to running wheels in the home cage for an 8-week period, beginning 2 weeks prior to breeding and continuing until the pups were weaned. The offspring were allowed to age with minimal intervention and were examined as adults. Sociability, anxiety, repetitive behaviors, and learning and memory were tested and compared to the offspring from non-wheel exposed controls from both strains, to determine if prenatal maternal exercise altered these behaviors.

Results: Prenatal exercise only affected a few behaviors in the offspring, and those effects were often the opposite of what was expected. For example, wheel running had only a mild effect on the autistic-like behaviors found in the BTBR mice. Social behavior was unchanged in the BTBR mice following prenatal exercise exposure. Repetitive behaviors were mildly affected, as the male BTBR mice exposed to prenatal wheel running spent more time grooming than any of the other mice in the open field, and all of the BTBR offspring from the wheel running dams were impaired

in reversal learning in the water T-maze. However, despite this influence on self-grooming and reversal learning, voluntary wheel running did not affect repetitive digging in the marble burying test. BTBR mice exposed to prenatal maternal voluntary wheel running also showed increased anxiety associated behaviors.

Conclusions: Maternal voluntary exercise appears to mildly increase the development of repetitive behaviors but not social behaviors in the BTBR mice and had a mild effect of increasing anxiety-like behaviors. Thus, these results suggest that maternal voluntary wheel running does not lessen autistic-like behaviors in the BTBR mice.

23 **164.023** Transcriptional Alterations and Attentional Deficits in a Rat Model of Fragile X Syndrome

C. Golden[1], *M. S. Breen*[2], *S. De Rubeis*[2], *J. Buxbaum*[3] *and H. Harony-Nicolas*[2], *(1)Icahn School of Medicine at Mount Sinai, New York, NY, (2)Seaver Autism Center for Research and Treatment, Icahn School of Medicine at Mount Sinai, New York, NY, (3)Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY*

Background: Fragile X Syndrome (FXS) is a neurodevelopmental disorder caused by mutations in the *FMR1* gene. It is a leading monogenic cause of autism spectrum disorder and inherited intellectual disability and is often comorbid with attention deficits. Most FXS cases are due to an expansion of CGG repeats at the 5' untranslated region of the *FMR1* gene leading to suppressed expression of fragile X mental retardation protein (FMRP), an RNA-binding protein involved in mRNA metabolism. We found that a previously published *Fmr1* knockout (KO) rat model actually expresses an *Fmr1* transcript with an in-frame deletion of exon 8, which encodes a K-homology (KH) RNA-binding domain, KH1. It so happens that several of the few point mutations that are known to cause FXS are found within the KH domains.

Objectives: We aimed to determine whether this previously published *Fmr1* KO rat has deficits in attention and in transcriptomic regulation in a region underlying attention, the medial prefrontal cortex (mPFC).

Methods: We used the five-choice serial reaction time task (5-CSRTT) to measure visuospatial attention and RNAseq to evaluate the transcriptional profile of the mPFC.

Results: We observed that an exon 8 deletion in both male and female rats leads to mPFC-associated sustained attention deficits on the 5-CSRTT, similar to what has been observed in FXS patients and *Fmr1* KO mice. Furthermore, we found that this deletion leads to alterations in the expression of transcripts within the mPFC, which mapped to two weighted gene co-expression network modules. These modules are conserved in human frontal cortex and enriched for known FMRP targets. Hub genes in these modules represent potential targets for FXS.

Conclusions: The deficit in sustained attention resembles a typical FXS-associated phenotype and suggests that this *Fmr1*-$^{\Delta}$exon 8 rat models FXS with face validity. Furthermore, these findings provide support for a prefrontal deficit in FXS, indicate that attentional testing might be a reliable cross-species tool for investigating FXS, and identify dysregulated conserved gene networks in a relevant brain region.

24 **164.024** Translational Assessments in Two Genetic Preclinical Models of Disrupted Chromatin Processes: Development and Motor Outcomes

S. Petkova[1], *C. P. Canales*[2], *A. S. Nord*[3], *J. Ellegood*[4], *J. P. Lerch*[4] *and J. L. Silverman*[5], *(1)MIND Institute and Department of Psychiatry and Behavioral Sciences, Sacramento, CA, (2)Center for Neuroscience | MIND Institute, Department of Psychiatry and Behavioral Sciences, University of California Davis, Davis, CA, (3)Center for Neuroscience, Department of Neurobiology, Physiology, & Behavior, University of California, Davis, Davis, CA, (4)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada, (5)MIND Institute and Department of Psychiatry and Behavioral Sciences, University of California Davis School of Medicine, Sacramento, CA*

Background:

Numerous genes related to chromatin modification processes are among the top autism -associated risk genes, including AT-Interactive Domain 1B (*ARID1B*) and Chromodomain-Helicase DNA Binding Protein 8 (*CHD8*) (Cook & Scherer, 2008, O'Roak & State, 2008, O Roak 2014, Lossifov 2014, Werling 2018). These two candidate genes have related functional activities albeit act via differential pathways: *ARID1B* is a SWI/SNF complex protein in neuronal BAF chromatin complexes, and *CHD8* encodes an ATP-dependent chromatin helicase.

Objectives:

To examine developmental outcomes such as physical growth and neurological reflexes in two preclinical models of genetically defined ASD.

To focus on motor as a key domain because: a) there is a strong correlation between motor and social communication, b) there is a strong correlation between motor skills and assessment of cognitive abilities, and c) motor is highly translatable between preclinical models and human studies.

Methods:

Heterozygous *Arid1b*$^{+/-}$ generated by the Toronto Centre for Phenogenomics, *Chd8*$^{+/del5}$ from the Nord laboratory (Gompers et al., 2017) and wildtype littermate, sex and age matched controls were assayed in developmental milestones on postnatal days (PND) 2-14, similar to those previously described (Fox, 1965) with extended detail. Physical measurements such as body weight, length, and head width were measured. Progress of motor reflexes such as negative geotaxis, cliff avoidance, righting reflex and circle transverse assayed for neonatal hypotonia and ataxia. Milestones for tracking development of fore and hind limb strength were forelimb grasp, forelimb bar holding, forelimb and hindlimb hang tests. Adult gross and fine motor abilities including balance, strength, coordination, locomotive activity, and gait were evaluated using classic tests such as the open field, rotarod and innovative gait mapping using the treadmill scanning DigiGait™ system.

Results:

Arid1b$^{+/-}$ pups were impaired on several parameters of developmental milestones compared to littermate *Arid1b*$^{+/+}$ controls. Body weight, length and head width were smaller in *Arid1b*$^{+/-}$, indicating atypical growth and development. Longer latencies to reverse from an inclined position in negative geotaxis and to traverse out of circle were detected in *Arid1b*$^{+/-}$, highlighting delayed motor-related neurological reflexes and the onset of walking. Adult *Arid1b*$^{+/-}$ were also impaired on multiple parameters of locomotive activity. In contrast, *Chd8*$^{+/del5}$ showed no substantial delays nor deficits in growth, motor skill development or strength during neonatal testing, compared to wildtype littermates. Adult *Chd8*$^{+/del5}$ also exhibited few gait abnormalities.

Conclusions:

Many neurodevelopmental disorders ranging from the broadly defined ASD to the rare genetic syndromes have common features of developmental delay and motor dysfunction. An emphasis on finely detailed motor skill analyses across development as outcome measures has been understudied. Broadly, *CHD8* and *ARID1B* function as chromatin modification proteins. Herein, we described developmental delays and numerous motor outcomes using finely tuned clinically-relevant assays in genetic preclinical models of these two ASD risk genes. Investigation of motor outcomes is essential for demonstrating the test the utility of innovative drug designs and validate other traditional medicinal therapies that may be in the drug discovery pipeline.

25 **164.025** Trials and Tribulations: Co-Clinical Trials of Autism in Mice and Humans

Z. Lindenmaier[1,2], *A. Kinman*[1], *T. Chien*[3], *K. Easson*[3], *D. Fernandes*[1], *E. Chater-Diehl*[4], *M. T. Siu*[4], *D. Butcher*[5], *J. Ellegood*[6], *R. Weksberg*[4,7], *J. A. Foster*[8], *E. Anagnostou*[9,10,11] *and J. P. Lerch*[2,6], *(1)Mouse Imaging Centre, Neuroscience and Mental Health, Hospital for Sick Children, Toronto, ON, Canada, (2)Medical Biophysics, University of Toronto, Toronto, ON, Canada, (3)Mouse Imaging Center, Neuroscience and Mental Health, Hospital for Sick Children, Toronto, ON, Canada, (4)Genetics and Genome Biology, Hospital for Sick Children, Toronto, ON, Canada, (5)Department of Pathology and Molecular Medicine, McMaster University, Hamilton, ON, Canada, (6)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada, (7)Institute of Medical Sciences, Unviersity of Toronto, Toronto, ON, Canada, (8)Department of Psychiatry & Behavioural Neurosciences, McMaster University, Hamilton, ON, Canada, (9)Department of Paediatrics, University of Toronto, Toronto, ON, Canada, (10)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (11)Hospital for Sick Children, Toronto, ON, Canada*

Background:
Despite promise in animal models, novel therapeutics consistently fail in clinical trials of autism. Due to the heterogeneous nature of autism, treatment will likely only ameliorate symptoms in a subset of patients.

Objectives:

There is a need to simultaneously test promising new compounds while understanding and predicting which patients will respond to each therapy. To determine what might contribute to response susceptibility, we propose the implementation of co-clinical trials in autism. In co-clinical trials, novel compounds, with established safety profiles, are simultaneously tested in mouse models of autism as well as in Phase 2 trials in humans with autism.

Methods:

A high-throughput protocol for mouse models of autism with genetic modifications in known autism genes is discussed, which encompassess chronic treatment over development, multiple magnetic resonance imaging time-points, behavioural tests before, during, and after treatment, and microbiome and epigenetic analyses. Human subjects also follow an extensive phenotyping protocol, including behavioural testing, as well as genetics, epigenetics, and imaging assessments. To ensure scientific rigor, both the preclinical and clinical studies are blinded, with placebo-treated controls, with sample size deteremined by power analyses. To establish the optimal regime, three co-clinical trials were created assessing promising therapeutics in autism: oxytocin, Tideglusib (a glycogen synthase kinase 3b inhibitor), and Arbaclofen (a GABA agonist). The protocol was modified with each iteration, optimizing the protocol based on the findings from each trial.

Results:

The first trial found no differential response to oxytocin treatment in mouse models in both neuroanatomical and behavioural phenotypes, and only some trending effects in humans on higher cognition measures. The protocol was modified for the Tideglusib trial, by narrowing the focus of the behavioural tests, increasing power by backcrossing onto the same background strain, changing the administration method, as well as by altering some other procedures. Analysis to date shows some differential treatment response was seen in the mouse models, with the Shank3 knock-out mouse model showing exacerbated hyperactivity (q=0.00) and non-anxiety (q=0.043) , and the Arid1b heterozygous deletion showing significant (q=0.01) changes in the volume of the insular cortex with treatment. The human trials also demonstrated some treatment response, with significant (q=0.05) differences on measures of social withdrawal, repetitive behaviours, as well as daily living skills, memory, and sleep quality.

Conclusions:

A comparison across species in both drugs remains to be performed. The next co-clinical trial will be on the drug Arbaclofen, and the protocol will again be modified to address issues of the former trials. Ultimately, we hope to establish a rigorous multi-modal, multi-species approach of assessing treatment, with the intention of stratification by response susceptibility.

26 **164.026** Understanding the Role of Oxytocin in Autism: Establishment of Zebrafish MODEL

S. Shams[1], *J. Landin*[2], *K. Tsui*[3], *P. Kettunen*[4] *and L. Westberg*[5], *(1)Pharmacology, University of Gothenburg, Gothenburg, Sweden, (2)Department of Pharmacology, University of Gothenburg, Gothenburg, Sweden, (3)Pharmacology, University of Gothenburg, Göteborg, Sweden, (4)Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom, (5)University of Gothenburg, Gothenburg, Sweden*

Background: Oxytocin is a neuropeptide that regulates a wide range of mammalian social and non-social behaviors relevant to autism, such as bonding, social recognition, anxiety, and aggression. Recently, intranasal administration of oxytocin has been reported to improve social function in autistic patients and has shown promise as a potential treatment of social impairments seen in autism. Since the mechanisms underlying autism and oxytocin's role in allaying social symptoms in autistic patients are not well-understood, animal models with capacity for sophisticated genetic manipulation are necessary. Zebrafish (*Danio rerio*) is a highly social vertebrate with phylogenetic conservation in oxytocin and key neurotransmitter systems and we exploit these features to develop an animal model of autism in zebrafish.
Objectives: Importance of the oxytocinergic system in mammalian social behavior is well-established, but less is known about its homologous system in zebrafish. Our aim is to investigate social interaction and neurochemistry in zebrafish mutants with genetically manipulated oxytocin system.

Methods: Using adult male and female CRISPR-Cas9-mutants lacking either of the two zebrafish oxytocin receptor genes, *oxtr* and *oxtrl*, we performed a battery of tests for social and non-social behaviors. We measured behavioral responses ($n \geq 16$ for each group) to experimentally-induced aggression and anxiety-related behavior, and ability to recognize previously encountered social stimulus in mutant and wildtype control fish. We also quantified the levels of neurotransmitters (dopamine, serotonin, norepinephrine, glutamate, glycine, GABA) in multiple brain regions

of these mutants using high precision liquid chromatography.

Results: Our data show that zebrafish lacking oxytocin receptors display impairments in aggressive, social, and anxiety-related behavior, in a receptor-specific and sex-dependent manner. We also found significant differences in neurotransmitter levels in the measured brain regions (olfactory bulbs and telencephalon, mesencephalon, diencephalon, cerebellum & hindbrain), indicating a role of oxytocin in regulation of other neurotransmitters.

Conclusions: These results advance our understanding of neural mechanisms underlying oxytocin-regulated social interaction in zebrafish and further highlight the potential of future investigation of zebrafish oxytocin system towards generating better therapeutic treatments for autism.

Poster Session
165 - Behavioral Genetics
11:30 AM - 1:30 PM - Room: 710

27 **165.027** Autism Spectrum Disorder and Additional Areas of Difficulty: Patterns of Difficulties in a Population-Based Twin Sample

***E. Colvert**, V. L. Milner and F. Happé, Social, Genetic and Developmental Psychiatry Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:
There is increasing interest and concern regarding additional psychiatric problems that co-occur with Autism Spectrum Disorder (ASD), as reflected in recent changes to diagnostic schemes. Since additional disorders may add to the burden for individuals with ASD and their carers, and may be amenable to treatment, recognition and diagnosis are important. Previous studies have reported raised rates of additional psychiatric difficulties in ASD, however, the majority of these have included clinic samples, which may be biased towards more complex or severely impaired cases.

Objectives:

The study aims to establish, for the first time, the rates and patterns of co-occurring difficulties in a large population-based twin sample covering the full range of the autism spectrum, and to examine possible risk factors.

Methods:

Three groups of participants were included: 135 twins who met criteria for a research diagnosis of ASD (87% male; mean age 13 years 5 months); 55 non-ASD co-twins (36% male; mean age 13 years 6 months); 144 comparison twins (69% male; mean age 12 years 9 months). Participants and their parents completed the Strengths and Difficulties Questionnaire (SDQ) as part of a wider research assessment. The SDQ includes five domains of difficulties: emotional, conduct, hyperactivity, peer and pro-social; and produces mean and cut-off scores. Measures of possible risk factors were also included: age, full scale IQ, SES, sex, zygosity and autism severity (ADI-R, ADOS-G, Childhood Autism Spectrum Test).

Results:

For both mean scores and cut-offs on the SDQ the ASD twin group showed significantly higher levels of difficulties than both the non-ASD co-twins and the comparison twins. No differences were seen between the co-twins and the comparison group.

The frequency of multiple problems was examined (limited to the emotional, conduct and hyperactivity domains), showing 46% of the ASD twin group had difficulties in more than one domain. In contrast, 11% of the co-twins and 7% of the comparison group showed multiple areas of difficulty.

Analyses of risk factors found that for all three sample groups autism severity was the biggest contributor in terms of the mean SDQ scores. The higher participants scored in terms of autism severity the higher their SDQ scores. This link occurred for cut-off scores, albeit reduced and confined to the ASD group only.

Conclusions:

The results of the study support previous research findings of high levels of comorbid difficulties for those with ASD. The population-based design and the use of standardised measures allow a clearer understanding of the rates and the nature of those difficulties for the group across the full autism spectrum. The severity of ASD symptoms was the risk factor most strongly associated with SDQ ratings and rates of multiple problems, for all three sample groups, with other risk factors showing fewer connections. The very high rates of difficulties shown by the ASD group indicate that comorbidity of difficulties is a serious issue and more evidence concerning the nature of comorbid difficulties is needed to help develop and target interventions for those with ASD.

28 **165.028** A Gene First Approach to Understanding Sleep Problems in Autism

***R. Tesfaye**[1], G. Huguet[2], Z. Schmilovich[3], O. Diallo[4], A. Dionne-Laporte[5], A. Yusuf[6], B. Chaumette[3], M. Elsabbagh[7], G. A. Rouleau[1] and S. Jacquemont[8], (1)Neurology and Neurosurgery, McGill University, Montreal, QC, Canada, (2)Research Center of UHC Sainte-Justine, Montreal, QC, Canada, (3)Human Genetics, McGill University, Montreal, QC, Canada, (4)MNI Brain Tumour Research Center, McGill University, Montreal Neurological Institute, Montreal, QC, Canada, (5)MNI Brain Tumour Research Center, McGill University, Montreal, QC, Canada, (6)Psychiatry, McGill University, Montreal, QC, Canada, (7)McGill University, Montreal, PQ, Canada, (8)CHU Sainte Justine, University of Montreal, Montreal, QC, Canada*

Background: Sleep is disturbed in up to 80% of youth with autism spectrum disorder (ASD). It's suggested that these sleep problems may be attributed to genetic abnormalities. It is well established that the circadian rhythm is regulated by a network of core circadian clock genes expressed in the suprachiasmatic nucleus. However, the genetic contribution to the two most prevalent sleep complaints in ASD, namely insomnia and sleep duration abnormality, remains unknown. A recent genome wide association studies (GWAS) including over one million adults, implicated 959 candidate genes with insomnia symptomatology, 203 for poor sleep duration, and other risk genes for various sleep traits. New GWAS findings, in addition to established circadian genes, may provide a gene-first approach to bridge the current knowledge gap in understanding the neurobiological underpinnings of sleep disturbance in ASD.
Objectives: Our goal was to determine whether differences in genetic variants within a) core circadian clock genes b) circadian pathway genes and

c) sleep trait candidate genes, are observed between individuals with ASD and their unaffected siblings. We expect significantly more copy number variants (CNVs) encompassing sleep in individuals with ASD in comparison to siblings without a diagnosis.

Methods: We used available data from the Simons Simplex Collection (SSC), a comprehensive phenotyped and genotyped sample of more than 2,583 individuals with ASD (4 -18 years) and their families (parents and non-diagnosed sibling). A list of circadian clock genes were identified in existing literature, pathway genes were extracted from published databases (KEEGPathway and GeneOntology) and GWAS sleep trait candidate genes were taken from Jansen et al, 2018. Microarray technology was used to identify CNVs, pipeline detections from our previous publications were applied to call relevant CNVs. We first investigated the risk of ASD by comparing diagnosed youth to siblings who were carriers or not of rare CNVs (< 0.1%), using the sleep genes identified.

Results: After a microarray quality control, 2091 pairs of ASD youth and siblings remained. When CNVs were filtered by all genes present in our different sleep lists, we found 5% of ASD youth with a rare deletion compared to 3.1% of siblings, while 7.9% of youth with ASD had a rare duplication compared to 6.4% of siblings. A Fisher's exact test revealed a significant excess of deletions encompassing sleep genes in individuals with ASD compared to unaffected siblings (p=0.003; Odds ratio 1.6; CI95% [1.2 ; 2.3]).

Conclusions:This is the first study to examine CNVs related to sleep in ASD. Our findings demonstrate that variations within sleep-related genes are more frequent in youth with ASD compared to sibling controls. This suggests that sleep disturbance may be inherently linked to the biological etiology of ASD. Future investigations between genetic variants of sleep, brain connectivity and behavioural/cognitive phenotypes will be conducted on a subset of this ASD population.

29 **165.029** Associating Autism Polygenic Risk Scores with Early Measures of Social Attention in Infants

R. Harrison[1], *A. Gui*[1], *A. Hendry*[2], *T. Gliga*[1], *C. Tye*[3], *G. Pasco*[4], *M. Elsabbagh*[5], *T. Charman*[6], *M. H. Johnson*[7], *E. J. Jones*[8], *E. Meaburn*[9] *and &. The BASIS Team*[1], *(1)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (2)Department of Experimental Psychology, University of Oxford, Oxford, United Kingdom, (3)Department of Child & Adolescent Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (5)McGill University, Montreal, PQ, Canada, (6)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (7)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (8)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (9)Psychological Sciences, Birkbeck College, London, United Kingdom*

Background:

Alterations in social attention in early development have been reported in infants who later develop autism spectrum disorder (ASD). However, we do not know whether social attention lies on the causal path from genetic and environmental risk to later diagnosis. We explore whether polygenic risk scores (PRS) for ASD associate with dimensional measures of social attention in an infant sibling cohort. First, we examine the speed and amplitude of event-related neural responses (ERP) to faces at 6-10 months, which is altered in infants with later autism (Jones et al., 2016). Second, we examine the proportion of time infants spend looking at faces on static slides with social and non-social content. Declines in face looking over time have been previously associated with autism outcome (Jones & Klin, 2013; Ozonoff et al., 2010).

Objectives:

The primary objective of this study was to investigate whether atypical social attention in early infancy is associated with polygenic risk for autism.

Methods:

ASD PRSs were generated for 138 infants of Caucasian ancestry derived from the British Autism Study of Infant Siblings (BASIS), a longitudinal prospective study of infants at high and low familial risk for ASD. PRS were generated using PRSice-2 and summary statistics from the Integrative Psychiatric Research Consortium (Grove et al.,2017). Social attention was assessed through i) event-related neural responses to gaze shift (P1,P400 latency and amplitude) and responses to faces and matched visual noise (N290) (Elsabbagh et al., 2012); ii) proportion of time infants spend looking at faces during a series of slides featuring faces, visual noise and objects (Gliga et al., 2010). ASD PRS were compared between infants with (N=23) and without (N= 115) an ASD diagnosis at 36 months. The association between the cross-sectional ERP responses to faces and PRS (n=138) was investigated. Longitudinal trajectories of proportion of attention to face generated using K-means for longitudinal data (KML) identified two parallel, downward-trending trajectories. PRS were compared between infants with different trajectories.

Results:

ASD PRS discriminated between infants with later ASD and those with typical or other atypical development (R2= 0.075, p = 0.0063). There was a trend association (p <0.1, r =-0.17) between PRS and N290 Latency, but not between P1 or P400. Face attention decreased over time in both identified trajectories. Infants on the lowest face attention trajectory had a slightly higher PRS (p <0.1), but there was no association with ASD diagnosis.

Conclusions:

ASD PRS clearly discriminates ASD and non-ASD outcomes and finds trend associations with measures of N290 latency. N290 latency has been previously associated on the phenotypic level with ASD diagnosis (Elsabbagh et al., 2012) and with dimensional scores on behavioural measures of social development (Webb et al., 2011). Further, there were trend-level associations between trajectories of social attention and PRS, suggesting that infants with a higher polygenic load may show a diminished interest in faces throughout infancy. Taken together, this shows the promise of taking a translational neurodevelopmental approach to dissecting developmental paths to autism.

31 **165.031** Genomic and Behavioral Analysis of Autism Spectrum Disorders Based on Different Brain Imaging Modalities

G. Barnes[1], *M. Elmogy*[2], *A. Switala*[3], *O. Dekhil*[4], *E. Rouchka*[5], *R. Keynton*[6] *and A. S. El-Baz*[3], *(1)University of Louisville School of Medicine, Louisville, KY, (2)University of Louisville Speed School of Engineering, Louisville, KY, (3)University of Louisville, Louisville, KY, (4)Bioengineering, university of Louisville, Louisville, KY, (5)Computer Science, University of Louisville Speed School of Engineering, Louisville, KY, (6)Bioengineering, University of Louisville, Louisville, KY*

Background:
Autism spectrum disorder (ASD) is a complex condition that can be defined as a group of diverse neurodevelopmental disorders. ASD is identified by early conditions which change information processing of the nervous system and impact the communication and social development of the patients. In addition to environmental factors, many genes of various pathways can be represented as varied risk factors for developing ASD.

Objectives: To merge genomic and behavioral data with multi modal MRI using Big Data Techniques

Methods: 200 individuals (80 with ASD and 120 controls) from the NDAR database were selected as having both T1-weighted MRI and single nucleotide polymorphism (SNP) genotyping. Of these, 74 also had available resting-state functional MRI (rs-fMRI) time series. Structural MRI scans were processed from which two vector-valued shape descriptors were derived. A "global" descriptor was obtained by approximating the surface with an 81st-order SPHARM model and calculating the power spectrum from the spherical harmonic coefficients. A vector of "local" descriptors was built by aligning each surface with a map of select Brodmann areas, 25 per hemisphere, and taking the average Gaussian curvature of the surface within each region. The pattern of activity from Rs-fMRI scans within each independent component was scored as consistent with ASD using a fuzzy, neural network-based classifier, and these scores form a vector of functional connectivity descriptors. All SNP genotyping had been performed using the Illumina HumanOmni 2.5-8 whole-genome kit. The extracted descriptors from both sMRI and fMRI were used as phenotypic information in the genomic linkage analysis performed using PLINK software to identify genomic variants (SNP Cclls from GenomeStudio software) significantly associated with each of the three descriptor vectors. Significant SNPs were identified by rs# in dbSNP, and any associated genes were cross-referenced with Uniprot, GeneCards, and the SFARI database

Results:

Using a false discovery rate (FDR) of 0.1, twelve SNPs were found to be significantly associated with regional brain curvature on sMRI, including four intron variants, two coding variants, and six within intergenic DNA. Of the SNPs most strongly associated with global brain shape, with FDR = 0.1, five were intronic and two intergenic. The top 5 SNPs linked with ASD-related functional connectivity, with uncorrected $p < 10^{-5}$, were intronic or intergenic. However, none of these was significant at FDR = 0.1. The sample size being much lower than for sMRI analyses. Implicated genes include several associated with vesicles/vesicle transport (*AP1G2*, *STON2*, *SYTL1*), including synaptic vesicles, with metal ion transport including calcium ions (*HCN1*, *SLC12A8*, *STIM1*), and with embryonic development (*STOX2*) and neural migration in particular (*ASTN2*). Other affected genes may have a membrane or chromatin regulatory function (*MDGA2*, *NXPE2*/*NXPE4*, *UHRF1*) or are non-protein coding (*LINC01800*, *MIR99AHG*). Only two of the genes identified, *ASTN2* and *HCN1*, are currently listed in the SFARI database.

Conclusions: In summary, distinct novel genes or traditional autism risk genes may be identified differently by Rs-fMRI, or local vs global descriptors of sMRI that map, along with behaviors, to RDoC defined neural circuits relevant to ASD.

32 **165.032** Genotype-Phenotype Correlation in Brazilian Patients with Phelan-Mcdermid Syndrome : New Insights for a Better Clinical and Genetic Counseling Management

E. V. Branco[1], *M. R. Passos-Bueno*[2], *C. I. Samogy Costa*[1], *F. Monfardini*[1], *H. Ferraz*[3], *R. Fock*[4], *R. A. Barbosa*[5], *A. B. Perez*[4], *N. Lourenço*[1], *M. Vibranovski*[1], *A. Krepischi*[1] *and C. Rosenberg*[1], *(1)Universidade de São Paulo, São Paulo, Brazil, (2)Centro de Pesquisas Sobre o Genoma Humano e Células-Tronco, Instituto de Biociências, Universidade de São Paulo, Sao Paulo, Brazil, (3)Chemical Engineering Program, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil, (4)Universidade Federal do Estado de São Paulo, São Paulo, Brazil, (5)Morfologia e Genética, Universidade Federal de São Paulo, São Paulo, Brazil*

Background:
Phelan-McDermid Syndrome (PMS) is a rare genetic disorder characterized by global developmental delay, intellectual disability and mild dysmorphisms associated with several comorbidities. PMS results from *SHANK3* loss of function, mainly caused by copy number variations (CNVs) of different sizes. Although *SHANK3* haploinsufficiency has been associated with the major neurological symptoms of PMS, it cannot explain the great clinical variability seen among patients.

Objectives:

Our goals were to characterize a Brazilian cohort of PMS patients, explore the genotype-phenotype correlation underlying this syndrome and estimate the frequency of PMS among ASD and ID individuals.

Methods:

A total of 34 PMS patients were clinically and genetically evaluated. The data were obtained by a questionnaire answered by parents and dismorphic features were evaluated using patients' pictures. We have analysed the 22q13.3 CNVs and and other potentially pathogenic CNVs. We also performed a genotype-phenotype correlation analysis in order to determine whether comorbidities, speech status and autism spectrum disorder correlate with deletion size. Finally, a cohort composed by 829 ASD individuals and another composed by 2297 ID patients were used to determine the frequency of PMS among these disorders.

Results:

In our clinical data, sparse eyebrows were a prominent clinical feature (80%). Genotype-phenotype correlation allowed us to restrict minimum regions of deletion at 22q13.3 which are neither associated with renal complications (<1.3 Mb) or with lymphedema (<4.3Mb). We also confirmed a positive association between language impairment and deletion size. About 21% of the patients showed an additional rare CNV, which may contribute to a more severe phenotype or clinical features not commonly seen in PMS. Among ASD Brazilian or ID patients referred to CNV analyses the frequency of 22q13.3 deletion was 0.6% (5/829) and 0.65% (15/2297), respectively, confirming its relevance among neurodevelopmental disorders.

Conclusions:

To date, this is the first work describing a cohort of Brazilian patients with PMS and it highlights the importance of second hits in this condition. Taken together, our data show that the clinical history of PMS in a different ethnicity and culture did not differ significantly from other countries, which represents a baseline for any future management.

33 **165.033** Identifying Mechanisms Underlying Neurodevelopmental Disorders: Family-Wide and Inherited Influences on Early Social Attention Skills

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Background: To understand mechanisms underlying the emergence of Autism Spectrum Disorder (ASD) and co-occurring conditions, we need to identify processes that mediate between genetic risk and later symptoms. One candidate process is attention, which gates what the child can learn. In fact, attention to people in the first years is highly heritable and atypical in infants who later receive diagnosis of ASD. However, this could be related to both social features of ASD, and co-occurring attention difficulties like Attention Deficit/Hyperactivity Disorder (ADHD). Here we test whether disruptions in attention towards faces could lie between genetic risk and outcome by looking at i) familial risk-group difference; ii) its association with quantitative familial risk for ASD and ADHD; iii) its association with polygenic scores.

Objectives: To investigate contribution of familial likelihood of early social and attention problems, wecombined genotypic, phenotypic and eye-tracking data from 334 14-month-old infants who participated in the British Autism Study of Infant Siblings (BASIS: http://www.basisnetwork.org/) and their older siblings.

Methods: i) For risk-group analysis, mean duration of the longest look at the face stimulus (henceforth, peak-look duration) during a face pop-out task was calculated for 222 infants with an older sibling with ASD and/or ADHD (high-risk), compared to 112 infants without family history of ASD (low-risk); ii) For relation to quantitative familial load, the Social Communication Questionnaire (SCQ) and Strengths and Difficulties Questionnaire (SDQ) were used to measure social and attentional problems in a subset of the infants' older siblings with ASD (N=114); iii) To understand to what extent the aggregate effect of common genetic variants explains atypicalities in early social attention behavior, polygenic risk scores (PGS) for two neurodevelopmental disorders were obtained for 198 infants (173 high-risk, 62 low-risk). Summary statistics by the Integrative Psychiatric Research and the Psychiatric Genomics Consortium were used to compute PGS for ASD and ADHD.

Results: i) Peak-look to faces was longer in high-risk vs. low-risk infants ($F(1,327)=19.4$, $p<0.001$, Figure 1). ii) Longer peak-look duration was associated with more parent-reported social ($b=0.02$, $p=0.009$) and attention ($b=0.08$, $p=0.013$) difficulties in the older sibling with ASD. This confirmed that early differences in this measure of visual attention to social stimuli might be associated with familial burden for both ASD and ADHD. iii) Peak-look duration was not significantly predicted by ASD-PGS (Nagelgerke's $R^2= 0.017$, $p=0.072$) after controlling for possible design-related confounders such as recruitment phase, number of valid trials and age in months ($b=945.97$, $p=0.23$). ADHD-PGS significantly predicted peak-look duration (Nagelgerke's $R^2= 0.22$, $p=0.038$), even when controlling for design-related covariates ($b=160.27$, $p=0.023$, Figure 2).

Conclusions:

Disruptions in early social attention in high-risk infants quantitatively vary with ASD and ADHD symptoms in their older sibling. Moreover, a modest but significant contribution of genetic risk for ADHD might influence infants' looking behavior when paying attention to people, having cascading effects on learning. Further work will examine the longitudinal relation to ASD and ADHD symptoms in toddlerhood. Taken together, our work highlights a promising new approach to understanding developmental mechanisms that underlie the emergence of neurodevelopmental disorders.

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34 **165.034** Modeling Disordered Eating in Terms of Core Autism Symptoms Increases Heritability Estimates

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Modeling disordered eating in terms of core autism symptoms increases heritability estimates

Background: Although aberrant eating behaviors are a well-established problem among individuals with autism, it remains unclear whether those behaviors are related to core autism symptomatology. The answer to this question has implications both for our basic understanding of the neurobiology of autism and for the design of therapeutic interventions. If aberrant eating behaviors and core autism symptomatology arise from a shared latent neuropathology, one might expect that treatment affecting one domain could also show efficacy in the other.

Objectives: Using a sample of over 5,000 families with autism, we aimed to model aberrant eating behaviors in terms of core autism symptomatology, and determine whether these models could demonstrate a significant association between the two domains. We further aimed to quantify the SNP-heritability of traits related to aberrant eating behaviors, thus laying the groundwork for identifying biological risk mechanisms.

Methods: In partnership with the nationwide (US) genetic study, SPARK for Autism, we distributed online self-report surveys assessing sleep, eating, and gastrointestinal patterns to SPARK participants (children with autism and their parents). The analysis presented here is our first look at the NIAS data from this study, a nine-item instrument for measuring aberrant eating behaviors. The NIAS has three sub-scales: picky eating, diminished appetite, and fear of eating consequences. We trained Random Forest classifiers to predict each NIAS sub-scale score in children, using item-level data from the SCQ (measuring social communication) and the RBS-R (measuring restricted and repetitive behaviors) as predictor variables. SNP-heritability estimates were carried out on a sub-sample of 2,627 children who also had complete genetic data available.

Results: Both SCQ- and RBS-R-based multivariate models of NIAS subscales showed significant association between disordered eating and core autism symptoms (all three NIAS subscales $p<0.000001$). Family history of eating disorders corresponded with a significant increase in total NIAS scores in both unaffected adults ($t=7.38$, $p<0.0001$) and affected individuals ($t=3.86$, $p<0.001$). Additionally, total child NIAS scores were significantly associated with mothers' scores on the EAT-26 ($n=3676$ dyads, $r=0.10$, $p<0.0001$). Despite this evidence suggestive of familiality, none of the three NIAS subscales, as reported by participants, showed significant SNP-heritability in this sample. However, the fear subscale, as predicted by the SCQ and RBS-R Random Forest, showed significant SNP-heritability (h2=0.28; S.E.=0.16). Interestingly, this subscale was the only NIAS measure significantly linked to a family history of specifically anorexia nervosa ($t=4.38$, $p<0.00001$).

Conclusions: These results suggest that disordered eating in autism is significantly linked to its core symptomatology (social communication

deficits and restricted and repetitive behaviors). The lack of SNP-heritability present in NIAS subscales, and its emergence when disordered eating is modeled in terms of core autism symptoms, may suggest that further work is needed to develop instruments that measure eating behaviors in a way that is both biologically and clinically meaningful. Work is now underway to further characterize the nature of the interplay between traits related to eating, socialization, and restricted and repetitive behaviors.

Poster Session
166 - Behavioral Neuroscience
11:30 AM - 1:30 PM - Room: 710

35 **166.035** Role of the Gut Microbiome in Autism-Related Behaviors

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Background:
Phelan-McDermid syndrome (PMS) is a neurodevelopmental disorder caused by haploinsufficiency of the Shank3 gene. Patients with this mutation are also commonly diagnosed with autism spectrum disorder (ASD). In fact, PMS has been identified as one of the most frequent monogenic causes of ASD. In clinical populations there is marked heterogeneity in the severity of the PMS phenotype, while these differences may be due to variety in the mutations involved, it is important to consider potential contributing environmental influences. Interestingly, a significant subset of patients with ASD present with gastrointestinal disturbances, and sequencing of the gut microbiota has shown significant alterations in the bacterial makeup of stool from patients with ASD. Additionally, there is a large body of evidence linking the composition of the gut microbiome to brain development and behavior. To this end, we investigated changes in gut microbiome and metabolites as well as effects of microbiome depletion in a recently developed Shank3 mouse model with exons 4-22 deleted (SHANK3$^{\Delta 4\text{-}22}$) resulting in knockout of all detectable SHANK3 isoforms.

Objectives:

To examine the effect of Shank3 deletion on the microbiome and metabolome as well as assessing the effects of the lack of a diverse gut microbiome on autism-like behaviors in the SHANK3$^{\Delta 4\text{-}22}$ model.

Methods:

Heterozygous SHANK3$^{\Delta 4\text{-}22}$ breeders produced (Wt), heterozygous and homozygous KO offspring. Offspring (both males and females) were weaned on postnatal day (PND) 21 and split into two treatment groups – control drinking water and antibiotic depletion (Abx). The Abx group received a cocktail of broad spectrum non-absorbable antibiotics (Bacitracin 0.5mg/ml, Neomycin 2mg/ml, Vancomycin 0.2mg/ml, Pimaricin 1.2ug/ml) via their home cage drinking water, while the control groups received untreated water. When animals reached PND60 they were subjected to behavioral tests including three-chambered social interaction, marble burying and open field. After behavioral assessment animals were culled and brains were collected for molecular analysis and cecal contents for 16S rRNA sequencing and metabolomic profiling.

Results:

Cecal content analysis demonstrated marked differences in microbiome composition at the phylum and class level between SHANK3$^{\Delta 4\text{-}22}$ KO and Wt controls. Additionally, SHANK3$^{\Delta 4\text{-}22}$ KO mice were found to have an altered cecal metabolic profile as shown by increased levels of a number of amino acids including phenylalanine and methionine, as well as decreases in levels of several short-chain fatty acids. Behaviorally, SHANK3 $^{\Delta 4\text{-}22}$ Het & SHANK3$^{\Delta 4\text{-}22}$ KO mice demonstrated decreased social interaction compared to Wt in the three-chambered social interaction paradigm and this deficit was exacerbated by microbiome depletion.

Conclusions:

Mice constitutively lacking the Shank3 gene demonstrate alterations in the content of their gut flora and the resultant metabolome even when diet and environment are controlled. Additionally, the autistic-like behaviors seen in SHANK3 $^{\Delta 4\text{-}22}$ mutant mice are influenced by alterations to the endogenous flora. Taken together, these studies suggest a gene x microbiome interaction may be contributing to the phenotype of PMS. Although these findings are preliminary, they raise the possibility that interventions targeted at normalizing the gut flora and metabolome may have translational potential in PMS or other causes of ASD.

36 **166.036** A New LIVE MOUSE Tracking System Reveals That SHANK2 and SHANK3 Mutant MICE Display Opposite Abnormal Behaviours in Object Exploration and HOME-Cage Social Conditions

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Background: Mutations in genes coding for synaptic proteins were shown to increase susceptibility to autism spectrum disorder (ASD). Among the causative proteins, cell adhesion molecules such as neuroligins and neurexins as well as scaffolding proteins such as SHANK3 and SHANK2 were robustly associated with ASD in independent patients. We previously analysed transgenic knockout mice lacking *Shank2*. These mice displayed abnormal glutamatergic receptor expression and neurotransmission, as well as hyperactivity, longer grooming bouts and subtle abnormalities in social interactions and communication.
Objectives: The aim of the present project was to develop new protocols to investigate further the behavioural deficits in *Shank2* mutant mice in object exploration and in the home cage. We conducted a comparative study in *Shank3* mutant mice. Such new ways of phenotyping within the home cage allow to characterise behavioural abnormalities at a finer level of details and in a more comprehensive way than the classical tests, that trigger a high level of stress in the mice. Testing mice together without intervention also permits to better control experimental conditions.
Methods: Comparisons were drawn between *Shank2*$^{-/-}$ (deletion of exon 16), *Shank3*$^{-/-}$ (deletion of exon 11) and their respective wild-type adult female littermates (generated on a C57BL/6J background). We tested 12-18 animals per genotype. We tested locomotor activity and reactions to a novel object in a single mouse, as well as mixed-genotype group home cage behaviour. We used a newly developed tracking system (Live Mouse

Tracker). This system allows to follow individually each mouse within a group over several days and to record its individual behaviours and social interactions.

Results: We were able to show that later generations of *Shank2* mutant mice still displayed a high hyperactivity in comparison with their wild-type littermates, while *Shank3*$^{-/-}$ mice displayed a reduced activity in comparison with their wild-type littermates. *Shank2*$^{-/-}$ mice lacked risk assessment behaviour when confronted with a novel object, in contrast to their wild-type littermates and to *Shank3*$^{-/-}$ mice. Home cage behaviour was minimally affected in *Shank3* mutant mice while social behaviours were significantly perturbed in *Shank2* mutant mice.

Conclusions: In conclusion, the Live Mouse Tracker system allows to describe fine behavioural specificities in mouse models of autism. Indeed, both models display abnormal locomotor activity and social behaviour, but not in the same direction. These results highlight that in mice carrying mutations in similar synaptic genes associated with ASD like *SHANK2* and *SHANK3* can impact social behaviour but with apparently different mechanisms and consequences.

37 **166.037** Altered Behavior of Prenatally Valproic Acid-Exposed Rats Group-Housed in Automated Home Cages

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Background: Autism spectrum disorder (ASD) is characterized by impaired socio-communicational function and repetitive/restricted behaviors. Prenatal valproic acid (VPA) administration in rodents shows several similarities to ASD symptoms (also frequently seen after fetal VPA exposure in humans), hence it is used as a preclinical disease model of ASD with high translational value.
Objectives: The aim of the present study was to characterize ASD-relevant behaviors of communities of individually identifiable rats in automated home cages without human intervention.

Methods: Ten prenatally VPA-exposed (E12.5, 300 mg/kg i.p.) and ten control (E12.5, physiological saline i.p.) Wistar rats were housed in two IntelliCages (TSE Systems, Germany). An IntelliCage unit consisted of an open communal space and four recording chambers in the corners with two drinking bottles per corner behind remotely controlled doors. Rats were individually implanted with a transponder which allowed recording visits and drinking behavior. To open the controlled doors, animals had to perform a nosepoke. The behavior of the animals and activity within the corners of the cage was monitored using a tracking software (IntelliCage Plus, TSE Systems). The principal parameters reflecting activity were number of visits to any of the four corners, initiated nosepokes, lick number, and duration of these parameters. The stay at the IntelliCages was divided into phases of 1) acclimation (unlimited drinking opportunity), 2) nosepoke learning (drinking for 7 sec allowed after a nosepoke), 3) side preference learning (limited water access with bottles evenly assigned to rats), 4) reversal learning (pseudorandom switch of the previously allowed bottle) and 5) competition (water available from only one bottle for all the rats).

Results: Although rodents normally tend to explore their new environment, the prenatally VPA-exposed rats showed a drastic impairment in initial exploratory behavior (visit without drinking). A generally reduced exploratory behavior was seen throughout the experiment which may indicate an increased level of anxiety. The circadian activity peak of the VPA group was shifted by approximately two hours during the acclimation period when water was available without restriction. The VPA group displayed excessive drinking, which could be a sign of increased repetitive behavior, since the general physiological status and blood chemistry of the VPA group did not show a significant difference compared to the vehicle group. Vehicle and VPA group did not differ in side preference or reversal learning abilities. In the competitive phase, the vehicle group switched to uneven resource distribution, where only a few dominant animals had access to water. Interestingly, they secured their chance to drink with frequent iterating visits, thereby “guarding” the water resource. VPA animals did not switch to uneven distribution, they shared the water access more evenly between each other and displayed no evidence of guarding behavior.

Conclusions: Investigating prenatally VPA-exposed rats in the IntelliCage allowed us to detect novel features of the model that further increase the translational value of the model, potentially provide a better understanding of the disorder and may facilitate ASD drug discovery.

38 **166.038** An Association between Sensory Responsiveness and Cortical GABA Concentration in Autism-Spectrum Disorder

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Background: Individuals with autism spectrum disorders (ASD) often show sensory abnormalities (Marco et al., 2011). Studies have argued that an altered γ-aminobutyric acid (GABA)-mediated signaling within particular brain circuits may explain this symptom in ASD (Cellot and Cherubini, 2014). We previously found increased sensory hyper-responsiveness in ASD associates with greater temporal resolution to discriminate two successive sensory stimuli that were temporally spaced by varying intervals (Ide et al., 2017). Functional magnetic resonance imaging (fMRI) experiment revealed that neural activity in few brain regions associate with high temporal resolution of stimuli. The ventral premotor cortex (vPMC) was especially associated with the severity of sensory hyper-responsiveness (Ide et al., 2018, submitted). However, whether GABA concentration in vPMC mediates excitatory / inhibitory roles contributing to the overall severity of sensory hyper- / hypo- responsivity still remains unclear.
Objectives: We sought to determine whether sensory hyper- / hypo- responsiveness are associated with cortical GABA concentration and hypothesized that altered GABAergic signaling within the brain circuit involving vPMC induces aberrant sensory processing.

Methods: We recruited 12 typically developing participants (TD; 5 males) and 3 male ASDs. We took their responses on Adolescent / Adult Sensory Profile (AASP; Brown et al., 2001) for characterization of altered sensation. The questionnaire has four sub-scales: Low Registration and Sensation Seeking (passive and active hypo-responsiveness), Sensory Sensitivity and Sensation Avoiding (passive and active hyper-responsiveness).

We performed in vivo measurement of GABA concentration with proton magnetic resonance spectroscopy (H^1-MRS). We initially performed 3D-MPRAGE imaging for anatomical images to locate regions of interest (ROIs) in participants and then ran MEGA-PRESS sequence twice to quantify GABA: one for vPMC and another for primary visual cortex (V1) as a control region. We calculated the ratio of GABA to N-acetyl aspartate (NAA) and N-acetylaspartylglutamate (NAAG) for each ROI and used them as within subject indices for metabolite concentration.

Results: A correlation between the ratio of vPMC to V1 of GABA concentration and AASP scores showed a positive association between subjective Sensation Seeking scores and GABA concentration across all participants (r = 0.66, p < 0.01; Figure 1). The same analysis excluding the three ASDs

revealed that the GABA level positively correlated with Low Registration (r = 0.58, p = 0.05) and Sensation Seeking (r = 0.60, p = 0.04), respectively. There was no association of other scores with GABA concentration.

Conclusions: Our preliminary results comprising of TDs and ASDs suggest that a higher GABA concentration may show reduced sensitivity and behavioral reactivity to stimuli. Taken together with our earlier finding of an association between vPMC and sensory hypersensitivity, there is a possibility that atypical facilitatory / inhibitory roles played by relative GABA concentration in vPMC may result in dysfunctions of sensory processing as regards hyper- / hypo- responsiveness.

Our current, small sample size limits us from concluding unequivocally about the relationship, between GABA concentration of vPMC and sensory processing in ASD. We are measuring more number of patients to elucidate whether GABAergic neural signalling in ASD could be involved with different aspects of sensory responsiveness.

39 **166.039** Atypical Body Movements during Sleep in Young Children with Autism Spectrum Disorder

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Background: Children with autism spectrum disorder (ASD) reportedly suffer from sleep problems at a higher rate than typically developing (TD) children. Several previous studies have reported differences in sleep indices (e.g., sleep latency) in children with ASD. However, no previous studies have focused specifically on the time course of body movements.
Objectives: We investigate the time course of body movements in young TD children and young children with ASD as well as the relationship between body movements during sleep and social ability.

Methods: Seventeen TD children and 17 children with ASD participated in this study (5 to 8 years old). We used an accelerometer attached to the waist to record movements during sleep and measured the average time course of body movements for 3 nights.

Results: Our results demonstrated that the rate of body movement 2 to 3 hours after sleep onset was higher in children with ASD than in TD children. In addition, the higher rate of body movement at 0.5 to 1 hour after sleep onset was associated with a lower social ability in the children with ASD.

Conclusions: Our results suggested that the time course of body movements is an objective behavioural index for young children with ASD.

40 **166.040** Atypical Perception in Autism: Characterizing Inference in Basic Perceptual Processing

ABSTRACT WITHDRAWN

Background: Perceptual atypicalities are a widely acknowledged but poorly understood feature of autism. Prevailing models, formulized in Bayesian terms, suggest that reduced top-down influences underlie atypicalities in perception. Within this framework, changes in bottom-up factors, if they exist at all, are considered *quantitative*, mostly involving changes in noise levels. Thus, testing has been generally limited to examining top-down factors without much recourse to potential underlying constraints of sensory processing.
Objectives: We have recently demonstrated violation of Weber's law in autism, in the visual and tactic modalities, suggesting a modality-independent mechanism of abnormal stimulus encoding. Specifically, JNDs in individuals with ASD are not scaled with intensities, indicating deficits in the low-level calibration mechanism. Here, we examined whether this modulated mechanism of stimulus encoding is associated with the reduced effects of priors (e.g., anchoring, range effects). The typical pattern of increased biases for noisier measurements may not be evident in autism, where scalar variability (Weber ratio) does not seem to hold.

Methods: In *Experiment 1*, we extended our recent findings by demonstrating the violation of Weber's law in autism also in the auditory domain, while manipulating the effect of perceptual anchoring. We examined discrimination thresholds for empty tones intervals using three standards duration. JNDs were compared between the different duration and between two conditions: (1) blocked presentation, in which an anchoring is created for each standard (2) random presentation, in which anchoring is weaker. *Experiment 2*, was design to directly examine the relationship between the precision of the sensory input and the utilization of priors. The height-width illusion was used to manipulate perceptual bias (i.e., higher rectangles are perceived narrower than lower ones), and level of contour blurriness (i.e., precision of the measurement). Greater biases were expected in neurotypicals (TD) for the noisier measurements.

Preliminary Results: In *Experiment 1*, 17/17 of our TD showed the expected increase of JNDs with increasing duration, and the effect of anchoring, resulting in higher JNDs for random presentation. Interestingly, 4/7 of our ASD did not show any scaling of JNDs with magnitude but a sub-group of 3/7 showed adherence to Weber's law. Perceptual anchoring was smaller in this group and did not increase with duration to the same extent as in TD. *Experiment 2* demonstrated substantial increase in the amount of the height-width illusion as a function of blurriness for TD, while ASD tended to show the illusion only when the input became noisier, and JNDs did not scaled with the increase in blurriness.

Conclusions: We replicated the violation of Weber's law in the auditory modality (but only for a sub-group of our ASD participants), and demonstrated that individuals with autism exhibit utilization of priors under certain conditions. Clear susceptibility to perceptual illusions is seen in ASD; however, when precision in the sensory input is high, the otherwise mandatory prior effects do not bias perception.

41 **166.041** Reduced Fronto-Temporal Coherence during Speech Production in Fragile-X Syndrome

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Background: Fragile X Syndrome (FXS) is the most common inherited intellectual disability and monogenic cause of autism spectrum disorder (ASD). Expressive language deficits are nearly ubiquitous among individuals with FXS, but our understanding of the neurological bases for these deficits remains limited. Speech production depends on feedforward control and the synchronization of neural oscillations between speech-related areas of left inferior frontal gyrus (IFG) and auditory cortex in left superior temporal gyrus (STG). Fronto-temporal coherence prior to

vocalization is thought to reflect the corollary discharge of intended speech generated from an efference copy of the speech command against which the actual speech sound is compared. This process reduces the neural response to self-generated speech ("N1 suppression") and is critical for making adjustments for future speech.

Objectives: Using the Talk/Listen paradigm during EEG recordings, we aimed to determine whether alterations in coherence between left frontal and temporal cortices prior to speech production are present in individuals with FXS and relate to language dysfunction.

Methods: Twenty-one right-handed participants with full-mutation FXS (8 female, aged 7-55 years old) and 20 healthy controls (HC; matched on age, sex, and handedness) completed the Talk/Listen paradigm during continuous EEG recording using the 132-channel EGI system. During the Talk condition, participants repeatedly pronounced short vocalizations of the phoneme "ah" every 1-2 seconds for a total of 180 seconds. Vocalizations were recorded using a microphone and transmitted back to the participants in real-time. During the Listening condition, participants passively listened to their recordings from the Talk condition. We compared pre-speech ERP activity, N1 suppression, P2 amplitude, single trial gamma power, and fronto-temporal coherence between groups and in relation to performance during a naturalistic expressive language task (narrating a wordless picture book).

Results: Prior to speech production, FXS participants showed reduced pre-speech activity in left IFG and reduced coherent activity between left frontal and temporal cortices as well as greater background gamma activity compared to controls. Though N1 suppression was similar between groups, N1 suppression was associated with greater coherence during talking in HC. In contrast, P2 amplitude was associated with N1 amplitude and fronto-temporal coherence during talking in FXS. Reduced N1 suppression and fronto-temporal coherence and increased gamma activity prior to speech production were related to greater reductions in narrative measures of talkativeness, intelligibility, and lexical complexity in FXS patients.

Conclusions: Our findings indicate that the coordination of pre-speech activity between left frontal and temporal that reflects the transmission of an efference copy of the intended speech sound to auditory cortex is disrupted in FXS. Intact N1 suppression suggests individuals with FXS are able to send a sufficient corollary discharge to auditory cortex to signal impending speech production, but that the signal may be degraded and contain less precise information about intended speech sounds based on its association with the perceptual response to self-generated speech (P2). This degradation and diminished perceptual response may interfere with feedforward processes necessary for making adjustments for future speech, ultimately impacting the overall complexity and intelligibility of speech productions.

42 **166.042** Effects of Sensory Distractors on Interoceptive Processing in ASD

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Background: Our sense of our body's internal signals ("interoception") influences our emotional states, so it is a parsimonious target of study to understand both sensory and emotional processing in autism spectrum disorders (ASD). There is emerging evidence that individuals with ASD show nuanced strengths and weaknesses in this sensory system compared to typical development (TD), and these nuances have been linked to emotional outcomes such as anxiety. However, the few studies of this sensory system in ASD so far have mostly considered interoception in isolation from other senses. This study aims to investigate the extent to which individuals attend to interoceptive cues in the presence of competing, external sensory information, as we are always processing our internal signals in the context of ongoing sights, sounds, or touch. Though individuals with ASD are generally more distracted by competing sensory information, prior data from our lab looking at heartbeat counting over different temporal intervals suggests that individuals' with ASD may show more "sticky" attention to their internal signals (Schauder et al., 2015).

Objectives: The objective of this study was to investigate how a competing tactile signal affects the ability to perceive one's heartbeat, compared in ASD versus TD.

Methods: N=45 participants (ASD: N=23, ages 8-43, TD: N=22, ages 6-53) completed a heartbeat counting task across each of four temporal intervals (25s, 35s, 45s, and 100s). Participants completed one block with distracting, 25 Hz vibrations of either "low" or "high" amplitude (randomized by participant) applied to their finger via a device, plus one block without any vibrotactile input. Reported number of heartbeats was compared to actual heartbeats, measured with a pulse oximeter. Accuracy data was analyzed with a mixed effects model predicting accuracy by distractor level per diagnostic group, including covariates of age by diagnosis (as in Mash et al., 2017) and IQ.

Results: The TD group showed resilience in performance across lengths and distractor levels (all coefficients n.s.). Qualitatively, the group showed a slight performance decrement in the high distractor condition (t=-0.39), consistent with the expected difficulty of this condition. Conversely, the ASD group showed a trend of worse performance in the low distractor condition (t=-1.90, p=0.058) but relatively better performance in the high distractor condition, compared to low. The results suggest a preliminary difference in the level of distractor to which the ASD group is most susceptible to distraction, compared to TD.

Conclusions: While this pattern of results is inconsistent with an overall group difference in tracking internal signals when distracted by other cues, they do suggest that the level that is most distracting may be different in ASD versus TD. The ASD group showed the greatest performance decrement in response to the low tactile distractor, whereas the TD group only showed somewhat of a decrement in response to the high tactile distractor. While this effect requires follow-up to confirm, future work will also consider the timing of low versus high pulses relative to the individual's heartbeat, as the timing of multisensory inputs crucially affects their integration versus competition.

43 **166.043** Effects of the Co-Occurrence of Anxiety and Attention-Deficit/Hyperactivity Disorder on Intrinsic Functional Network Centrality Among Children with Autism Spectrum Disorder

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Background: Children with autism spectrum disorder (ASD) present with a high co-occurrence of anxiety and attention-deficit/hyperactivity disorder (ADHD). However, it remains unclear whether the co-occurrence of anxiety and ADHD in children with ASD alters whole-brain functional networks.

Objectives: Here, we aimed to examine anxiety- and ADHD-related brain network centrality in children with ASD separately and their relationships with ASD symptoms.

Methods: We assessed clinical anxiety and ADHD levels in children with ASD, aged 6 to 13 years old. Participants were categorized into four groups: ASD only, ASD+anxiety, ASD+ADHD, and ASD+both anxiety and ADHD. Autism Diagnostic Interview-Revised (ADI-R) was used to measure ASD symptoms in four specific domains: social, verbal, nonverbal, and restricted repetitive behaviors (RRB). Subsequently, we compared voxel-wise network degree centrality (DC) among the four groups.

Results: We found seven significant clusters in the main effect test and they were centered on the left middle temporal gyrus (MTG), the right lingual gyrus (LG), the left occipital lobe (OL)/cuneus, the left middle occipital gyrus (MOG), the right sub-gyral/extra-nuclear/carcarine, the right precuneus, and the left superior frontal gyrus (SFG). Least significant difference (LSD) post hoc comparisons revealed that, compared with ASD only, ASD+ADHD and ASD+both showed higher DC level in the right calcarine, and ASD+anxiety showed no significant difference. Moreover, a similar pattern was observed in the left superior frontal gyrus (SFG). The DC level of the right calcarine was positively correlated with ADI-R nonverbal scores, while the left SFG was negatively correlated with ADI-R social scores.

Conclusions: Our findings suggest that the right calcarine and left SFG act as important nodes in the co-occurrence of anxiety and ADHD among children with ASD. Our works shed light on the brain mechanisms underlying behavioral changes related to the co-occurrence of anxiety and ADHD in children with ASD.

44 **166.044** Examining Executive Functioning in Adolescents and Young Adults with Autism Spectrum Disorder Using the Nih Toolbox

R. M. Geddert[1], *V. P. Reinhardt*[1], *M. K. Krug*[1], *T. A. Niendam*[2], *D. L. Hessl*[1] *and M. Solomon*[1], *(1)Department of Psychiatry & Behavioral Sciences, UC Davis MIND Institute, Sacramento, CA, (2)Imaging Research Center, Sacramento, CA*

Background:

Adolescents with autism spectrum disorder (ASD) often exhibit impairments in executive functioning (EF; Hill, 2004; Ozonoff et al., 2004, Solomon et al., 2017). However, previous work reporting these deficits has been inconsistent, and it remains unclear in which specific cognitive domains deficits exist. Furthermore, little is known about how the cognitive profiles of those with ASD change over time, particularly in the transition from adolescence into early adulthood, as well as the impact of EF impairments on pivotal outcomes, including adaptive functioning.

Objectives:

1) To characterize the EF profiles of adolescents and young adults with ASD and typical development (TD) in a large IQ-matched sample using well-validated measures of cognition and 2) to examine associations between EF profiles and adaptive outcomes.

Methods:

Participants were 66 youth with TD and 66 age, gender and FSIQ matched individuals with ASD (ages 12 – 22), who were qualified using gold standard ASD diagnostic measures (Figure 1). Participants completed the NIH Toolbox Cognition Battery (NTCB), a well validated suite of computer tasks consisting of measures of fluid intelligence, including cognitive flexibility (Dimensional Change Card Sorting; DCCS), inhibitory control (Flanker), episodic memory (Picture Sequence Memory; PSM), list-sorting working memory (LSWM), and processing speed (Pattern Comparison Processing Speed; PCPS), as well as crystallized intelligence, including picture vocabulary (PV) and oral reading (ORT; Akshoomoff et al., 2014). Participants also completed an updated version of the Global Social Global Role (GSGR), a clinician-administered assessment of social competence and engagement in age-appropriate roles (Cornblatt et al. 2007).

Results:

The ASD group performed significantly worse on Flanker, DCCS, and PCPS ($p < .001$, all $BF_{10} > 9000$). Participants with ASD also performed worse on PSM ($p = .018$), but evidence was insubstantial ($BF_{10} < 2$) and differences were not observed in LSWM. There were no differences in measures of crystallized intelligence (Figure 2). These findings generalized to the composites, with significant differences in fluid ($p < .001$) but not crystallized composite scores. Stepwise discriminant function analysis was used to examine the combination of NTCB measures that best predicted diagnosis. The extracted function consisted of PCPS and DCCS, and accounted for 34% of the variance in each group's cognitive performance (Wilks $\lambda = .757$; Chi-square = 35.048, df = 2, $p < .001$). Additionally, higher fluid intelligence composite scores were positively associated with GSGR social functioning in ASD ($r_s = .29$, $p < .05$).

Conclusions:

Compared to a well IQ-matched TD sample, adolescents and young adults with ASD exhibited specific weaknesses in measures of fluid intelligence, specifically processing speed, cognitive flexibility, and inhibitory control. Furthermore, EF was positively associated with higher social competence, suggesting that the social impairments observed in ASD may be exacerbated or driven by EF impairments. Finally, discriminant function analysis suggests that reduced cognitive flexibility and processing speed may uniquely contribute to the cognitive profiles of individuals with ASD. These results further our understanding of the cognitive profiles of ASD and their influence on the adaptive outcomes observed in adolescence and early adulthood.

45 **166.045** PAIN Peception in Adults with High Functioning Autism Spectrum Disorder: Subjective Vs. Objective Measures

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Background:

Pain research in autism spectrum disorder (ASD) is scarce, with limited methodology, resulting in a paucity of knowledge comprising conflicting findings on the pain sensitivity profile of individuals with ASD. Overall neural hyper-responsiveness that underpins the ASD pathology is one of the manifestations of the excitatory/inhibitory (E/I) imbalance, which may also account for pain hyper-sensitivity. Yet, difficulties in

communicating socially appropriate responses to pain may cause underestimated judgment of pain by selves or others, and indeed pain hypo-sensitivity is suggested to characterize individuals with ASD.

Objectives:

To explore the pain sensitivity profile in individuals with ASD using both subjective (i.e. self-report) and objective (i.e. cortical event-related potentials) responses to experimental pain stimuli. Specifically, to investigate whether the two measures differ (i) in people with ASD compared to typically developed controls, and (ii) in the within group correlations between subjective and objective measures.

Methods:

This study included 24 high functioning individuals diagnosed with ASD based on the ADOS-2, and 24 healthy controls (CTRL), aged mean (SD): 28 (11); 26 (4); (p>0.05), respectively, with verbal performance and full-scale estimate of 80 and above on the IQ Wechsler Abbreviated Scale of Intelligence® - Second Edition (WASI®-II). Psychophysical testing comprised of phasic noxious heat stimuli that were delivered to the dominant volar forearm (572.5mm^2 thermode, PATHWAY system, MEDOC, Ramat Yishai, Israel) at 49°C, and 52°C, using a stimuli train of 20 repetitions (ISIs of 8 to 12 sec.) for each intensity. Pain ratings were obtained after each stimulus using a 0-100 numerical pain scale (NPS). Contact heat-evoked potentials (CHEPs) were recorded simultaneously and the N2 and P2 amplitudes, considered an objective tool for assessment of central pain transmitting pathways and pain quantification, was extracted for each participant.

Results:

Increase pain ratings in-line with temperature rise were found in both groups. Groups differed across the 2 temperature trains of stimuli. The ASD group reported lower NPS ratings in comparison to controls [CTRL *vs.* ASD: Mean (SD); 49°C: 37.59 (22.25) *vs.* 26.15 (18.98); p=0.05 , 52°C: 52.88 (25.63) *vs.* 34.97 (23.29); p=0.01]. In contrast, greater N2-P2 amplitude (μV), at Cz location in response to 52°C stimuli, was found in ASD *vs.* the control group [CTRL *vs.* ASD; Mean (SD); 29.98 (16.93) *vs.* 40.24 (14.15); p=0.01]. Moreover, an interaction was found between group X pain ratings on P2 amplitude (p=0.03); while controls demonstrated a significant association between pain ratings and P2 amplitude (r= 0.66; p=0.05), the ASD group did not (r=0.20; p=0.48).

Conclusions:

This is the first study exploring self-report pain ratings and evoked potentials during experimental heat pain stimuli. Our exploratory findings point at a mismatch between the individual's subjective pain reports and the neurophysiological responses. While behaviorally individuals with ASD demonstrate pain hypo-sensitivity, the brain responses imply neural hyper-responsiveness. This finding confirms our hypothesis that E/I imbalance may also shape the pain processing in ASD.

46 **166.046** Predicting ASD Severity from Stereotypies Complexity Patterns through an Innovative Machine Learning System: A Proof of Concept Study.

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Background: Stereotypies, despite their high frequency and strong diagnostic significance within autism, have not yet been fully elucidated due to their broad spectrum of presentation and pattern complexity. The VICTORY project (A Video Catalogue from Observational Retrospective Study on Stereotypies) a cross-sectional cohort study assessing presentation patterns, clinical Severity, and extinction modalities of stereotypies in autism, offers a new possibility to relate the complexity of stereotypies presentation to autism severity.
Objectives: The aim of this study is to assess the feasibility of predicting ASD severity in individual subjects from stereotypies patterns using innovative machine learning systems. This possibility would also enable further understanding as to which factors are significantly involved.

Methods: Twenty expert caregivers wearing a body cam recorded specific stereotypic behavior in a natural context during the everyday activities of 67 autistic subjects for 3 months of close follow-up. After a few minutes of recording, the possibility to interrupt their behavior by intervening physically to divert attention was recorded. A team consisting of one senior child neuro-psychiatrist together with a senior psychologist reviewed all the video recordings (1868) selecting 780 of them as the most meaningful to summarize the whole spectrum in each individual within the given time window. Each video was classified according to components (motor, sensorial, vocal, intellective), complexity (2 classes, simple and complex), body parts involved, sensory channels involved (hearing, sight, proprioception, taste, pain, smell), extinction modality and basic demographic features. Ninety-two variables were used to represent the input for preprocessing. The existence of a poor linear correlation among features of stereotypies patterns and ADOS score prompted us to use a machine learning system approach. An evolutionary algorithm (a TWIST system based on the KNN algorithm) was used to subdivide the dataset into training and testing sets as well as to select features yielding the maximum amount of information. After this pre-processing, 19 input variables were selected and different machine learning systems were used to develop a predictive model based on a training testing crossover procedure able to distinguish subject with an ADOS total score ranging from 8 to 20 from those with an ADOS total score ranging from 22 to 28.

Results: Acting on these inputs, the best supervised machine learning system(MLS) obtained a global accuracy of 84.96% (85.12 % - sensitivity and 84.79 % -specificity) in predicting the ADOS score class. Most of the stereotypies features selected by the algorithm were complex, with 2 or 3 different components in the same pattern among motor, sensorial, intellectual and vocal. A semantic connectivity map based on fourth generation unsupervised MLS depicted the association among high severity ADOS class with stereotypies made-up of 3 different components.

Conclusions: Machine-learning systems show a promising potential in highlighting the complex relationship between stereotypies patterns and ASD severity .

47 **166.047** Direct Assessment of Aggressive Behavior in Low Functioning Autism: A Cohort Observational Study.

E. Grossi, *S. Cattaldo and C. Colognesi, Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy*

Background: Aggressive behavior (AB) refers to directed acts of aggression that can potentially harm, or already have harmed others, themselves or destroyed property. Parents frequently report that aggression in their child is more distressing than poor adaptive skills. Most studies on this topic rely on the use of specific scales like the Children's Scale for Hostility and Aggression.
Objectives: The aim of the study is to quantify the expression of AB in a cohort of subjects with ASD admitted to a Rehabilitation Institute by means of direct careful observation of their behavior for 28 consecutive days. To our knowledge, this is the first study to explore directly observed

AB and to correlate its intensity with autism severity.

Methods: Twenty consecutive children and adolescents (mean age 15.15 yrs; range: 5-19; 19 males) with autism, admitted to our Institute took part to this observational study. The ASD subjects were diagnosed according to the DSM V criteria, then confirmed through ADOS 2. Ten expert female educators continuously monitored the subjects for 28 consecutive days recording the occurrence of the following AB: aggression of peers or educators by punching, kicking, boosts, biting, spitting, scratching; or self-inflicted injury with bites, scratches, punches to body or to head. The total sum of aggression and self-inflicted injury acts during the four weeks were taken as biomarkers of AB in the specific subject. These values were correlated with the ADOS total score and with the number of stereotypies patterns, derived from a video catalogue developed for a parallel specific study.

Results:

Five out of 20 subjects (mean age 14.8) showed zero aggression acts during the study period. Their mean ADOS score was 21.2. Fifteen subjects showed from 2 to 31 acts of aggression (mean= 7.46) during the study period. Their mean ADOS score was 19.06. Eleven out of twenty subjects showed zero self-injury acts during the study period. Their mean ADOS score was 18.09. Nine subjects showed from 1 to 37 acts of self-injury (mean = 13.22) during the study period. Their mean ADOS score was 21.44.The Pearson correlation index between the four-week number of aggression acts and ADOS scores and between four-week number of self-injury acts and ADOS scores resulted in 0.06 (NS) and 0.80 (p =0.009) respectively. In the same subgroups, the Pearson correlation index between the total number of aggression acts and the number of stereotypies patterns, and between the total number of self-injury acts and number of stereotypies patterns resulted in -0.24 (NS) and 0.74 (P = 0.001) respectively.

Conclusions: Our pilot study suggest that while self-injury behavior is highly correlated to Autism severity and stereotypies intensity, aggression per se is not at all correlated to both autism severity and stereotypies intensity. Future studies with direct observation on larger samples are needed to explain the nature of this difference.

48 **166.048** Subgrouping of Resting-State Limbic System Connectivity in Co-Occurring Autism and Social Anxiety Disorder

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Background:

Anxiety disorders occur in 42-85% of individuals with an ASD (Joshi et al., 2013). The limbic system (LS) is associated with the regulation of fear (Anad et. al 2005) and previous work has found that LS connectivity at rest correlates with anxiety (Mucci et. al, 2018). Social anxiety disorder (SAD), which is characterized by social fears, has been associated with hyperconnectivity of LS-related regions (Arnold et. al, 2014). Considering the high comorbidity of SAD in ASD, understanding heterogeneity in LS connectivity may elucidate pathways for tailored treatment and response. However, no studies have examined LS connectivity transdiagnostically, including individuals with comorbid Autism Spectrum Disorder (ASD+SAD), Moreover, it is not known whether individuals with ASD+SAD show similar patterns of connectivity in the LS compared to those without ASD.

Objectives:

To elucidate heterogeneous patterns of LS connectivity across adolescents with varying degrees of social impairment. Specifically, we used a graph theory approach, Group Iterative Multiple Model Estimation (GIMME) with community detection on fMRI resting state data to examine whether LS connectivity can robustly differentiate SAD, ASD+SAD, and controls (CON). Secondary analyses examine the relationship between the LS and measures of autism severity and social anxiety symptoms. We predicted that LS subgroups will emerge such that scores on measures of ASD and SAD severity will be distinct among diagnostic classifications.

Methods:

Adolescents with ASD+SAD, SAD only, and CON participated in this study (20 per group; N=60). Participants were matched on age (M=15.19) and FSIQ (M=108.38). Diagnoses were confirmed with semi-structured clinical interviews. fMRI data were collected on a 3T TIMTrio. Functional regions of the LS were identified via Neurosynth (Yarkoni, 2011) and included: bilateral amygdala, thalamus, anterior cingulate cortex, and bilateral orbitalfrontal cortex. GIMME was used with resting-state data from each subject. Subsequently, a community detection algorithm was used to identify subgroups characterized by LS connectivity patterns (Gates et al., 2014). Autism severity was measured via self-report on the Social Responsiveness Scale (SRS-2). Social anxiety was measured via self-report with the Leibowitz Social Anxiety Scale-Child Adolescent (LSAS-CA).

Results:

Analyses revealed two distinct subgroups based on LS functioning (Fig. 1). Group one represents a hyperconnected group, whereas Group 2 displayed hypoconnectivity among the LS. Additional analyses revealed no relationship between autism severity and social anxiety symptoms between the two groups (*ps*>.05; Table 1).

Conclusions:

The data did not support the hypothesis that self-reported ASD or SAD symptoms are related to distinct neural signatures. Findings indicate the development of the LS may not be related specifically to clinical symptoms or diagnostic classification. Rather, results indicate that although symptom expression may be consistent, underlying neural connectivity in the LS connectivity may better explain heterogeneity. This finding holds importance for the development individualized, and neuroscience-informed interventions.

49 **166.049** The Default Mode Network in Autism Spectrum Disorders and Attention Deficit Hyperactivity Disorder

ABSTRACT WITHDRAWN

Background:

Autism Spectrum Disorders (ASD) and Attention Deficit Hyperactivity Disorder (ADHD) are neurodevelopmental disorders with overlapping phenotypic symptomatology and shared genetic makeup. Previous studies have investigated ASD and ADHD using resting state functional magnetic resonance imaging (rfMRI). One particular functional network of interest is the Default Mode Network (DMN) as it has been implicated in several mental disorders. ASD studies have reported mixed trends of increased and decreased functional connectivity (FC) in the DMN, whereas ADHD studies have reported increased FC.

Objectives:

Previous studies have investigated DMN alterations in ASD and ADHD separately, considering these two disorders as unique clinical conditions. Current research has done little work to address NIH's recent Research Domain Criteria (RDoC) that mental disorders may lie on a continuum. To better understand shared characteristics between ASD and ADHD, this study analyzed the DMN FC in both ASD and ADHD children. ADHD-Combined (ADHD-C) and ADHD-Inattentive (ADHD-I) subtypes were also investigated.

Methods:

Archival datasets from Autism Brain Imaging Data Exchange (ABIDE)-I and ADHD-200 datasets were used, with 33 ADHD, 35 ASD, and 32 typically developing (TD) males (ages = 7–17 years) used in the study. The Data Processing Assistant for RfMRI Advanced Edition (DPARSF-A, Version 4.3_171210) as well as comparisons between global signal regression (GSR) versus no GSR were used. 11 regions of interest (ROIs) from the Dosenbach-160 (DOS-160) atlas related to executive functioning (EF) and attentional network regions were investigated due to deficits in EF and attentional networks noted in existing ASD and ADHD literature. Effects of demographic covariates and motion (age, IQ, group, meanFD) on average FC and individual ROI pairs were also studied using general linear models (GLMs).

Results:

FC correlations were compared across the ASD, ADHD, and TD groups with three comparisons: ADHD-TD, ASD-TD, and ADHD-ASD. Average and individual DMN connectivity across the 11 ROIs were also calculated. Increased positive correlations were seen post GSR in ADHD-TD comparisons, with positive correlations between the inferior temporal cortex (inf-temp) and the anterior cingulate cortex (ACC) *($p<0.05$)*. Positive correlations between the mPFC and vlPFC were also present after applying GSR ($p < 0.05$). Finally, ASD-TD t-test results showed decreased negative correlations after applying GSR, with only one negative correlation between the ACC and occipital DMN regions. After plotting correlational trends pre and post GSR, ADHD-C subtype and ASD groups presented similar patterns of average DMN FC, whereas ADHD-C and ADHD-I subtypes showed opposing trends of average DMN FC. Individual FC between the 11 DMN ROI pairs showed that negative correlations increased for ADHD-ASD between ROIs, such as vlPFC and sup-front*($p<0.05$)* in the GLM with age, VIQ, and group after running GSR.

Conclusions:

These results confirmed our RDoC based hypothesis that ASD and ADHD share similar negative correlational patterns in DMN related ROIs. This lays the framework for investigating additional overlapping brain-behavior deficits in executive functioning and attentional network regions in the DMN. However, additional brain-behavioral analysis, as well as a larger sample size comparing ASD, ADHD, and TD groups is warranted.

50 **166.050** The Interaction of Cue Modality and Response Type: Audiovisual Integration Advantage or Visuomotor Disadvantage?

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Background: Movement, coordination and multisensory integration are important components for communication and social interactions. There are known differences in the development of perception, communication and motor control in individuals with autism. However, there is little understanding as to how movement complexity and multisensory integration interact, and how the characteristics of a movement relate to communication skills in individuals with autism. Previous research has shown that young adults respond more quickly to visual versus auditory cues when performing eyes-only, key-press, and reach-to-point motor responses.
Objectives: The present study investigated if individuals with autism use similar movement control strategies when completing a multisensory-motor integration task. We predicted that integrating auditory information would be more challenging, leading to a larger difference between visual and auditory conditions.

Methods: Ten young adults with autism (Mean age 26.5years; 8 male/2 female; 10 right-handed) sat at a touchscreen monitor and EyeLink 1000plus gaze-tracker (500Hz). Participants were shown two potential visual targets (2degrees of visual angle; 16.5degrees from central fixation), and a subsequent central visual or auditory cue that identified the correct target. Participants responded either with: eyes-only, key-press, or a reach-to-point motor response. The two cue types and three response conditions were blocked and counter-balanced. Reaction time (RT) and movement time (MT) were collected using Experiment Builder (SR Research). Participants also completed the Broad Autism Phenotype Questionnaire, Raven's Progressive Matrices, and the Peabody Picture Vocabulary Test to assess the effect of perceived social communication skills, pattern recognition, and vocabulary on movement and coordination, respectively.

Results: Saccade RT did not vary based on modality or condition. There was a significant effect of condition on Saccade MT with longer MT in the reach-to-point condition compared to the key-press condition, suggesting that additional time is required for the saccade when the task is more complex. There was a significant main effect of condition for Hand RT in which the reach-to-point condition had a significantly shorter hand RT than the key-press condition. Consistent with TD adults, movement planning, but not execution, was significantly influenced by knowledge of the limb. The reach-to-point condition also had significantly more trial-to-trial variability than the eyes-only and key-press conditions in Saccade RT and MT, and Hand RT, suggesting increased performance variability with an increase in task complexity.

Conclusions: When compared to previous research, adults with autism used similar movement strategies related to the three movement conditions. However, the overall advantage of visual cues for temporal measures of motor performance was not seen. The present results are consistent with evidence that visual-motor integration is more challenging for individuals with autism.

51 **166.051** The Relation between Social Functioning and Executive Control in Preschool-Aged Children with and without ASD

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Background: A hallmark of ASD is reduced social functioning. Additionally, impaired executive control (EC), the ability to manage higher-order cognitive functions that underlie goal-directed behaviors, has been identified in many children with ASD. Research suggests that EC is needed for proper development of social functioning. Given that EC and social functioning are impaired in ASD, it is important to examine the relation between these two constructs in this population.
Objectives: To examine relations between EC and social functioning in preschool-aged children (two and four year-olds) with and without ASD.

Methods: As part of an ongoing study, two and four year-olds with ASD (n=21) and typically developing controls (TD; n=21) completed tasks that measured EC and social functioning. In line with previous research, performance on a Joint Attention task (Miller & Marcovich, 2015), which consisted of gaze following, object spectacle, and book presentation tests, measured social functioning. The total instances of initiating joint attention (IJA) was the primary outcome. Additionally, lower-level joint attention behaviors were measured: Total instances of responding to joint attention (RJA) and initiating behavioral requests (IBR). Consistent with previous studies, performance on two looking tasks (A-not-B; Bell & Adams, 1999 and A-not-B with invisible displacement (ID); Morasch & Bell, 2011) measured EC. The total number of correct reversals summed across these tasks was used as the primary outcome to measure inhibitory control of the prepotent response, a critical component of EC. Higher scores indicated better performance for both tasks.

Results: The results of an ANCOVA, controlling for age and IQ, indicated that IJA did not differ significantly between groups (p>.05). Although IQ had a significant effect (F(1,36)=5.76, p=.022), age did not (p>.05). For total correct reversals, age (F(1,38)=19.56, p<.001) but not IQ (p>.05) had a significant effect and groups differed significantly (F(1,38)=4.55, p=.039; ASD worse than TD), above and beyond age and IQ. Finally, within-group partial correlations, controlling for age and IQ, showed a significant, moderate positive correlation between IJA and total correct reversals (r=.488, p=.047) among children with ASD. No significant correlation was found between IJA and total correct reversals for the TD group (p>.05). Further, no significant correlations were found between total correct reversals and RJA nor IBR within either diagnostic group (p's>.05).

Conclusions: The results from these analyses suggest that there is a significant relationship between social functioning and EC in preschool-aged children with ASD. Children with ASD who had more instances of IJA performed better on a task measuring inhibitory control. These findings are notable given the link between EC and successful social functioning. However, while *all* children with ASD are socially impaired, the degree to which this population experiences executive dysfunction likely varies greatly between individuals. This heterogeneric presentation is important when building a behavioral profile of children with ASD to guide treatment-related decisions. Higher-powered, future analyses will continue to examine the individual behavioral differences among ASD children over time.

Poster Session
167 - Cellular Neuroscience
11:30 AM - 1:30 PM - Room: 710

52 **167.052** Autism-Associated Variants of Syntaxin Binding Protein 5 (STXBP5) Disrupt Dendritic Morphology Via the Regulation of Rho Signaling

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Background:
Autism is a neurological condition characterized by marked qualitative differences in communication and social interaction. Genetic studies have implicated numerous genes, including those encoding proteins important for synaptic development and function that may contribute to the diverse autism phenotypes. Deletion and mutation of syntaxin binding protein 5 (STXBP5) have been identified in individuals with autism. STXBP5 encodes the protein tomosyn which contains an N-terminal WD40 domain and a C-terminal SNARE motif. Tomosyn was first identified as a syntaxin binding protein that negatively regulates neurotransmitter release. However, tomosyn has also been shown to regulate neurite outgrowth in immature neurons via interaction with ROCK, the downstream effector of RhoA. Here we examined the mechanism by which tomosyn controls the structural stability of mature neurons and also evaluated the hypothesis that the autism-associated mutation of STXBP5/tomosyn disrupts dendritic morphology by altering the Rho signaling pathway.

Objectives: We first examined the effect of the loss of tomosyn in primary cultured neurons and investigated alterations in the Rho signaling pathway as a mechanism underlying the affected cellular phenotype. We then determined the functional domain of STXBP5/tomosyn that is responsible for regulating Rho activity. We further evaluated whether two variants of STXBP5 identified from individuals with autism resulted in the disruption of the Rho signaling pathway and compromised the structural stability of neurons.

Methods:

We used shRNA to knock down tomosyn in mouse primary hippocampal neurons and examined dendritic morphology using morphometric analysis. Miniature excitatory post-synaptic currents (mEPSC) were measured to determine the synaptic function using whole-cell patch-clamp electrophysiology. Rho activity was measured by an intramolecular Forster Resonance Energy Transfer (FRET) assay with co-expression of the RhoA biosensor. Domain deletions and autism-associated variants of STXBP5/tomosyn were engineered and the effects on Rho activity and dendritic morphology were measured using the approaches mentioned above.

Results:

Tomosyn knockdown neurons exhibited compromised dendrite arborization and reduced dendritic spine density. These neurons also showed decreased mEPSC amplitude and frequency. Increased Rho activity was identified in tomosyn knockdown neurons measured by Rho biosensor FRET. Inhibiting Rho activity with dominant negative RhoA or C3 transferase was sufficient to restore complete dendritic morphology. Neurons expressing the C-terminus of tomosyn (tomosyn-DN) showed increased Rho activity and reduction in dendrite length similar to the knockdown, suggesting the N-terminus of tomosyn is responsible for regulating Rho activity. Two STXBP5 variants (L412V and Y502C) found in individuals with autism exhibit single mutations at the N-terminal WD40 domain of tomosyn. The shRNA-resistant wildtype tomosyn, but not autism-associated variants, rescued the dendritic phenotype in tomosyn knockdown neurons.

Conclusions:

We showed that tomosyn controls dendritic morphology via regulation of Rho signaling. Two STXBP5 variants found in individuals with autism contain single mutations at the N-terminus that may contribute to cellular pathophysiology of autism by disrupting Rho regulation and the structural stability of neurons.

53 **167.053** Failure of Homeostatic Plasticity Caused By Novel Autism Gene-Genome Interactions

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Background: Autism spectrum disorder (ASD) has a strong genetic basis and a large number of genes have been identified that confer high risk for ASD in humans. But, it remains unknown how genetic risk translates into the phenotypic severity of ASD for a given individual.
Objectives: We hypothesize that the phenotypic severity of a heterozygous de novo autism gene mutation can be altered/modified by second site, heterozygous loss of function mutations in the genetic background of an individual.

Methods: To test this hypothesis, we took advantage of Drosophila as a model system. First, we demonstrate that heterozygous ASD mutations do not impair baseline synaptic transmission or presynaptic homeostatic plasticity (PHP). Next, we systematically combined a heterozygous ASD mutations with heterozygous chromosomal deletions that uncover defined regions of the Drosophila genome. In each double-heterozygous combination, we assessed the expression of PHP by direct quantification of synaptic transmission, entailing more than one thousand intracellular recordings.

Results: We have screened two thirds of the Drosophila genome and identified 40 loci that impair homeostatic plasticity when combined with a heterozygous autism mutation. We selected five of these loci and tested each against four additional ASD genes; CHD2, CHD8, WDFY3 and ASH1L. Assaying this set of double heterozygous mutant combinations, we discovered that more than two-thirds of the double heterozygous combinations caused impaired homeostatic plasticity. This rate of homeostatic impairment is far greater than predicted by chance ($p<0.01x10-13$). RNAseq analysis of double heterozygous mutant combinations, and additional phenotypic characterization of double heterozygous mutant at the electrophysiological and ultrastructural levels will be presented.

Conclusions: We propose that impaired homeostatic plasticity could be a common pathophysiology related to the phenotypic severity of ASD caused by a rare de novo mutation in a given individual. By extension, our data may define a means by which diverse categories of ASD gene mutations could converge upon a common human phenotype.

54 **167.054** Glutamatergic Activity Is Sufficient to Drive Striatal Spine Formation and Long-Term Plasticity Induction in Cortico-Striatal Co-Cultures

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Background: Altered dendritic morphology and synaptic dysfunction are implicated in the pathophysiology of numerous neurological disorders. Clinical findings and research in genetic mouse models of autism spectrum disorder (ASD) are converging on alterations to striatal structure and function, suggesting that synaptic development and plasticity of striatal neurons may play an important role in ASD symptomatology and etiology. While the mechanisms regulating synaptic plasticity and dendritic spine development are well described at glutamatergic synapses in excitatory cortical and hippocampal neurons, less is known of how these principles translate to GABAergic striatal spiny projection neurons (SPNs), which receive glutamatergic input from cortical and thalamic neurons and form the sole output pathways to the basal ganglia.
Objectives: We sought to examine how manipulating glutamatergic activity at the cortico-striatal synapse affects spine formation and functional plasticity in SPNs. We used cortico-striatal co-cultures from wild-type male and female embryonic mice to examine the functional and structural consequences of altering the excitatory input from cortical neurons on SPNs. The aim was to develop rapid pharmacological assays that can be used in genetic mouse models, in order to study the vulnerability of striatal neurons neurological disorders such as ASD.

Methods: We examined the effects of chronic and acute action-potential silencing (by applying tetrodotoxin to the cultures), as well as the requirement for residual glutamatergic activity through AMPA and NMDA receptors, on presynaptic protein Synapsin-1 and spine/filopodia density in SPNs. To assess rapid activity-dependent plasticity, we used a 3-min glycine application in magnesium-free solution, which results in NMDAR-dependent LTP in other cell types, and measured both electrophysiological and structural outcomes. All experiments were repeated in at least 3 separate cultures, with experimenter blind to treatment condition during analysis.

Results: Chronic and medium-term silencing induced dendritic spine loss, increased filopodia density, and altered Synapsin-1 clusters in SPNs. The application of AMPA- and NMDA-type glutamate receptor antagonists prevented spine but not filopodia alterations, suggesting these are distinct processes. Glycine application was sufficient to increase spine and AMPAR subunit GluA1 cluster density and co-localization, and increased presynaptic glutamatergic release as indicated by whole-cell voltage clamp recordings.

Conclusions: These findings suggest that silencing-induced spine loss, but not filopodial proliferation, is an active process requiring residual glutamate receptor activity in SPNs. Furthermore, NMDA receptor activation in the absence of magnesium is sufficient to drive LTP-like structural and functional plasticity changes in co-cultured SPNs. Together, the data elucidate the importance of glutamate in shaping striatal structure and function even in the absence of neuromodulators such as dopamine, and how the cortico-striatal co-culture system may be useful for studying the role of striatal synapse changes in ASD.

55 **167.055** Granularity and Connectivity in Brains and Cognition: Toward an Information Processing Model of the Cognitive Styles over ASD and TD Populations

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Background:
ASD has two diagnostic criteria: impairments of communication and restricted interests. While accompanied by disturbances of perception and/or motor coordination, most people with ASD are often good at handling objects and machines. However, we do not have a unified model that can explain these diverse characteristics. ASD models proposed so far often focus only on parts of the aspects, and a new unified model is needed for future innovative research and therapeutic practices.

Objectives:

We reconsider the phenotypical diversity of ASD from the viewpoint of "cognitive granularity" that we have been advocating, by which we consider the possibility of modeling ASD in a unified way. Cognitive granularity represents the size of semantic units (schema, basic level categories, etc.) for the agent to articulate and recognize the environment, and is involved in predicting and controlling the environment including the behavior of

others. From the accumulated facts on the behavioral characteristics and the abnormality in the brain structure, it is predicted that ASD people have finer cognitive granularity. Based on the idea, we formulate a unified cognitive model over the diverse behavioral characteristics not only of ASD but also of TD on the continuous axis of cognitive granularity.

Methods:

As evidence to support the finer cognitive granularity in ASD, Casanova reported that mini-columns in ASD brains have a higher density than that of TD. A mini-column is a columnar structure of approximately 100 neurons vertically arranged through the cortical layers; being bundled up together, mini-columns cover the entire surface of the brain, forming the cerebral cortex. Mini-columns are considered to be the smallest functional unit of the brain, whose higher density suggests that (1) ASD brains employ a larger number of mini-columns in information processing, and (2) ASD brains process information in a less integrated way because the smaller mini-columns reduce long-distance connection between them [Fig. 1].

Results:

The abnormality of granularity and connectivity in ASD brains well-explains the information processing styles of the ASD population. (1) ASD people use more mini-columns to represent the environment, suggesting that they acquire categories with finer and specific distinction, often in obsessively detailed manners. (2) ASD people have difficulties in integrating information represented by distantly distributed mini-columns, resulting in the failure of sensory integration and motor coordination as well as of perceiving gestalt and forming "central coherence".

Moreover, finer granularity in ASD also explains their difficulties in mentalizing other's behavior. With the finer cognitive granularity, a variation of human actions that share the same goal would look like arbitrary sequences of causal micro-actions without shared invariants, namely, "intentions" [Fig. 2]. This implies that "theory of mind" or "mentalization" would stem from coarser cognitive granularity that enables TD people to see the mental gestalt in other's physical behavior.

Conclusions:

We believe that cognitive granularity works as the unified model, or endophenotype, of ASD, which explains the continuum of cognitive styles over ASD and TD populations. The idea is still in a hypothetical phase; we need in-depth discussions with INSAR community.

56 **167.056** Role of IL-1b in Inflammation-Mediated Neural Circuit Formation Defects In Vivo

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Background: Neuroinflammation initiated by maternal infection during fetal development has been strongly implicated in the etiology of neurodevelopmental disorders, including autism spectrum disorders (ASD) and schizophrenia. Little is yet known about the precise mechanisms that contribute to neurodevelopmental defects caused by inflammation.

Objectives: Using the zebrafish larva as a genetically tractable model, we sought to study the effects of inflammatory insults on neurodevelopmental programs in the retinotectal system *in vivo*.

Methods: Zygotic microinjection of Brn3c:Gal4 and UAS:mYFP plasmids allowed for sparse labeling of retinal ganglion cell (RGC) axons. At 3 days post-fertilization (dpf), when RGCs enter the optic tectum, we treated the larvae with bacterial lipopolysaccharide (LPS) to induce inflammation. We imaged the cells *in vivo* by 2-photon microscopy and reconstructed the arbors for morphometric analysis. The experimenter was blinded to the condition until the analysis was completed.

Results: We show that treatment of zebrafish larvae with LPS causes an increase in RGC branching dynamics immediately after the inflammatory insult (145.4% increase in number of branches added, P = 0.0068, 119.7% increase in number of branches lost, P = 0.033, 2-way ANOVA, n = 10 LPS treated, n = 9 untreated). We also saw an increase in overall size and branch numbers in LPS treated animals over the following several days (121.9% increase in total arbor length at 6 dpf, P = 0.0075, 158% increase in total number of branches, P = 0.0077, 2-way ANOVA, n = 18 LPS treated, n = 18 untreated). mRNA levels of the pro-inflammatory cytokine IL-1b levels are increased 6.8-fold following LPS treatment (P = 0.012, K-W test, n = 7), and morpholino oligonucleotide (MO) knock-down of this cytokine negates the effects of LPS treatment. Delay of specification of the myeloid lineage, which includes microglia, by MO knockdown of the PU.1 transcription factor, eliminates the immediate effects on RGC branching dynamics (90.3% of number of branches added, P = 0.6445, 112.1% of number of branches lost, P = 0.345, 2-way ANOVA, n = 8 LPS treated, n = 7 untreated), indicating a role for microglia in the mechanisms that mediate inflammation-induced neuronal defects.

Conclusions: We have shown that inflammation during neuronal development causes immediate changes in branching dynamics and long-term morphological defects in arborization. IL-1b is a critical cytokine in this process and mediates the effects of inflammatory stimulus on neuronal growth. Microglia are also involved in mediating the immediate effects of LPS treatment on cellular dynamics. Zebrafish larvae can be genetically manipulated in large numbers, permitting rapid candidate signal screening in vivo. Our findings will inform translational studies that can help us better understand and ultimately may prevent the occurrence of neurodevelopmental disorders such as autism.

57 **167.057** Synaptic Proteins and Structure Defects in Adolescent Rats Following Prenatal Exposure to Valproic Acid

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Background: Autism Spectrum Disorders (ASDs) are a heterogenous group of neurodevelopmental brain diseases. The number of cases is steadily increasing, currently 1 child in 100 is diagnosed with autism, while the prevalence in the U.S. is estimated to be 1 in 50 children. Their typical symptoms include impaired communication (verbal and non-verbal) as well as social interactions along with stereotyped, repetitive behaviors and restricted interests. Recent genetic studies in affected individuals with ASDs indicate the exist of the mutations in a number of genes coding proteins involved in the development and function of synapses, suggested the synapses as a possible site of autism origin. However, the cause of the defects of synaptic proteins and their roles in the pathogenesis of idiopathic autism remain obscure.

Objectives: The aim of this study was to investigate the effect of prenatal exposure to valproic acid (VPA), - rodent model of environmentally triggered ASDs - on the synaptic structure as well as the synaptic protein level in adolescent rat offspring.

Methods: Pregnant Wistar rats received a single intraperitoneal (*i.p.*) injection of VPA (400 mg/kg of body weight) on gestational day (GD) 12.5.

Controls received a single *i.p.* dose of solvent (sterile 0.9 % NaCl). On postnatal day (PND) 22 to 23, rat pups were separated. In order to study social disorders at neonatal stage, we analyzed vocalization of the offspring in response to maternal isolation in all infant rats at PND 11 and anxiety-related behavior (open field test) in adolescent male offspring (PND 40). Males offspring were decapitated at PND 52, their brains removed and cerebral cortex including hippocampus isolated. We determined the gene expression of neuroinflammatory factors, changes in levels of key pre- and postsynaptic proteins, as well as abnormalities of synaptic morphology in cerebral cortex and hippocampus.

Results: Our data showed that embryological exposure to VPA impairs early communication (lower vocalization) in neonatal and enhances anxiety-like behavior in adolescent rats. Prenatal exposure to VPA promotes pathological changes in synapses in both analyzed structures including nerve endings swelling, blurred and thickened synaptic cleft structure as well as swelling the pre- and postsynaptic parts accompanied with lysis and disruption of their synaptic membranes. Together with ultrastructural changes we observed alterations in proteins involved in the synaptic vesicles regulation and neurotransmitter release, increased expression of synaptobrevin (VAMP1/2), synaptophysin and synapsin-1 while the level of presynaptic membrane protein SNAP25 was decreased. In addition, analysis of postsynaptic proteins revealed the lowering level of PSD95 in both hippocampus and cerebral cortex whereas neuroligin-1 (NLGN1) decreased exclusively in cortex. Moreover, we observed changes in the expression of Shank family proteins (*SHANK1*, *SHANK2*, and *SHANK3*) compared to control rats. Prenatal exposure to VPA also upregulated the expression of pro-inflammatory cytokine interleukin 6 (IL-6) and cyclooxygenase-2 (COX-2) in adolescent rat offspring.

Conclusions: These results demonstrate that prenatal VPA exposure affected the synaptic proteins level which could be responsible for synaptic structure and plasticity changes and subsequently contributing to behavioral abnormalities in ASDs.

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Poster Session
168 - Communication and Language
11:30 AM - 1:30 PM - Room: 710

58 **168.058** Developmental Academic Profiles in Siblings of Individuals with ASD

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Background: The broad autism phenotype (BAP) refers to a set of subclinical personality and language traits that exist in a subgroup of unaffected relatives of individuals with autism spectrum disorder (ASD) that are qualitatively similar to the defining features of ASD. Studies have begun to disaggregate the neuropsychological and developmental underpinnings of the BAP. In recent work using archival academic testing data, specific childhood academic profiles were reported in individuals who later went on to have a child with ASD, where language skills developed more slowly than reading and math. These profiles predicted both the BAP in adulthood and the severity of their child's ASD symptoms (Losh et al., 2017), suggesting a potential childhood marker of genetic liability to ASD. Using archival data, this study extended these analyses to siblings of individuals with ASD to investigate whether specific childhood academic profiles may index genetic liability to ASD in clinically unaffected first degree relatives.

Objectives: To examine whether specific childhood developmental academic profiles are evident among siblings of individuals with ASD, constituting a developmental signature reflecting genetic liability.

Methods: Academic test data from the Iowa Test of Basic Skills (ITBS)(Hoover, Dunbar, & Frisbie, 2001) were obtained from siblings of individuals with ASD (n=25) and controls without a personal or family history of ASD (n=32). The ITBS assesses language, reading, and math in grades K-12. Participants also completed an extensive battery of clinical-behavioral and neuropsychological measures.

Results: Differences emerged between groups in language abilities (ps<.04), but not in reading or math (ps>.62). Differences in language were driven by the Language Usage and Capitalization subtests, which assess ability to detect grammatical errors in extended passages and make judgements regarding proper capitalization usage (e.g, distinguishing proper versus common nouns), respectively. Lower performance in language and reading tests were associated with poorer performance on tasks of social cognition later in development (rs>.582, ps<.05) and language fluency (rs>.585, ps< .04), although no associations were found between academic performance and Social Responsiveness Scale or Autism Diagnostic Observation Schedule scores (ps>.22).

Conclusions: Findings suggest a pattern of academic performance in siblings of individuals with ASD that mirrors the profile previously reported in parents, with lower performance in language tests but no differences in reading or math. Also consistent with findings in parents, academic performance was linked to some phenotypic markers associated with ASD suggesting early academic language skills may represent an indicator of later developing social-communication atypicalities related to ASD. Taken together, these findings suggest that academic-related language abilities serve as a potential developmental marker of genetic liability to ASD that might be studied to investigate inter-generational transmission of broader traits associated with ASD.

59 **168.059** Discourse Profiles of Mothers of Children with ASD and Female FMR1 Premutation Carriers

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Background: Subclinical pragmatic language differences comprise a core feature of the broad autism phenotype (BAP), believed to reflect genetic liability to ASD. Similar pragmatic language profiles among *FMR1* premutation carriers (PM; Losh et al., 2012) suggest a potential role of the *FMR1* gene in ASD-related pragmatic language (Lee et al., 2017). An important next step is to investigate linguistic contributions to these broader pragmatic differences. Discourse markers (e.g., filled pauses, backchannels) are words and nonverbal behaviors that manage conversations, promote turn-taking, and create rapport; even subtle deviations in their use can significantly influence the course of conversation. This study examined potential overlap in patterns of discourse marker use in mothers of individuals with ASD (M-ASD) and PM carriers, compared to

controls, to investigate similarities in previously documented pragmatic differences in these groups.
Objectives: Characterize and compare patterns of conversational discourse marker use in mothers of individuals with ASD, female PM carriers, and controls, and evaluate links to global pragmatic language skills.

Methods: Eighty-seven M-ASD, 63 PM carriers, and 43 age- and IQ-matched female controls participated in semi-structured conversations with a trained examiner. Transcripts and videos of these conversations were coded for discourse marker use including speaker markers (i.e., lexical fillers, revisions, filled pauses) and listener markers (i.e., backchanneling, such as nodding). Global pragmatic language ratings were coded from video by independent, blind raters using the Pragmatic Rating Scale (PRS; Landa et al.,1992). Pragmatic language total- and factor scores (i.e., dominant or reticent) were included in analyses.

Results: PM carriers used significantly more lexical fillers and backchannels than the M-ASD group and controls ($ps < .05$), controlling for overall word count. Groups did not differ significantly in filled pauses or revisions ($ps > .10$). M-ASD and PM carriers demonstrated higher PRS total and factor scores (i.e., more difficulty) than controls ($ps < .05$). In both M-ASD and PM carriers, but not controls, higher PRS total scores related to fewer backchannels ($r = -.36$, $p < .01$; $r = -.31$, $p< .05$); greater reticence factor scores correlated with fewer revisions ($r = -.31$, $p< .01$; $r = -.42$, $p < .05$) and filled pauses ($rs = -.31,-.36$, $ps < .01$). In the PM group, higher PRS totals and dominant factor scores related to more frequent revisions ($r = .33$, $p < .01$; $r = .23$, $p< .05$). Increased lexical fillers related to unusual rate of speech ($r = .33$, $p< .05$) in the PM group.

Conclusions: This study suggests a complex influence of discourse markers on pragmatic language. Consistent with prior literature, overall pragmatic language profiles between M-ASD and PM carriers were similar (Losh et al., 2012); however, PM carriers employed some discourse markers at increased rates compared to the M-ASD group. In spite of differences in the frequency of their use, discourse markers influenced pragmatic language in similar ways for the PM and M-ASD groups, but not controls. This suggests an important, but subtle, role in conversational management through discourse marker use, potentially indicative of subclinical profiles related to ASD.

60 **168.060** Discrepancies in Parent Vs. Clinician Reporting of Autism Specific Language Patterns across Racial and Ethnic Groups

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Background*:* Previous research has shown differences in parent and clinician reporting of symptoms of Autism Spectrum Disorder (ASD) (Lemler, 2012) and that symptom recognition, diagnosis, and treatment can be heavily influenced by culture (Donohue et al., 2017; Tek & Landa, 2012; Daley, 2004). In previous analyses, we found differences in non-minority parent reports compared to clinician reports of ASD complex mannerisms but not in minority parent reports compared to clinician reports.
Objectives: This study aims to examine differences in parent versus clinician reporting of language related symptoms of ASD by first analyzing discrepancy between parent and clinician ratings for two language related symptoms: stereotyped speech and echolalia (SSE). Second, we explored whether these discrepancies differed across racial and ethnic groups.

Methods: Data on individuals with ASD was used from Boston Children's Hospital and the Boston Autism Consortium Phenotypic and Genetic Factors in ASD study. 119 participants met inclusion criteria, including: 1) Demographics form, 2) Behavior and Sensory Interest Questionnaire (BSIQ, Hanson et al., 2016), and 3) Autism Diagnostic Observation Schedule-Second Edition (ADOS, Lord et al., 2012). Participants were grouped according to NIH minority status (NIH, 2017). Clinician-reported SSE (CSSE) was measured using an average of the ADOS A3 and A4 codes "Immediate Echolalia," and "Stereotyped Speech", scored 0-3. Parent-reported SSE (PSSE) was measured using BSIQ-F1 category of "Language Preservations," using an average of two individual codes: F1.a. Immediate echolalia and F1.b. delayed echolalia (i.e. stereotyped speech), scored 0-3). First, a one-way ANOVA was used to compare the CSSE and PSSE scores. Next, Tukey post-hoc tests were performed to analyze between-group comparisons for CSSECaucasian, CSSEMinority, PSSECaucasian, and PSSEMinority, to explore whether there were significant differences based on minority status of the child.

Results: Of 119 participants, 87 (73%) were identified by their parents as "White/Caucasian" and 32 (27%) as one of the listed racial and/or ethnic minority descent categories. Categories endorsed by parents included 9 (7.6%) "Asian," 4 (3.4%) "Black/African-American," 6 (5%) "More than one race," 11 (9.2%) "Hispanic," and 5 (4.2%) who identified as "Other." Due to low numbers in each minority group, these groups were combined together for the current analysis. Results from a one-way ANOVA showed significant differences in reporting between PSSE and CSSE ($p=0.005$). Tukey post-hoc contrasts showed significant differences in CSSEMinority and PSSEMinority ($p=.014$) but no significant differences in CSSECaucasian and PSSECaucasian ($p=.476$). All other findings were not significant (CSSEMinority and PSSECaucasian, CSSECaucasian and PSSMinority, PSSMinority and PSSCaucasian).

Conclusions: Preliminary analyses showed significant differences in reporting of SSE between parent and clinicians, suggesting that parents and clinicians are recognizing evidence and/or levels of echolalia and stereotyped speech differently. Between-groups analyses resulted in a statistically significant difference between parent and clinician report of SSE for the minority group, but not for any other group. Differences in the reporting of behaviors can impact diagnosis and treatment, and illuminates the need for more research in this area. Inconsistencies in reporting could possibly be attributed to parents having different knowledge about ASD symptomology across cultural groups.

61 **168.061** Do Play Contexts Impact Engagement States in Preschool Children with Autism Spectrum Disorder?

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Background:
A large proportion of a preschool child's day is spent in play. As a result, it is often through play that children interact with their environment. This makes play a powerful tool for clinicians to use during intervention with preschool children. Existing research has shown that many preschool children with Autism Spectrum Disorder (ASD) have challenges in social engagement, however, very little research has examined the extent to which play context affects how children with ASD engage with their environment. Discovering which play contexts are more conducive to engagement could inform the context in which clinicians conduct therapy with children with ASD and shape recommendations about play context for parents of children with ASD.

Objectives:

To explore the impact of two different play contexts (symbolic and gross motor) on the engagement states of pre-school children with ASD.

Methods:

Seventy-one children with ASD aged 25-57 months were videotaped during natural play interactions with a parent. Five minutes each of play with symbolic toys and play with gross motor toys were used to examine children's engagement states. Data used in this study were part of a larger RCT, however, only pre-treatment, parent-child play interactions were examined here. Time-tagged video coding of the children's engagement states was conducted using Datavyu software and Adamson and colleagues' (2010) engagement coding system. The 8 engagement codes were collapsed into three categories of engagement states: (1) not engaged with parent, (2) engaged with parent only, or (3) engaged in joint attention.

Results:

On average, participants spent significantly more time not engaged with their parent during play with symbolic toys than during play with gross motor toys ($t(70) = -2.65$, $p < 0.05$). During play with gross motor toys, a significantly greater amount of time was spent engaged with their parent only ($t(70) = 4.12$, $p < 0.05$), compared to when children were playing with symbolic toys. There was no significant difference in joint attention between the gross motor and symbolic play contexts ($p > 0.05$).

Conclusions:

Play contexts seem to impact how pre-school children with ASD engage with their environment. Children with ASD engage with parents for a greater proportion of time when in an environment with gross motor toys as compared to when in an environment with symbolic toys. Clinicians might benefit from using gross motor play contexts when targeting social engagement goals with preschoolers with ASD. Clinicians may be reassured that gross motor play appears to be equally useful as symbolic play for targeting engagement in joint attention.

62 **168.062** Do Predictors in Machine Learning Classification of ASD Differ for Children Vs. Adolescents?

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Background: Autism spectrum disorder (ASD) is defined by early and persistent deficits in social communication, as well as the presence of restricted interests and repetitive behaviors. The majority of children with ASD are verbally fluent, and information gathered from brief natural language samples could facilitate remote screening while generating ecologically valid social communication profiles to inform personalized treatment planning. Prior research suggests that a variety of linguistic features produced by participants with ASD and their conversational partners are useful predictors of diagnostic status and/or symptom severity, including prosody, turn-taking rates, and word choice (Bone, 2013; Parish-Morris et al., 2016). However, few studies have harnessed the power of machine learning to predict diagnosis from short, conversational language samples with *non-expert interlocutors*, and little is known about whether prediction accuracy and specific predictive features remain consistent in childhood vs. adolescence. This study addresses these two important gaps.

Objectives: Apply machine learning to language features extracted from transcripts of naturalistic conversations, with the goals of (1) classifying participants as ASD or typically developing, and (2) comparing classification accuracy and predictive features between a child sample, an adolescent sample, and a collapsed sample that includes all participants.

Methods: Eighty-five matched participants (Table 1) participated in two 3-minute semi-structured "get to know you" conversations with two previously unknown confederates who were not autism experts (Ratto et al., 2011). In the first conversation, the confederate is trained to act interested in the conversation, and in the second, bored. Transcripts were analyzed using LIWC software (Tausczik & Pennebaker, 2010) and R's 'qdap' package (Rinker, 2017), resulting in 121 features for participants and confederates in each condition, as well as the difference between conditions. Our machine learning pipeline included a logistic regression classifier trained with participant and/or confederate features within a leave-one-out-cross-validation loop. Cross-validated classification accuracy was measured within children and adolescent samples separately, as well as across the entire age range; accuracy was compared using McNemar's test. Conversational features with non-zero coefficients in the classifier were identified as top predictors of diagnostic status.

Results: Diagnostic classification accuracy was high in both age groups: 89% in adolescents and 76% in younger children (Table 2). Accuracy dropped significantly to 66% (p<.015) when the entire age range was classified within a single model, suggesting that optimal classification models may differ by age group. The most accurate classification model was driven by participant-level features for children and by confederate-level features for adolescents. For children, top predictive features included participant pronoun use, intra-turn pause duration, and "friend"-category words. For adolescents, top predictive features in the most parsimonious model included confederate word-level "authenticity" and negations.

Conclusions: This study showed that (1) features derived from naturalistic conversations with *non-expert interlocutors* can be used for diagnostic classification, and (2) top classification features may change over the course of development. Using machine learning to extract clinically-relevant dimensions from short, naturalistic conversation samples with naïve confederates could provide a new path toward rapid improvements in remote screening, characterization, and developing yardsticks for measuring treatment response.

63 **168.063** EARLY Reading Skills in Children with ASD: Giftedness or Impairment?

ABSTRACT WITHDRAWN

Background:

7% of our clinical population with ASD in Tunisia have early reading abilities, also referred to as hyperlexia

Most of parents and some professionals often consider this skill as a gift and reinforce it, whether some others consider it as an impairment and try to reduce it.

Objectives: Our objective was to correlate early reading skills with some major traits of autism.

Methods:

61 children aged 4-11 years old with documented early reading skills through a thorough assessment of reading and developmental levels of

language and intelligence, were further assessed for systematization (Empathy Questionnaire/Systemization Questionnaire EQ-SQ), sensory abnormalities (Sensory Profile 2) and stereotyped behaviors(Repetitive Behaviour Questionnaire RBQ)

Results:

Reading scores were significantly associated with systematization quotient (p=0.003) but not with empathy quotient.

They were also significantly associated with RBQ global score, especially with the Sameness dimension ($p<10^{-3}$)

Early reading skills were associated to the 'Sensitive/Sensor' profile (0.049) according to the SP2 scores, and more specifically to visual hypersensoriality (0.04)

Conclusions:

It seems that early reading skills in ASD correspond, rather than a talent, to a stereotyped hypersystemizing behavior underpinned by sensory abnormalities.

64 **168.064** Early Sociocognitive Skills, Language and Autism Severity in Children with Autism Spectrum Disorder

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Background:

The Early Sociocognitive Battery (ESB; Chiat & Roy, 2008) is a novel measure of early sociocognitive skills. Scores on the ESB predict language expression and comprehension and social communication skills in typically developing children and those with language impairments. Results of longitudinal studies also indicate that scores on the ESB predict long-term social communication outcomes for children with early language difficulties. Children with very low ESB scores in the early years appear to be particularly vulnerable to later social communication difficulties and possible ASD (Chiat & Roy, 2013). Early improvements in these skills, e.g., through targeted interventions, may lead to improved long-term outcomes in children with ASD.

Objectives:

Little is currently known about the profile of ESB scores in children with ASD. In this study, we investigated the profile of ESB scores in a group of children with 'core' autism. We hypothesised that children who had not yet developed early sociocognitive skills would have more severe ASD symptoms and worse language than those children who demonstrated joint attention, social responsiveness and symbolic comprehension, as measured by the ESB.

Methods:

ESB data were collected for 249 children aged 2-11 years, taking part in the Paediatric Autism Communication Trial-Generalised (PACT-G) study. PACT-G is a randomised controlled trial of a social communication intervention for children with ASD. Measures of nonverbal ability (Mullen Scales of Early Learning, or British Ability Scales), expressive and receptive language (CDI, Oneword Picture Vocabulary Tests), Communication (Vineland Communication subdomain scores) and ASD severity (ADOS-2 subdomain scores) were also available. All data were collected at the baseline assessment, prior to randomisation and delivery of any trial intervention.

Results:

We divided the PACT-G sample into quintiles based on ESB scores and investigated how membership in each quintile related to other child characteristics, such as ASD symptom severity and language. Children who had high ESB scores, i.e., better early sociocognitive skills, had significantly lower ADOS-2 Social Affect scores, $F(4, 219) = 52.52$, $p < .001$, $\eta^2 = .49$, and fewer repetitive behaviours (ADOS-2 Rigid and Repetitive Behaviour scores), $F(4, 219) = 3.37$, $p = .01$, $\eta^2 = .06$, than children who had low ESB scores. Similarly, children with better early sociocognitive skills also had better expressive and receptive language, as measured by the Vineland Adaptive Behaviour Scales (Receptive Communication, $F(4, 230) = 24.78$, $p < .001$, $\eta^2 = .30$; Expressive Communication, $F(4, 230) = 34.73$, $p < .001$, $\eta^2 = .38$) and the Receptive, $F(4, 229) = 51.43$, $p < .001$, $\eta^2 = .48$, and Expressive, $F(4, 226) = 39.27$, $p < .001$, $\eta^2 = .41$, One Word Picture Vocabulary Tests.

Conclusions:

These findings show a differential pattern of language and ASD symptoms, based on the profile of early sociocognitive skills, for children with 'core' autism. Identifying difficulties in these skills may lead to targeted interventions that could improve long-term communication outcomes for children with ASD. Early sociocognitive skills could also be used to predict differential response to social-communication interventions.

65 **168.065** Evaluating the Pragmatic Rating Scale-School Age: Robust Psychometrics and Clinical Implications

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Background: Pragmatic, or social communication, deficits are key characteristics of autism spectrum disorder (ASD); subclinical differences are detectable in first degree relatives of individuals with ASD (Landa, 1992; Greenslade et al., in press). Two main types of pragmatic language measures exist: parent report and standardized structured clinician-administered assessments. Both have limitations. Parent–rated may be less sensitive than clinician-rated measures (Hess & Landa, 2012) and structured measures lack ecological validity. To provide a clinician-rated measure based on ecologically valid communication samples, the Pragmatic Rating Scale-School Age (PRS-SA; Landa, unpublished) was developed. The PRS-SA enables clinicians to rate level of social difficulty (0=none, 3= severe) across 21 components of communication.
Objectives: To evaluate the internal consistency and concurrent validity of the PRS-SA in 4- to 8-year-olds with a continuum of ASD symptomatology, and preliminarily examine whether the PRS-SA is useful for detecting ASD symptoms and risk. Hypothesis: The PRS-SA will demonstrate: (1) moderate internal consistency due to the diversity of social language and communication features measured; (2) strong correlation (concurrent validity) with standard ASD measures, as pragmatic impairment is central to ASD; and (3) good sensitivity and specificity for ASD classification (positive/negative).
Methods: 136 4- to 8-year-olds (*M*=6.94 years, *SD*=1.85) (83 males; *n*=49 with ASD) at high and low risk for ASD participated in a prospective,

longitudinal study of ASD (additional data will be added by the INSAR presentation). All had complete data on the Abbreviated Stanford Binet Intelligence Scale, 5th Edition, ADOS-2, SRS-2, and PRS-SA. Cronbach's alpha examined internal consistency. Pearson's correlation coefficients assessed PRS-SA criterion validity (concurrent) with the SRS-2 and ADOS-2 (standardized ASD assessments). A receiver operating curve (ROC) analysis was conducted to examine PRS-SA sensitivity and specificity for identifying ASD+ or ASD- status (Figure 1).

Results: Cronbach's alpha (α=.635) indicated a moderate level of internal consistency, and no improvements were noted with the removal of any individual item. PRS-SA total score was significantly correlated with SRS-2 total score (r=.453, p=.002) and ADOS-2 Communication domain algorithm score (r=.424, p<.001).

ROC analysis generated an AUC of .890, indicating a good level of sensitivity and specificity for identifying ASD status. A PRS-SA cut off score of 21 is optimal for identifying ASD+/ASD- status: sensitivity=.837, specificity=.790.

Conclusions: As hypothesized, the PRS-SA demonstrated moderate internal consistency, likely reflecting the diversity of communication behavior encompasses in pragmatics and measured by the PRS-SA. Factor analysis will explore potential subscales when sample size is increased, and will be reported in this presentation. Strong correlations between PRS-SA total score and two standardized mainstream ASD measures (one a parent report and one a clinician-rated, direct observation), provide strong concurrent validity evidence, affirming the PRS-SA's use to detect ASD-related pragmatic communication behavior. Our findings suggest that PRS-SA scores of ≥21 in 4- to 8-year-olds indicate the need for ASD evaluation. Additional recruitment will allow a validation of this cut off score in an independent confirmatory sample; sensitivity and specificity results from this analysis will be reported.

66 **168.066** Evaluation of a Novel Non-Word Repetition Test As a Clinical Marker for Language Impairment in Multilingually-Exposed Children with ASD

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Background: Language impairment (LI) is observed in 40-60% of children with ASD (Pickles et al., 2014). Sentence Repetition tests (SR) are quick and can reliably identify LI (Archibald et al., 2009). However, SR tests involve repetition of linguistic content and as such do not work well with multilingually-exposed children, since they may appear to have LI when in fact they just have reduced exposure to the language of testing. Nonword repetition (NWR) tests can also reliably identify LI, but they employ nonwords and are less influenced by language exposure (Thordardottir & Brandeker, 2013). No NWR task exists with stimuli that are phonotactically permissible in multiple languages. In this context, we developed a Multilingual Non-Word Repetition (ML-NWR) test for administration in English, French and Spanish, and applied it to a large sample of children with ASD or typical (TYP) development.
Objectives: To examine whether 1) ML-NWR performance is comparable with different dominant languages (L1s), 2) ML-NWR performance is less affected by amount of exposure to L1, than a SR test, 3) ML-NWR is accurate in identifying children with ASD and LI from a multilingual sample, 4) ML-NWR performance correlates with performance on an established English NWR test.

Methods: Data from 88 participants (38 with ASD) were analyzed. Participants varied in age (5-10 years), L1 (English or French), amount of exposure to that L1, presence or absence of ASD, and presence or absence of LI (among the children with ASD). Participants were administered the ML-NWR test and a SR test (from the CELF-4 or French Canadian version) in their L1 and, for bilinguals, their L2. A subset of 12 participants (seven with ASD) was also administered the Children's Test of Nonword Repetition (CNRep). LI was defined as SR score less than or equal to 1 SD below the mean along with prior documentation of structural-language difficulties. In the ML-NWR test, 27 stimuli of increasing length and phonological complexity were administered live by an examiner. Examiner and participant productions were transcribed in IPA by two independent listeners who were blind to participant LI status.

Results: 1) ML-NWR performance was globally comparable across participants with English versus French as an L1; data was therefore collapsed for further analysis. 2) In the TYP group, current amount of L1 exposure was significantly correlated with SR, but not with ML-NWR performance. In the ASD group, neither correlation was significant (Figure 1). 3) The ML-NWR test achieved a good level of utility as a tool for detecting LI in a multilingual sample (Figure 2). A percent phonemes correct (PPC) cut-off of 95% yielded a sensitivity of 75% and a specificity of 77%. 4) ML-NWR performance was significantly and highly correlated with CNRep performance (r = .894, p < .001).

Conclusions: The ML-NWR test was less influenced by amount of language exposure than a SR task. It displayed a good level of utility as a screener for LI in multilingually exposed children with ASD. Ongoing analyses will compare stability of LI detection across L1 and L2 in bilingual participants.

67 **168.067** Examining the Contribution of Children's Play and Engagement to Language Development in Preschoolers with Autism Spectrum Disorder

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Background: Individuals with autism spectrum disorder (ASD) display significant heterogeneity in symptom and skill presentation across the lifespan (e.g., Georgiades et al., 2013; Howlin & Magiati, 2017). In addition, some of these individual difference factors (e.g., cognitive function, expressive language skills) present at treatment outset have been linked to treatment outcomes (Howlin & Magiati, 2017) giving rise to an interest in factors that may impact the child's participation in the learning environment. In an effort to improve outcomes, such as language development, skills such as joint attention and symbolic play are often direct targets of early intervention for children with ASD (e.g., Kasari et al., 2008) yet trajectories of language development in these children are not fully understood and further research is needed.
Objectives: The present study aimed to examine the contribution of children's engagement and symbolic play skills on later expressive language functioning. Although these data were drawn from a larger ASD preschool intervention study, the present study investigates individual differences in participating children for the sample as a whole.

Methods: The sample for this study consists of 134 preschool children (85% male, M = 4.2 years, SD = .62) diagnosed with ASD who were enrolled in

one of 78 participating classrooms in the study and present for all relevant assessments. The classrooms were located in North Carolina, Florida, Minnesota, and Oregon. Children participated in an assessment battery at the beginning of the year that included measures of general developmental level (MSEL), symbolic play (SPA), joint engagement (ICER-R) and autism symptoms (ADOS-2). At the end of the school year, expressive language was also assessed (PLS-5).

A three-level hierarchical regression was conducted with expressive language (EC standard score) as the dependent variable, child age and developmental level (MSEL Composite Standard Score) entered as predictors on the first step, joint engagement (duration of coordinated or supported joint engagement with people and objects during ICER-R) on the second step, and symbolic play (duration during the SPA) entered on the third step.

Results: The full model predicted 47.8% of the variance in expressive language scores, $F(5,128) = 25.38$, $p < .001$. The models adding joint engagement ($\beta = .148$, $p < .05$, *F change* (1,129) = 5.28, $p < .05$) and symbolic play ($\beta = 2.82$, $p < .01$, *F change* (1,128) = 4.76, $p < .05$) each explained an additional 2% of the variance beyond the lower level predictors.

Conclusions: These results show that children with higher levels of joint engagement and symbolic play at the beginning of the year demonstrate more expressive language skill at the end of the year. This suggests the importance of continuing targeted interventions and monitoring related to complex play, classroom engagement, and early language predictors in children diagnosed with and at-risk for ASD. This sample included preschool children with notable language impairment, a group for whom the sequelae of these early deficits may be particularly problematic if not adequately addressed.

68 **168.068** Exploring Problem Behavior and Language Development in Preschoolers with Autism Spectrum Disorder

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Background: Children with autism spectrum disorder (ASD) consistently demonstrate high levels of externalizing behavior problems compared to their typically developing peers, though significant heterogeneity is present (e.g., Anderson, Maye, & Lord, 2011). Behavior problems occur in many domains of functioning for children with ASD and have the potential to interrupt learning opportunities, social interactions, and other critical points of engagement.

Objectives: The present study examined the contribution of children's problem behaviors to later expressive language functioning. These data were drawn from a larger study preschool intervention project for children with ASD, however the present focus is on individual differences.

Methods: The sample includes 137 preschool children (85% male, $M = 4.2$ years, $SD = .62$) diagnosed with ASD and enrolled in one of 78 participating classrooms across four states. Children participated in an assessment battery at the beginning of the school year targeting general developmental level (MSEL), problem behaviors (CBCL CTRF), and autism symptoms (ADOS-2). At the end of the year, problem behaviors were reassessed and expressive language was evaluated using the PLS-5. At the beginning of the year 37 children used less than 5 words during the ADOS assessment (27%), 76 regularly used single words (55.5%), and 24 were using phrase speech (17.5%).

A hierarchical regression was conducted with expressive language as the dependent variable (PLS-5 Expressive Communication Standard Score), child age and developmental level (MSEL Standard Score) entered as predictors on the first step, and problem behaviors at the beginning of the year (CBCL CTRF Total T-score) on the second step.

Results: The full model predicted 46.8% of the variance in expressive language, $F(3,133) = 40.94$, $p < .001$. Problem behaviors explained an additional 2.5% of the variance beyond the lower level predictors, $\beta = -.162$, $p < .05$, *F change*(1,133) = 6.39, $p < .05$. Even when considering only the children with minimal expressive language at the start of the year (completed ADOS Module 1, n = 113), the full model predicted 36.2% of the variance in expressive language scores, $F(3,109) = 22.19$, $p < .001$. Problem behaviors explained an additional 3.7% of the variance beyond the lower level predictors, $\beta = -.195$, $p < .05$, *F change*(1,109) = 6.56, $p < .05$. Problem behaviors at the end of the year were significantly related to problem behaviors at end of the beginning of the year, $r = .61$, $p < .001$, and to expressive language at the end of the year, $r = -.32$, $p < .001$.

Conclusions: Results show that children exhibiting more reported problem behaviors at the beginning of the year demonstrated lower expressive language skills at the end of the year. It appears that problem behaviors have a significant impact on language both concurrently and across time. Significant problem behaviors may be arising in the absence of matured expressive language, and continued communication interference may exacerbate these issues highlighting the need for early communication interventions. However, further exploration is needed around stronger predictors of language development in children with more significant language delays.

69 **168.069** Gesture Use in the Conversation of Korean Children with High-Functioning ASD: Focused on Communicative Functions and Types of Gestures

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Background:

Gestures play an important role in conversation by accompanying and amplifying information conveyed in speech. Deficits in using communicative gestures in ASD have been reported repeatedly. Early studies found reduced rates of gestures in children with ASD, however recent studies have reported that it is the type and function of gestures that is limited rather than a decrease in gesture frequency. Limitations in the gesture use of children with ASD can also have a negative effect on conversation.

Objectives:

This study aimed to investigate gesture use in the conversation of children with high-functioning autism spectrum disorder (HFASD) focused on communicative functions and types of gestures

Methods:

The participants were 17 HFASD children and 34 typically developing children (TD) matched on chronological age, language age, and IQ. The HFASD were diagnosed as having ASD first by a psychiatrist, and then confirmed using ADOS-2(mean=11.94, range=8-20). The mean chronological age in months of the HFASD group was 98.83±18.60, and the TD group was 99.31±20.70. The language age of the HFASD group was 88.72±22.16 and the TD

group was 92.25±23.38. The mean IQ of the children with HFASD was 99.55±9.96 and TD children was 99.28±13.62.

Behavior samples of the participants were collected during conversation with the examiner through a semi-structured procedure (Choi & Lee, 2013). The samples were recorded using two camcorders.

The gestures of the participants were analyzed according to the communicative function of the gesture, which were categorized as serving the function of responsiveness or assertiveness (Dore, 1986). Gestures were also grouped into four gesture types; deictic, iconic, markers (conventional), and speech beats (Goldin-Meadow & Mylander, 1984). The total number of gestures, and the number of gesture according to communicative function and type were measured.

Results:

The total number of gestures were not significantly different between the two groups (t=-.087, p=0.922). The HFASD group (23.13±15.40) used a similar number of gestures as the TD group (23.50±12.11).

In contrast to the similar frequency of gesture use, significant differences were observed in the communicative functions and the types of gestures. Compared to the TD group, HFASD group used responsiveness function gestures significantly less often, however, there was not a significant difference in the use of gestures that served the assertive function (t=-4.189, p<.001).

In the number of type of gesture, the HFASD group used iconic gestures the most (9.66±9.48) and beats gestures the least (2.60±3.24). In contrast, the TD group used markers gestures the most (12.56±6.15) and deictic gestures the least (1.71±2.30). A significant difference between the two groups was observed in a markers gestures only (t=-2.921, p<.01).

Conclusions:

In the results of the study, the HFASD children used a similar number of gestures during conversation; however, they showed significant differences in the communicative function and types of gestures. The HFASD children used more gestures that fulfilled the assertiveness function, and significantly more marker gestures than TD children as well. The results of the study showed that the different gesture use of the HFASD children was closely related to their limited social abilities.

70 **168.070** Grammatical Strengths of Aspect Processing in the General Population of Mandarin-Exposed Preschool Children with Autism Spectrum Disorders

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Background:

Despite their selective impairments in producing grammatical morphemes, preschool English-exposed children with ASD have demonstrated a strength in on-line understanding of grammatical aspect (Tek et al., 2013; Tovar et al., 2015). The general population of preschool Mandarin-exposed children with ASD has similarly been observed to omit aspectual morphemes significantly more often than typical children (Su et al., 2018; Zhou et al., 2015). This study investigates whether Mandarin-exposed children with ASD's impairments in producing aspect markers stem from their grammatical deficits (i.e., utilizing aspect markers to encode temporal meaning) or their pragmatic difficulties (i.e., referring less frequently to non-present events).

Objectives:

Using Intermodal Preferential Looking (Naigles & Tovar, 2012), we assessed the online processing of aspect markers in a general group of Mandarin-exposed preschool children with ASD, investigating whether they utilize the perfective marker *le* and the progressive marker *zai* to distinguish between completed and ongoing events.

Methods:

Participants included 42 Mandarin-exposed children with ASD, MA=52.07 ± 14.89 months; *M*(vocabulary)=235.62 ± 212.17 words, and 39 TD children, MA=31.79 ± 1.34 months; *M*(vocabulary)=695.95 ± 84.11 words. The TD children were recruited to be significantly younger (p<.001) with the goal of matching the ASD group in vocabulary; however, TD vocabularies were significantly larger than ASD (p<.001). Children listened to sentences with the perfective marker *le* (e.g., *ta xi-le wawa* 'she washed the dolly') or the progressive marker *zai* (e.g., *ta zai-xi wawa* 'she is washing the dolly') paired with side-by-side completed or ongoing events, only one of which matched the test sentence.

Results:

The participants' looking behaviors while viewing the videos indicated that both groups demonstrated comprehension of the aspect markers. On the percent looking to match measure (Table 1), effects of audio, F(1, 79)= 30.77, p<.001, and trial, F(1, 79)=9.28, p=.003, and a significant interaction between audio and trial, F(1, 79)=6.57, p=.012, emerged during the total test trials relative to the control trials. Follow-up t-tests showed that both groups looked significantly longer to the match during the test relative to control trials for the 2nd half of the test trials with the perfective marker *le* and for the 1st half of the test trials with the progressive marker *zai* (all ps<.05). Timecourse data confirmed this looking pattern that hearing the perfective marker *le* triggered more eye movements to the completed event during the 2nd half of the test trials, whereas hearing the progressive marker *zai* triggered more eye movements to the ongoing event during the 1st half of those test trials, in both groups of children (Figure 1 illustrates the timecourse data of the ASD group).

Conclusions:

Mandarin-exposed preschool children with ASD demonstrated similar sensitivity to aspect markers as younger TD children, even though the expressive vocabulary levels of the ASD group were dramatically delayed. Thus despite their frequent omissions of the aspectual morphemes in language production, comprehension of grammatical aspect may be preserved in the general population of preschool children with ASD across countries.

71 **168.071** How Are Minimally Verbal Children and Adolescents with Autism Spectrum Disorder Using Pragmatic Communication in a Different Medium?

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Background: Minimally verbal (MV) individuals with ASD demonstrate difficulties in pragmatic communication, both in the use of speech and communicative gestures, when engaging with a conversational partner (La Valle et al., in prep). Motor difficulties may contribute to reduced communicative gestures (Dewey, Cantell, & Crawford, 2007); however, no studies have assessed gestural forms in MV individuals with ASD. Further, how MV individuals are using pragmatic communication in a different medium, sign language, and how this may differ between children and adolescents, has not been studied, yet a full understanding of pragmatic communication should include both more categorical (sign) and imagistic (gestural) components (Kendon, 2014). The inclusion of sign and gesture can lend key insights into how other modalities collaborate to accomplish communicative goals (Goldin-Meadow & Brentari, 2017). This study will assess how MV children and adolescents are using sign and gesture to display communicative intent during a social interaction.

Objectives: To compare the pragmatic communication profiles of MV children and adolescents with ASD by investigating gestural form and sign language use when engaging with a conversational partner.

Methods: Twenty-five MV children with ASD (19 males; *M*age: 8.92 years) and 25 MV adolescents with ASD (19 males; *M*age: 15.89 years) were administered the ADOS (*n* = 50 Module 1). Within this sample, five children (4 males; *M*age: 9.91 years) and 8 adolescents (6 males; *M*age: 15.35 years) used sign language. Of the 13 participants who used sign language, 12 used sign language and communicative gestures. Transcripts of the first 30 minutes of the ADOS sessions were coded for gestural form: reach, point, reach approximation, point approximation, nodding, and head shaking and sign language use, including the form of the sign (clear sign vs sign approximation). Sign function was assessed in terms of communicative intent: responding to a question, request, repetition, label, comment, and to acknowledge/agree/disagree with the conversational partner.

Results: Both participant age groups, on average, produced fewer than two gestures. The primary gestural form for both groups was a reach approximation (*M* = 3.36). Adolescents nodded more (Mean rank = 30) during the conversational interaction compared to children (Mean rank = 21; *U* = 200, *p* = .001, *r* = .46). The groups did not differ in reaching, pointing, reach approximations, point approximations, and head shaking. Both participant age groups of signers, on average, produced 2.38 signs. Adolescents used more clear signs (Mean rank = 28.5) compared to children (Mean rank = 22.5; *U* = 237.5, *p* = .037, *r* = .58). The primary sign function for both groups was to request (*M* = 1.5). The groups did not differ in any of the sign functions (see Figure 1).

Conclusions: Findings highlight potential motor difficulties as evident by the use of poorly formed gestures. However, both groups showed similar patterns in the use of communicative functions when using sign language (e.g., request). Overall, use of gestures and signs were very low, suggesting that MV individuals with ASD are not compensating for decreased verbal output via other modalities when engaging with a conversational partner.

72 **168.072** Hyperlexia in ASD: First Study in an Arabic Language Context

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Background:

While a large number of children with autism spectrum disorder (ASD) do not develop oral language or show major difficulties in basic language skills, a number of them can have spectacular early reading skills, also referred to as "hyperlexia".

This particularity has not been studied before in Arabic language context.

Objectives: We, therefore, aimed at carrying out a study on Tunisian children with ASD and hyperlexia, in order to estimate the prevalence of this association and its characteristics.

Methods:

A cross-sectional descriptive study was conducted at University Hospital of Monastir on 868 patients with ASD aged 4 to 11 years old.

First a screening checklist for early reading skills was used by clinicians to select early readers, then a battery assessing reading skills was used with the positive cases;

Evaluation also consisted in demographic, biographical and developmental data as well as individual assessment of intelligence (Leiter 3) and receptive language (Peabody 2).

Results:

We found a prevalence rate of hyperlexia in ASD of 7%.

With respect to quantitative measures of reading, all children with hyperlexia had more advanced reading abilities than their chronological age, their level of expressive language, their mental age, and the average reading abilities of their age group. They also had a level of receptive language adapted to their ages and reading levels.

Depending on the ability or inability to decode the "No-Words" and the degree of mastery of the vocalization rules, these children were divided into two groups: A group "good readers" (n = 8), who used highly developed phonological reading strategies and reached the final stage of orthographic stage and a second group of "beginners or poor readers" (n = 22), who used visual reading strategies, had low mastery of vocalization rules, and confusion of colloquial and standard Arabic.

Conclusions:

Hyperlexia seems frequent in Tunisian context and should be considered during the assessment and the follow up of patients with ASD

73 **168.073** Infant Communication Measures Predict Preschool ASD Symptom Severity and ASD Diagnosis

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Background:
Recent screening tools have expanded our potential to identify infants at greater likelihood of later autism spectrum disorder diagnosis (GL-ASD), and have utility for both clinicians and researchers. However, the time lag between a positive infant screening and a conclusive ASD diagnosis presents challenges, including caregiver psychological burdens due to uncertainty about their child's diagnosis, delayed access to ASD-specific services requiring a diagnosis, and slower, more costly progress in research when study aims require knowledge of diagnostic outcomes. Thus, researchers continue to seek infant markers that more accurately predict ASD diagnostic outcomes.

Objectives:

1. Evaluate the extent to which infant communication measures are associated with severity of preschool ASD symptoms in the Social Affect (SA) and Restricted and Repetitive Behaviors (RRB) domains
2. Test the accuracy of infant communication variables in classifying preschool ASD-related diagnostic outcomes

Methods:

Preschool assessments provided diagnostic outcomes for 52 children (aged 36 – 70 months) identified through community screening at 12 months as at GL-ASD. Children were assessed initially at 13.7 months, pursuant to an intervention trial. Infant communication measures included the Communication and Symbolic Behavior Scales (CSBS) Social, Speech, and Symbolic composites; Mullen Scales of Early Learning (MSEL) Receptive and Expressive Language and Visual Reception scales; and frequencies of Canonical Vocalizations and Directed Vocalizations coded from 30 minutes of adult-infant interaction. Preschool outcomes were the Autism Diagnostic Observation Schedule (ADOS) Calibrated Severity Scores (CSS) for the SA and RRB domains (available for 45 children), and final clinical classification (ASD or non-ASD).

Results:

Associations between infant communication measures and preschool ADOS SA and RRB CSS scores were examined, controlling for MSEL Visual Reception scores and intervention group. Infant CSBS Speech and MSEL Expressive Language had significant partial correlations with preschool SA CSS (both *r*s = -.39). Three infant communication variables had significant partial correlations with RRB CSS: MSEL Receptive Language (*r* = -.31), Canonical Vocalizations (*r* = -.41), and Directed Vocalizations (*r* = -.49). Multiple other partial correlations between infant communication measures and preschool SA or RRB scores were marginally significant. We evaluated an iterative series of binomial logistic regression models, using variables significantly or marginally significantly correlated with CSS scores, to derive a parsimonious model predicting preschool diagnostic classification from infant CSBS Social, MSEL Receptive and Expressive Language, and Directed Vocalizations. The model yielded a $\chi^2$of 9.81 (p= .044) in the omnibus test. The model correctly classified 79% of the sample – 31/34 (91%) of NonASD children but only 10/18 (56%) of children with ASD.

Conclusions:

Multiple measures of infant communication correlated with preschool SA and/or RRB symptoms. Such measures may collectively support earlier "best estimate" diagnoses of infants at GL-ASD, although none of the measures we tested had significant unique discriminative power within the model. The current model requires validation with an independent sample. Further, our model misclassified 44% of the children eventually diagnosed with ASD as "NonASD," suggesting that ongoing monitoring and reassessments are warranted for screen-positive infants even when initial communication assessments do not support an ASD diagnosis.

74 **168.074** Infant Predictors of Language and Communicative Skills in School-Aged Children at Familial Risk for Autism Spectrum Disorder (ASD)

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Background:
Atypicalities in language development are frequently observed among individuals with autism spectrum disorder (ASD). Evidence suggests that these language features are also present among children at familial risk for ASD, without a clinical diagnosis. Early predictors and aetiological pathways of language development in ASD and familial risk for ASD are not fully clear. Research in typically developing (TD) children suggests that early social attention facilitates both expressive and receptive language development. However, there is a scarcity in longitudinal research exploring the predictors of language development within ASD.

Objectives:

This prospective longitudinal study aims to explore the developmental trajectories and early-life predictors of language skills during mid-childhood (6-8 years) in children at increased familial risk for ASD. Specifically, we aimed to examine if 1) children at high-risk for ASD exhibit difficulties with language skills; 2) there are differences in language skills among high-risk children who meet diagnostic criteria for ASD and those who do not; and (3) language outcomes during mid-childhood are associated with social attention during infancy.

Methods:

Language ability was measured at age 6-8-years in a cohort of children at high-risk (HR) for ASD, who have been studied prospectively since infancy. Expressive (EL) and receptive (RL) language skills were assessed using the Clinical Evaluation of Language Fundamentals (CELF) and the Vineland Adaptive Behaviour Scales (VABS), which measure structural language and communicative skills, respectively. Language skills were compared between high-risk children who met DSM-5 criteria for ASD (HR-ASD; *n*=15), high-risk children without ASD (HR-non ASD; *n*=27) and low-risk controls (LR; *n*=37). Social attention was measured using a battery of eye-tracking tasks at ages 7- and 14-months. Of particular interest was the association between early gaze-following (GF; proportion of first looks to the correct object), attentional engagement (AE; proportion of time spent looking at the correct object) and Eye-Mouth Index (EMI; attention to eyes relative to the mouth) during social scenes and later language development. ASD symptoms were measured using the Social Responsiveness Scale-2 (SRS-2).

Results:

There were no significant group differences in performance on the CELF, but there were significant differences on both the EL and RL scales of the VABS. Group comparisons suggest that the HR-ASD group had significantly lower scores than the LR group. EMI at 7-months was significantly associated with expressive language scores on the CELF in both the HR ($r(21)=-.49$, $p=.004$) = and LR groups r(23)=-.57, $p=.02$), where increased attention to the mouth was associated with better language skills (Figure 1). However, increased attention to the mouth was also associated with higher ASD symptoms in the HR group ($r(26)=-.41$, $p=.03$). There were no other significant associations between the language measures and AE, GF or EMI.

Conclusions:

Children at-risk for ASD exhibited intact structural language but had difficulties with everyday communication. Increased attention to the mouth relative to the eyes in infancy was associated with better language during mid-childhood but also with higher ASD symptomatology. This suggests that attention to the mouth may facilitate language learning, but that attention to the eyes promotes better social understanding.

75 **168.075** Interference of the Communicative Profile of Children with Autism Spectrum Disorders upon the Quality of Life of Their Mothers

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Background: According to the World Health Organization, quality of life is defined as the perception an individual has on his/her position within the cultural context and the system of values in which he/she is contained. This perception is intrinsically related to the objectives, expectations, patterns, and concerns of such individual.We know that when a member of a family is assailed by an ailment, the quality of life of all of those who surround him/her suffer a strong impact. One of the great concerns of the families regarding the development of a child with Autism Spectrum Disorder (ASD) is the lack or impairment of the child's speech.
Objectives: The objective of this study was to analyze the interference of the communicative profile of children with ASD upon the quality of life of their mothers

Methods: This was a transversal study. The sample was obtained from 41 mothers of children diagnosed with ASD by a multi-disciplinary team: the mothers were divided in two groups: 20 mothers of non-verbal children-GASD-NV; and 21 mothers of verbal children-GASD. We applied the WHOQOL-Bref questionnaire to score and analyze the quality of life of these mothers.

Results: There was no significant difference in the maternal perception related to the domains that reflected quality of life which we compared between these two groups of mothers. In both groups we observed high indexes of insatisfaction.

Conclusions: We verified that the quality of life of the mothers of children with ASD were affected, regardless of the communicative profile of the child.

76 **168.076** Is PLAY Related to Spoken Language Development in Children with Autism: Preliminary Evidence from Project IMPACT Intervention

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Background: Spoken language is a strong predictor of developmental and academic outcomes in children who have ASD (Lincoln et al., 1988; Howlin et al., 2000). In typically developing children, social experiences and play facilitate language development (Adamson et al., 2009, Dawson, 2008, & Kuhl, 2010; Carpenter et al., 1998; Toth et al., 2006). Thus, children with ASD are at risk for language delay given the social impairments characteristic of the disorder. Social communication is the most common outcome measured by early intervention programs. However, the specific dimensions of social communication as they relate to spoken language gains are not well understood.
Objectives: The primary purpose of this study is to investigate whether an evidence-based parent-mediated social communication (Project ImPACT intervention; Ingersoll & Dvortcsak, 2010) will increase social communication and spoken language in young children with ASD. The second objective is to examine the relation between three dimensions of social communication: play, social engagement, and imitation as measured by the Social Communication Checklist (SCC; Ingersoll & Dvortcsak, 2010) and spoken language as measured by the MacArthur Bates Communicative Development Inventories (MB-CDI; Fenson et al., 2007).

Methods: The data were collected as part of a larger ongoing study of the Project ImPACT intervention. Children (average age 31.63 months; 16 M; N=18) participated in Project ImPACT, where interventionists coach caregivers on strategies to support their children in the areas of social engagement, language, social imitation, and play for 12 weeks. Preceding and following therapy, each child's caregiver and clinician assessed communication, language, and social interactions through the SCC and the MB-CDI. Pre- and post-intervention assessments of language and play by parents and clinicians were analyzed using Spearman's correlation.

Results: Following intervention, 68% of the parents reported improved language, as measured by MB-CDI scores. Amount of play, as reported by the parent post-intervention, was significantly correlated with post-intervention scores on MB-CDI Vocabulary subsections: Sound Effects and Animal Sounds ($r= .63$, $p= .009$); Vehicles (Real or Toy; $r= .57$, $p = .021$); Toys ($r= .519$, $p= .039$); Furniture and Rooms ($r= .618$, $p=.014$); Small Household Items ($r= .662$, $p= .005$); Outside Things and Places ($r= .631$, p= .009); Quantifiers ($r= .519$, $p= .039$). 37% of post-intervention MB-CDI scores showed significant correlation to the amount of play reported by parents post-intervention. All Actions and Gestures subsection scores were significantly correlated with the amount of reported play (First Communicative Gesture, $r= .632$, $p=.009$; Games and Routines (Gestures), $r= .603$, $p= .015$; Actions with Objects, $r= .525$, $p= .037$; Pretending to be a Parent, $r= .593$, $p= .016$; Imitating Other Adult Actions, $r= .552$, $p= .027$).

Conclusions: Preliminary findings following twelve-week Project ImPACT intervention indicate strong correlations between play and spoken, as well as non-verbal communication for turn-taking and initiation of interaction. Play is an accessible and age-appropriate strategy that can be used by caregivers in their homes to facilitate early development of language and social skills, and this study contributes to understanding the role of play in development of communication in children on the autism spectrum.

77 **168.077** Joint Engagement in Minimal Verbal Children with Autism

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Background:

Joint engagement (JE) is the state where children interact with an object and a social partner, providing a rich context for social communication. Children with autism have difficulties sustaining JE (Adamson et al., 2009) but can make gains through developmental interventions (e.g., Kasari et al., 2014). Therefore, this construct of JE haspreviously applied in interactions focused on spontaneous bidirectional interaction versus adult led instruction. The study will examine the proof-of concept for exploring engagement in Discrete Trial Teaching (DTT).

Objectives:

The study will examine: 1) the construct of engagement within DTT intervention, 2) whether children who participated in DTT made gains in JE at intervention weeks 3 and 6, and 3) whether JE predicts responder status at week 6.

Methods:

Participants. The sample is a from a subset of a social communication intervention trial. Children were randomized to either Joint Attention Symbolic Play Engagement Regulation (JASPER) or DTT. Twenty-seven minimally verbal (less than 20 spontaneous words) children with autism, ages 4.6-8 years (mean age=6.32; SD = 1.18) received DTT.

Intervention. Each child received 30-minute DTT sessions 5x/week (or 40-minute sessions 4x/week) conducted 1:1 at school, home, or other community locations.

*Interventionist-Child interactions (ICX).*Engagement was coded from 10-minute videos between the interventionist and child from weeks: 1 (first session), 3, and 6. Children's engagement state (Joint Engagement, Object, Person, Onlooker, and Unengaged) were coded in seconds. JE was also coded either child initiated or adult-directed. Proportion of time spent in each state was analyzed.

Clinical Global Impression-Improvement. Responder status was measured by the CGI-I, which measured children's improvement of social communication on a likert scale of 1-7. Children with a rating of a 1 (very much improved) and 2 (much improved) were categorized as responders. Children with a rating of 3 (minimally improved) to 7 (very much worse) were categorized as slow responders.

Results:

The proportion of time that children spent in adult-initiated JE significantly increased at week 3 ($F(1,52)=14.8$, $p=0.0003$) and at week 6 ($F(1,52)=14.5$, $p=0.0004$). There were 9 responders and 18 slow responders to the intervention at week 6. Changes in adult-initiated JE from baseline to week 3 ($Z=-0.646$, $p=0.52$) and to week 6 ($Z=-1.168$, $p=0.243$) did not predict response.

Conclusions:

Children in DTT increased the time spent in adult-directed JE over six weeks of intervention. However, the increase in adult-directed JE did not predict responder status which measured children's *spontaneous*use of social communication. This suggests that children in DTT were more attentive and responsive to instruction over time but did not necessarily increase their use of *spontaneous*social communication. Therefore, this result did not capture the mechanism for change in social communication that one would expect in developmental interventions. This may be due to the nature of DTT instruction, where children are expected to be more responsive to the interventionists' prompts and may have fewer opportunities to initiate. Future research should further examine the quality of joint engagement (adult versus child-led) across instructional models.

78 **168.078** Judgments of Discourse Quality and Impression Formation of Adults with Autism Spectrum Disorder

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Background: Studies of spoken discourse in Autism Spectrum Disorder (ASD) essentially rely on transcripts, and suggest less coherence relative to neuro-typicals (NT) (e.g. Baixauli, Colomer, Rosello, & Miranda, 2016; Stirling, Douglas, Leekam, & Carey, 2014). Individuals with ASD are also perceived as socially more awkward than their typical peers (Bone, Black, Ramakrishna, Grossman, & Narayanan, 2015; Grossman, 2015). Crucially, negative first impressions of adolescents with ASD have also been associated with reduced intentions to take up or maintain social interactions with these individuals (Sasson et al., 2017). However, up to date, no study has sought to directly relate the linguistic features identified in transcripts with impression formation of the speaker. Furthermore, studies have focused essentially on the impressions of typically developing individuals.

Objectives: The aim of the current study is to relate discourse features identified in transcripts with their perception by naïve listeners with and without a diagnosis of ASD as well as their contribution to impression formation of the speaker. Our research questions are threefold:1) Do naïve listeners perceive discourse features identified in transcript analyses? 2) If so, do they influence rater's impression of the speaker? 3) Are there group differences in the perception of discourse features?

Methods: To measure participants' impression of discourse abilities and the speaker, a rating scale was designed. Seven items targeted discourse quality (i.e. relevance, referential cohesion, coherence, level of detail, naturalness, fluency and perseverance) and four items targeted subjective impressions of the speaker (i.e. ease of understanding speaker, ease of being understood by speaker, likelihood of becoming friends, and typicality). Rating stimuli were 12 audio recordings of a dyadic conversation on the topic of relationships. Six audios involved an experimenter and a NT speaker (3 females, 3 males) and six audios involved the same experiment and an ASD speaker (3 females, 3 males). Raters were 16 participants with ASD (7 males), mean age = 28.98 (SD = 7.81), mean IQ = 113.01 (SD = 16.79). Testing is still on-going for 4 participants with ASD and the NT participants (matched on sex, age and IQ).

Results: There was a significant main effect of speaker's diagnostic ($\chi^2(1) = 44.926$, $p < 0.001$), with ASD speakers receiving overall lower ratings ($M=4.57$, $SD=1.78$) than NT speakers ($M=5.10$, $SD=1.55$). There was also a significant interaction between speaker's diagnostic and scale items ($\chi^2(10) = 48.889$, $p <0.001$). ASD speakers received significantly lower ratings on discourse relevance, referential cohesion, coherence, level of detail and fluency, as well as speaker's perceived typicality.

Conclusions: These preliminary results suggest that ASD participants rated ASD speakers' discourse, as well as ASD speakers themselves, as being less typical than their NT peers. Interestingly, there was no significant effect of speakers' diagnosis on perceived ease to understand the speakers and being understood by them as well as likelihood to become friends. It remains to be determined whether NT raters will perceive discourse

abilities and the speaker similarly to ASD raters, viz. whether speaker's diagnostic will have an effect on the same scale items.

79 **168.079** Language Preference & Proficiency in Sequential Bilingual Children with Autism Spectrum Disorders (ASD)

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Background: Children with ASD have been informally observed and have been associated with the preference of English in television programs, movies, and even as a way to learn and communicate; this being assumed by some Speech and Language Pathologists in Puerto Rico (2016). Objectives: The study titled Language preference and proficiency of sequential bilingual children with Autism Spectrum Disorders (ASD) was conducted with the purpose of investigating bilingualism in families with at least a child with ASD, and the language best dominated and preferred by the child. Also, to understand the nature of the language practices, and their limitations or constraints according to administered surveys.

Methods: The first phase of the method was the administration of instruments, which had an exploratory approach and identified the preferences of language and other types of exposure to language of these children. This was measured with the Survey for Parents, The Survey for Speech and Language Therapists and Pathologists, Special Education Teachers, Psychologists, as well as other Professionals and with the Screening Sheets of Exposure to Language for Parents. The participants or subjects on this stage had to meet the following criteria: (a) ages of 6-12 years old, (b) a documented diagnosis of ASD, (c) Puerto Rican living in Puerto Rico, and (d) being a sequential bilingual (Spanish/ English).

Results: A sample of *n=38* completed the first phase of this study. The sample of participants varied between parents of children with ASD and Professionals who give services to children with ASD. The majority of the sample was composed of women (92.1%). The results indicate that (92.1%) of the children with ASD prefer English. Also, it was reported that the frequency of English usage was *pretty much*(51-75; ¾) reflecting itself as a percentage of 51.7%. Finally, the results detected that the language used to communicate with the minors is Spanish (48.6%). Nevertheless, both languages (English/ Spanish) are used with the same frequency with a ratio of 45.7%.

Conclusions: According to the review of literature and theoretical framework, the English language is preferred by children with ASD. This language facilitates learning and communication; what is affirmed by the Speech and Language Pathologists in Puerto Rico. This may be due to the concreteness of the English language and linked to the metrical organization of speech. English is an easier language to acquire by children with autism since phonological development tends to be easier to attain because in Spanish the word length (number of syllables) tends to be significantly longer.

80 **168.080** Language Profiles of Infants Showing Early Signs of Autism Spectrum Disorder (ASD)

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Background:

Impairment or delays in language acquisition are among the clearest early indicators for Autism Spectrum Disorder (ASD). Typically, children understand words before they can use them (i.e., receptive language advantage). While children on the autism spectrum may have both receptive and expressive language delays or impairments, some past research suggests *receptive* language may be relatively more impaired (e.g., Hudry et al., 2010; 2014). However, few studies have investigated receptive-expressive language profiles in infants showing early signs of ASD.

Objectives:

To investigate language profiles in a unique cohort of infants showing early signs of ASD identified via community-referral, using multiple measures.

Methods:

A cohort of 94 infants with multiple language assessment data were assessed (67.0% male) aged 9-16 months (*M* = 12.32, *SD* = 1.97). Parents/caregivers completed the Vineland Adaptive Behavior Scales (VABS) for functional receptive and expressive communication, and the MacArthur Bates Communication Development Inventory (MCDI, Words and Gestures form) for receptive and expressive vocabulary. Direct assessment included the Autism Observation Scale for Infants (AOSI), a measure of early signs of autism, and the Mullen Scales of Early Learning (MSEL), yielding a measure of child receptive and expressive ability.

Results:

Both receptive and expressive language domains were delayed in this cohort when compared to chronological age. Correlational analyses revealed only moderate to low agreement among the two parent-report and one direct assessment of language. No evidence of reduced receptive advantage was observed in this cohort, in that language profiles were indicative of a more normative profile. Regression analyses revealed that autism symptoms were not predictive of receptive advantage on any of the measures. However, MSEL receptive advantage was significantly predicted by higher nonverbal abilities, and MCDI receptive advantage by older chronological age. No predictive associations were apparent for the VABS receptive advantage.

Conclusions:

Existing research on language profiles with diagnosed children and 'high-risk' infant siblings may not generalise to community-referred samples and/or very young infants showing early signs of ASD.

81 **168.081** Language, Gesture, and Looking Patterns during Viewing of Social Interactions in Children with Autism Spectrum Disorder: Results from the ABC-CT Interim Analysis

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Background: Autism spectrum disorder (ASD) is characterized by social communication difficulties, impacting both language and gesture. It is known that decreased attention to faces when viewing social interactions correlates with lower language abilities in ASD; however, it remains unclear how the presence of spoken language during viewed social interactions influences looking patterns.
Objectives: To investigate relationships among linguistic and gestural abilities with looking patterns to videos of social interactions with and without spoken language.

Methods: Eye-tracking data were collected across five sites from 161 children with ASD between the ages of 6 and 11 years (mean age=8.71 years, mean IQ=95.80) and 64 age-matched typically developing (TD) controls (mean age=8.73 years, mean IQ=114.64). Using a SR EyeLink-1000+ to collect eye-tracking data, participants viewed videos in which two people engaged in a shared activity. In one paradigm, actors spoke to each other; during a second paradigm, actors did not speak. Receptive and expressive language function was assessed by parent report on the *Vineland Adaptive Behavior Scales, 3rd Edition.* Gesture was assessed with the *Autism Diagnostic Observation Schedule, 2nd Edition* (*ADOS-2*) gesture scores. Repeated measures ANOVAs compared the log of the ratio of percent looking to activity compared to percent looking to face between eye-tracking paradigms. The relationship between the log-ratio and the *Vineland-3* Communication Scores were analyzed using Pearson's correlations, and gesture scores were analyzed using Spearman's correlations.

Results: Across both paradigms, children with ASD looked significantly less to faces compared to activity than TD children ($F(1,223)=7.625$, $p=0.006$). While there was no significant difference in looking time to faces in the TD group between speech and non-speech videos, children with ASD looked significantly less to faces compared to activity during videos with speech ($F(1,223)=32.931$, $p=0.001$). In children with ASD, higher *Vineland-3* expressive language scores significantly correlated with greater looking time to faces during the videos with speech ($r(161)=-0.203$, $p=0.010$). In TD children, greater *Vineland-3* receptive scores significantly correlated with more looking to faces compared to activity during the speech videos ($r(63)=-0.269$, $p=0.033$). There were no significant correlations between *Vineland-3* expressive or receptive scores and looking time to faces during non-speech videos in either diagnostic group, and *ADOS-2* gesture scores did not significantly correlate with looking time to faces during non-speech or speech videos in either diagnostic group.

Conclusions: In children with ASD, the presence of language in videos of social interactions was associated with decreased attention to faces; however, greater expressive language functioning in this group was related to increased attention to faces. This study highlights that speech may modulate preferential looking to faces in ASD and that eye-tracking studies should carefully consider content of stimuli. Future studies should investigate how associated features of ASD, such as social anxiety, impact attention to faces while viewing verbal and non-verbal interactions.

82 **168.082** Language, Grammar, and Nonverbal Cognitive Abilities in Adolescents and Young Adults with ASD: A Pilot Study

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Background: Little is known about the language abilities of adolescents and young adults with Autism Spectrum Disorders (ASD). Even less is known about how language abilities in this age range may relate to other developmental outcomes, such as nonverbal cognitive abilities. Previous work has found that some individuals with ASD may also have language impairment. Yet there is a gap in understanding how language, grammar, and nonverbal cognitive abilities may relate to one another. This gap has direct implications for understanding the phenotypic variability in autism, as well as in meeting the needs of individuals with ASD across the life span.
Objectives: A pilot study was carried out to investigate the following research questions:

1. How do language abilities compare to grammar abilities?
2. How do language abilities relate to nonverbal cognitive abilities?
3. How do nonverbal cognitive abilities compare to grammar abilities?

Methods: The Institutional Review Boards of the University of Kansas and the New York City Department of Education approved this study. This study was a descriptive study evaluating the efficacy of individualized assessment. Participants were assessed in a single session outside of school. The assessment protocol consisted of: 1) the Clinical Evaluation of Language Fundamentals-3 (CELF-3); 2) the Test for Early Grammar Impairment (TEGI); 3) the Columbia Mental Maturity Scale (CMMS), and; 4) the WISC-III Digit Span (D-Span).

All participants (n=10) carried a diagnosis of ASD, as students in a specialized school where most students qualify for Title I funding and free/reduced lunch, and were exempt from state standardized testing. The least restrictive environment of all participants was a self-contained classroom in a ratio of 8 or 12 students to 1 classroom teacher and 1 classroom paraprofessional. All participants were male, a racial/ethnic minority, and an adolescent (M = 18.3 years, range = 15 - 21 years).

Given the exploratory nature of the study, analyses included descriptive analysis and visual inspection of the data.

Results: Results revealed that:

1. Language abilities may not straightforwardly associate with grammar abilities. While CELF-3 scores showed little variation, with 80% showing a floor effect, the TEGI showed more variability. 50% of participants demonstrated adult-like performance (i.e., 97% or above).
2. Language abilities may not straightforwardly associate with nonverbal cognitive abilities. There was greater variability in the CMMS and the WISC III D-span than the CELF-3, such that 50% of participants had a maturity index of above 9L on the CMMS and 10% had an above-average on the D-span. An additional 20% had a score one SD below the mean on the D-Span.
3. Nonverbal cognitive abilities may not straightforwardly associate with grammar abilities. Some participants had relatively high maturity indices but non-adultlike grammar abilities.

Conclusions: Preliminary findings suggest that language, grammar, and nonverbal cognitive abilities may not always positively associate with one another. To better understand the relationships between various developmental outcomes in individuals with ASD, future research should focus on expanding the sample size and on documenting outcomes over time.

References available upon request.

83 **168.083** Local and Global Processing in Adults with Autism: Relation between Narrative and Perceptual Abilities

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Background:

Previous studies have shown that individuals with autism spectrum disorder (ASD) tend to structure their narrative around details rather than on global events (Barnes, & Baron-Cohen, 2012; Diehl, Bennetto & Young, 2006; Jolliffe & Baron-Cohen, 2000; Rumpf *et al*., 2012). Weak Central Coherence or Enhanced Perceptual Functioning are often invoked to explain these results, the core idea being that ASD individuals display a reduced influence of global information and enhanced focus on detail (Happé & Frith, 2006; Mottron *et al*, 2006). Yet, this relationship between narrative and perceptual abilities has not been experimentally tested.

Objectives:

We explore the relation between local/global processing in narrative and perceptual tasks in adults with ASD compared to NT controls.

Methods:

We analyse the story grammar (number of gist events vs. irrelevant details) in the online storytelling, based on the picture book 'Tuesday' from the ADOS-2. Our participants are 20 adults with ASD and 20 controls matched on age (mean=28), sex (14 males, 6 females), verbal IQ (mean=111), perceptual IQ (mean=106) and total IQ (mean=108). We also measure reaction times (RTs) and accuracy on four sub-tasks of the WAIS-V battery: Block Design, Picture Completion, Similarities and on a Block Design segmented task. Finally, participants' mental inhibition is measured with the Stroop interference test.

Results:

There is a strong Group effect on gist and details enunciation in narratives, with ASD participants verbalizing less gist, and more details in their narratives than NT participants.

There are no Group effects on RTs in Block design or on the effect of stimuli segmentation. However, there is a strong effect of Block Design RT on gist enunciation (but no interaction with Group). The faster participants are on this task, the more gist they provide in their narrative.

There is a significant effect of Picture Completion RT, and a strong interaction RT X Group effect on details enunciation. The faster ASD participants are to detect missing details on a figurative picture, the more details they tended to provide in their narrative.

Interestingly, there is a significant Stroop x Group interaction effect on picture Completion RT. For NT participants, the better they score on mental inhibition, the faster they are to detect missing details on a figurative picture. And finally, there is a significant Stroop interference x Group interaction effect on details enunciation. For ASD participants, the better they score on mental inhibition, the fewer irrelevant details they provide in their narratives (see Figure 1 & Table).

Conclusions:

While NT participants showed a global bias in a detail-focused figurative task (Picture Completion), ASD participants showed a local bias in global-focused one (Narrative). Interestingly, the results reveal that those bias are linked to mental inhibition. Thus, in global focused tasks involving no local distraction and clear instructions (i.e. Block Design Task and Similarities task), ASD participants perform similarly to NT participants.

84 **168.084** Machine Learning Classification of Natural Conversational Utterances Using Acoustic Features Drawn from Children with ASD and Typical Controls

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Background:

The earliest descriptions of autism spectrum disorder (ASD) include mention of atypical speech patterns, including unusual prosody. Although phonetic properties of speech have been explored in ASD, most prior research samples were either elicited in a highly structured context (e.g., reading sentences or word lists) or drawn from semi-structured clinical interviews with an autism expert (i.e., ADOS evaluations). While valuable, these studies produce results that may not generalize to the everyday conversations that really matter for children on the autism spectrum. In this study, we address a gap in the literature by developing and testing a machine learning (ML) classification approach to children's natural interactions with a naïve conversational partner.

Objectives:

Automatically measure phonetic features in the natural conversations of children with ASD and typically-developing controls (TD). Develop an ML classifier to predict the diagnostic category of the speaker.

Methods:

Seventy children with ASD (N=35, 13 females) or TD (N=35, 11 females), matched on IQ (ASD: 105; TD: 107; t=-.53, p=.6) and age (ASD: 11.42; TD: 10.57; t=1.33, p=.19), completed a 5-minute "get-to-know-you" conversation with a novel confederate who was not an autism expert (N=22, 19 females). At the turn level, we extracted 31 acoustic features from each participant's utterance using the RAPT algorithm (as implemented in get_f0) for pitch (Talkin, 1995), with Praat (Boersma & Weenink, 2017) and VoiceSauce (Shue et al., 2011) for other intensity and spectral features (Table). To avoid pitch-tracking errors, we ran the pitch-tracker twice, once to estimate the modal pitch range of each speaker and once to pitch-track within the obtained speaker-specific pitch range. Pitch values were normalized from Hz to semitones using the 5th percentile of each speaker as the base. We trained a support vector machine using Scikit-learn (Pedregosa et al., 2011) with a radial basis function kernel and 5-fold cross-validation. All acoustic features were scaled using MinMaxScaler in Scikit-learn. With the classification results of all turns from each child, we implemented a simple majority vote to predict the child's final diagnostic status.

Results:

Our acoustic turn-level classifier correctly identified whether an utterance came from an ASD or TD participant 60.59% of the time. A majority vote at the speaker level using turn-level results correctly distinguished ASD and TD 66.67% of the time. The accuracy of this acoustic/phonetic classifier is better than the 59% average recall reported using phonetic features at the turn level in prior research (Bone et al. 2016), and is especially promising given that current data are drawn from natural conversations with naïve interlocutors, which tend to be messier and more variable than other types of data.

Conclusions:

This preliminary exploration suggests that acoustic features of natural conversation are useful for distinguishing children's diagnostic category, and advances the goal of scaling real-world machine learning applications in ASD. Our next step is to combine multiple classifiers, using more sophisticated algorithms, feature selection methods, and an expanded feature set that includes lexical information (e.g., word choice, frequency of non-speech vocalizations, filled pauses) to predict diagnostic status and estimate symptom severity.

85 **168.085** Maternal Depressive Symptoms and Linguistic Input to Infants at High or Low Risk for Autism Spectrum Disorder

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Background: Parents of children with autism spectrum disorder (ASD) experience higher levels of depressive symptoms than the general population (Bailey et al., 2007). Depression can impair parents' social skills, and studies have shown that depressed mothers use fewer overall and less varied words when speaking to their children (Rowe, Pan, & Ayoub, 2005). While this relation has been studied in typical development, it remains less clear whether it is also found among mothers of infant siblings of children with ASD.

Objectives: We aimed to determine (1) whether mothers of infant siblings of children with ASD (high-risk with eventual ASD = HRA+; high-risk with no ASD = HRA-) and mothers of infants with no family history of ASD (low-risk comparison = LRC) experience different levels of depressive symptoms and (2) the relation between maternal depressive symptoms and linguistic input to infants within the first two years of life.

Methods: Mothers completed the Center for Epidemiologic Studies Depression Scale Revised (CESD-R; Eaton et al., 2004) when infants were 6, 12, 18, and 24 months of age. To address objective 1, CESD-R scores of HRA+, HRA-, and LRC mothers were compared at each time point, using nonparametric tests (n = 166). For objective 2, measures of maternal linguistic input (word tokens = number of total words; word types = number of different words) were examined from 10-minute parent-child interactions of a subsample of participants (n = 89) at child ages 12, 18, and 24 months. Correlational analyses were then conducted between maternal depressive symptoms and linguistic input, controlling for maternal education level, for the entire sample.

Results:

(1) Using Kruskal-Wallis tests, we found no significant group difference in CESD-R scores at 6, 18, and 24 months. However, we found a significant group difference in CESD-R scores at 12 months, $\chi^2(2, N = 129) = 6.22$, $p = .045$. Post-hoc analyses using Mann-Whitney U tests revealed that HRA+ mothers' CESD-R scores were significantly higher than those of LRC mothers, $z = -2.237$, $p = .025$. Additionally, HRA- mothers' CESD-R scores were higher than those of LRC mothers, though marginally significant, $z = -1.185$, $p = .069$.

(2) Mothers' 12-month CESD-R scores were significantly, negatively correlated with word tokens and types produced at 24 months, tokens: $r = -.34$, $p = .014$; types: $r = -.33$, $p = .017$. This same relation was found between mothers' 18-month CESD-R scores and token and type production at 24 months, tokens: $r = -.37$, $p = .015$; types: $r = -.45$, $p = .002$.

Conclusions: Mothers of children at high risk of developing ASD did not, for the most part, report higher levels of depressive symptoms. Additionally, mothers who reported higher depressive symptoms tended to use fewer, less diverse words with their children. Understanding maternal linguistic input to HRA children provides insight into these children's subsequent language development.

86 **168.086** Talking Success (Pilot Program): Preparing Young Adults with ASD for Life after Undergraduate Study

ABSTRACT WITHDRAWN

Background:

While college opaquely prepares students for the work force (e.g. study skills equivalent to being prepared for the work day), this is not transparent for students with autism spectrum disorders (ASD). Taylor and Seltzer (2011) reported individuals with ASD to be gainfully employed between 4.1% and 11.8% of the general population. Adults with ASD experience difficulty maintaining jobs, and acclimating to new job settings (Hendricks & Wehman, 2009; Howlin, 2000; Hurlbutt & Chalmers, 2004; Jennes-Coussens, Magill-Evans, &Koning, 2006; Müller, Schuler, Burton, & Yates, 2003). Adult-based social skills, inclusive of performance on a job interview, must be explicitly taught to individuals with ASD, in order to facilitate gainful employment.

Objectives:

Adelphi University in New York created the Bridges to Adelphi Program, to support students who self-disclose as having ASD. Each student has individualized objectives in the areas of academic, social, and vocational skills. The objective of this work was to report on an effective vocational and communication-based intervention for college students with ASD. The focus of this project was to support *pre*-employment. That is, how can an interdisciplinary team facilitate success for students who self-identify as having ASD and who desire, and are capable of, gainful employment?

Methods:

The author developed a pilot program within the Bridges to Adelphi program, called "Talking Success." Eight students engaged in weekly discussions focused on how to communicate effectively in the workplace. Talking Success was designed as an interdisciplinary transitional program, across speech-language pathology, social work, and vocational domains. During Talking Success meetings, students identified their location of employment, and specific duties (social and vocational) required within that particular aspirational site. Sessions were focused on building specific interview skills for each student's self-identified goal (e.g., active listening, formulating alternative responses) and were directed by a social worker and two graduate students studying speech-language pathology, who were supported by weekly meetings held by the author. A vocational trainer held supplementary meetings. Student success was monitored by journal entries from students, weekly reports by student clinicians (supervised by the social worker), and ultimately, obtaining a desired externship.

Results:

Five of the eight students secured their desired internships, with two now gainfully employed post-graduation, and one showing promise for near future employment. While the 20% success rate for gainful employment may appear minimal, one must consider sample size (n=8). Further, for these two individuals, outcomes had great impact on individuals who participated in Talking Success, showing potential for growth and development of this program. Preliminary findings are practical and immediately replicable and generalizable.

Conclusions:

Explicit training on social and vocational skills related to an individual's aspirational location of employment increases the likelihood of securing an externship in young adults with ASD.

87 **168.087** A Novel Hybrid Telehealth Approach for Assessing Social Communication in at-Risk Toddlers in Rural Communities from a Distance

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Background: Despite evidence for the efficacy of ASD-specific early behavioral intervention in improving children's outcomes, there remain significant barriers to disseminating empirically-validated treatments to families and community settings (Rogers & Talbott, 2016; Stahmer, Aranbarri, Drahota, & Rieth, 2017). Effectiveness trials demonstrating positive effects of a treatment in the final community setting are needed before public early intervention programs will cover such treatments. One central challenge to the conduct of such randomized controlled effectiveness studies is the measurement of proximal social communication behavioral treatment targets, which require live, reciprocal interactions, for toddlers living in rural and geographically distributed community settings.

Objectives: Our goal is to assess the feasibility, fidelity, validity, and reliability of one approach to meeting this need: a hybrid live-distance assessment, in which professionals working within local EI systems administer a play-based interaction, which is later scored from video by highly trained expert coders blind to study group at the University site.

Methods: Data were collected as part of an ongoing community-based pilot randomized controlled trial (RCT) testing an adapted Community-Early Start Denver Model (C-ESDM) across 4 states: Alabama, California, Colorado, and Pennsylvania. University partners in each state recruited 7 assessors (all female), who were graduate students (*n=1*) and early intervention professionals (*n = 6*) working in their local communities. Assessors received training on an adapted Community-ESDM Curriculum Checklist (CC) via telehealth and received feedback on submitted training tapes before conducting independent assessments. Assessments were scheduled in families' homes, lasted approximately 1.5 hours, and were videotaped for later coding by raters trained to reliability and blind to families' study group. Analyses examined the following 4 measures: Feasibility (proportion of scheduled visits completed); Fidelity (number of administrations meeting published CC administration and scoring rules); Inter-rater reliability (agreement between assessor and coding scores); and Validity (relations between assessor-derived CC scores and standardized and normed measures of social communication).

Results: 31 children (21 male) receiving low-intensity early intervention (EI) services by participating providers, and their caregivers, enrolled and had an intake assessment scheduled. An additional 3 families enrolled but withdrew before scheduling. Families completed 97% (30 of 31) of scheduled visits, indicating high feasibility. Preliminary analyses indicate acceptable fidelity levels for community assessors. Intra-class correlation coefficients for the Curriculum Checklist Proportional Score Totals between 21 coders and assessors was .87, indicating excellent interrater reliability. There were significant positive correlations between the MacArthur Bates total vocabulary inventory for both assessor (r = .57, p = .03, n = 15) and coder (r = .56, p = .03, n = 18) total scores.

Conclusions: While this method requires substantial efforts and staff time, it provides a potential route for increasing the participation of at-risk toddlers living in rural and low-resources areas into high-quality University-based treatment studies. This increases the acceptability and validity of the interventions and procedures.

Poster Session
169 - Diagnostic, Behavioral, Sensory and Intellectual Screening and Assessment
11:30 AM - 1:30 PM - Room: 710

88 **169.088** The Autism Preschool Peer Interaction Observation Scale (APIOS): Naturalistic Observation to Assess Social-Communicative Skills during Ongoing Interaction with Peers

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Background: Peer relations in typical development are cardinal for children's development of ample cognitive, linguistic, and social skills (e.g., Hay, Caplan, & Nask, 2009). Longitudinal evidence shows that individual variations in behavior and in responding to peers' behavior at early ages predict later social competence, even when accounting for factors such as temperament and attachment relations (e.g., Hay et al., 2009). Peer relations do not develop typically in children with autism spectrum disorder (ASD), thus limiting peer relationship experiences in young children with ASD and forming the basis for reduced peer engagement across development (Manning & Wainwright, 2010). Yet, naturalistic observation procedures to reliably evaluate spontaneous peer engagement are scarce, and those that are developmentally oriented at the preschool years are even more limited.

Objectives: The major aim of the current study was to examine the validity and reliability of a newly developed peer observation scale, the *Autism Peer Interaction Observation Scale (APIOS)*, in (a) differentiating between preschoolers with ASD and typical age-mates regarding their social functioning during real-life peer interactions in and out of natural classroom environments; and (b) linking the APIOS with frequently used standard reports to assess social-adaptive functioning (Vineland), social dysfunction (SRS-2), autism severity (ADOS), and IQ (Mullen).

Methods: Eighty-five preschoolers (age 3-6 years) participated in the study: *n*=50 individually included high-functioning children with ASD (HFASD; IQ>75) and *n*=35 typically developing age-mates matched on chronological age, IQ, and mothers' education. The theory-based APIOS (Shefer & Bauminger-Zviely, 2016) comprises a 3-hour observational procedure assessing preschoolers' social-communication abilities and difficulties during spontaneous peer interactions during various activities in and out of preschool. The APIOS includes 9 categories and 17 subcategories for *adaptive social functioning* (nonverbal communication, functional and complex social behaviors, prosocial behaviors, social and imaginary play, conversation, range and quality of facial expressions) and another 3 categories for *non-adaptive behaviors* (aggressive, stereotyped-repetitive, and irregular sensory interest), rated by the observer along a 4-point scale from 1 (typical) to 4 (very atypical behavior). APIOS inter-rater reliability, established for approximately 20% of preschool observations, ranged from 85.7% to 96.4%. To evaluate adaptive skills and social functioning, the Vineland and SRS-2 were completed by children's teachers.

Results: Main results verified the APIOS's distinctive value in differentiating HFASD from typical groups, with the latter showing more adaptive socio-communication and fewer non-adaptive behaviors. Based on the APIOS, we also clustered behaviors according to severity of socio-communicative deficit. In HFASD, the most deficient behaviors were imaginary play and conversation, and the more intact behaviors were nonverbal behavior and functional social communication. The APIOS correlated well with the Vineland, SRS-2, and IQ: Children observed to demonstrate more intact peer relations on the APIOS showed higher IQ, better adaptive skills, and fewer social atypicalities. In contrast, only a few significant correlations emerged between the APIOS and ADOS.

Conclusions: We discuss the importance of developing appropriate naturalistic peer-engagement observation procedures to obtain comprehensive assessment of social-communication in HFASD and also to provide intervention guidelines.

89 **169.089** The Playground Observation of Peer Engagement

M. Dean[1] *and Y. C. Chang*[2]*, (1)Education, California State University, Channel Islands, Camarillo, CA, (2)Special Education and Counseling, California State University, Los Angeles, Los Angeles, CA*

Background: Many children with autism spectrum disorder (ASD) have social challenges, which become increasingly apparent as children with ASD enter school. Several commonly used checklists and surveys are used to measure social behaviors of individuals with ASD (e.g., Gresham & Elliott, 2008; Constantino & Gruber, 2005), but these measures rely on reporters' perceptions of behavior, rather than objective observations of social behaviors within authentic social contexts. There is a critical need for social skills assessments that are able to measure the extent to which children with ASD utilize social skills in real life settings (Freeman & Cronin, 2017). The Playground Observation of Peer Engagement (POPE; Kasari, Rotheram-Fuller and Locke, 2005) is a 15-minute observation measure that captures discrete social behaviors by measuring the proportion of time that children spend in different engagement states and the frequency of social initiations, responses, and conversations. The POPE has been shown to detect changes in behaviors of children with ASD in naturalistic environments.
Objectives: The study purpose is to provide a systematic review of social skills intervention studies that have utilized the POPE to measure the effect of interventions on peer engagement in naturalistic environments.

Methods: A comprehensive search using three electronic databases and keyword search terms (Playground Observation of Peer Engagement, POPE, autism, ASD, playground observation, peer engagement) yielded 74 articles. Eight articles met the inclusion criteria: (a) Participants with ASD were in kindergarten through high school and were educated in a mainstream setting; (b) Social skills interventions at school in inclusive settings; (c) POPE was used to examine changes in social engagement of individuals with ASD.

Results: Selected articles include four randomized controlled trials (Kasari et al, 2016; Kasari, et al, 2012; Kretzman, et al, 2015; Shih, et al., 2018), one quasi-experimental design (Locke, et al, 2018), and three single subject experimental designs (Ezzamel & Bond, 2017; Radley et al., 2014; Radley et al., 2017). One hundred and ninety-six socio-economically and ethnically diverse children with ASD (ages 5 -11) participated in social interventions at school. POPE observations occurred before the start of the intervention (Baseline), post intervention (Exit), and four to six weeks post intervention (Follow-up). Evidence of behavior change was reported for Solitary, Joint Engagement, and Initiations and Responses. Five studies reported a significant decrease in Solitary between baseline and exit, with participants maintaining effects at follow-up (n=4). Six studies reported increase in Joint Engagement pre and post assessment, with four studies maintaining the effects at follow-up. Three studies reported an increase in positive social initiations and social responses post intervention, with two studies reporting maintenance effects at follow-up.

Conclusions: The POPE is an ecologically valid observation instrument that is able to capture discrete social behaviors of a diverse population of children with ASD at school. Currently, POPE observations have only been tested in elementary school settings. Research is needed to examine the usefulness of the POPE in secondary settings, and to examine which variables on the POPE are consistently being used to measure change.

90 **169.090** Latent Profiles of Social Interaction and Classroom Educational Experiences in Students with Autism Spectrum Disorder

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Background: Teachers report feeling underprepared to effectively program for students with Autism Spectrum Disorder (ASD) and less able to manage social communication and behavioral concerns characteristic of ASD (Locke et al., 2015). Difficulty providing effective programming for students with ASD has been identified as a significant source of stress, leading to low self-efficacy and a higher frequency of teacher burnout (Boujut et al., 2017)—which could place students with ASD at risk for educational failure. This could, in part, relate to the notable heterogeneity in social communication skills that students with ASD present in educational settings (Fleury et al., 2014).
Objectives: The purpose of this study was to identify subgroups of students with ASD based upon a set of social interaction features and examine if and how social interaction patterns influence the nature and quality of students' classroom experiences.

Methods: Participants include 119 preschool–3rd grade students with ASD and their teachers (*n* = 65) across 16 districts who were video-recorded in their classrooms at the beginning of the school year. Research assistants coded a 10-minute sample of the video observation using an adapted version of the *Classroom Measure of Active Engagement* (Sparapani et al., 2016) and Noldus Observer® Video-Pro Software (XT 14; 2017). Inter-rater agreement between the coders indicated overall good reliability, with coefficients ranging between 82–98%. We utilized latent profile analysis (LPA) to identify subgroups of interaction among students with ASD and compared models with two, three, and four profiles based on students'

communicative intentions (protesting, regulating others' behaviors, securing attention, commenting and asking questions) and the frequency they initiated communication with their peers and looked at others' faces.

Results: Preliminary findings (*n* = 63; 74% male) indicated that four patterns of social interaction best described the sample (Entropy =0.98), showing excellent overall model fit, the best fit in comparison to competing models, and strong membership probability (0.96 to 0.99). Students in subgroup 1 (5% of the sample) showed the highest frequency of comments and questions (2 SD above the sample mean) and initiated communication with peers (1 SD above). Subgroup 2 (10%) was characterized by a high frequency of protesting (3.5 SD above). Subgroup 3, the largest group (80%), was characterized by limited communication and eye gaze overall (0.5 SD below the mean). Students in subgroup 4 frequently communicated to gain a social partner's attention (4 SD above), exhibited a higher rate of communication and eye gaze overall, and frequently communicated with peers.

Conclusions: These preliminary findings indicate that patterns of social interaction form constellations that vary among students with ASD. We will run further analyses to explore the dynamic relations among profile membership, teacher discourse moves, and the quality of instructional practices. Examining the influence that profile membership may have on the nature and quality of students' educational experiences within classroom activities will provide insight into malleable features that support student engagement and help to guide educational programming for learners with ASD.

91 **169.091** The Brief Observation of Social Communication Change (BOSCC) Using Naturalistic Social Interactions for Minimally Verbal Children with ASD

S. H. Kim[1], *R. Grzadzinski*[2] *and C. Lord*[3], *(1)Psychiatry, Center for Autism and the Developing Brain, White Plains, NY, (2)Carolina Institute for Developmental Disabilities, University of North Carolina, Chapel Hill, NC, (3)University of California Los Angeles, Los Angeles, CA*

Background: The Brief Observation of Social Communication Change (BOSCC), a new treatment outcome measure, is designed to provide a standardized and efficient method of measuring changes in social and communicative behaviors in children with ASD over a relatively brief period of time (minimum of 8 – 12 weeks), observed in a naturalistic, play-based, semi-structured environment. The BOSCC offers the possibility of truly "blinded" scoring of videos by non-expert human coders. Much progress has been made in recent work on the BOSCC including the initial evidence of its strong reliability and validity (Grzadzinski et al., 2016; Kim, Grzadzinski, Martinez, & Lord, 2018).
Objectives: 1) We aim to synthesize the results from our recent work to demonstrate the initial validity and reliability of the BOSCC based on parent-child interactions (Grzadzinski et al., 2016)as well as examiner-child interactions using the standardized segments from the Autism Diagnostic Observation Schedule (ADOS; referred to as the ADOS-BOSCC hereafter) in minimally verbal children (Kim, Grzadzinski, Martinez, & Lord, 2018)as well as the work by other groups (Divan et al., 2018; Fletcher-Watson et al., 2016; Kitzerow, Teufel, Wilker, & Freitag, 2016; Nordahl-Hansen, Fletcher-Watson, McConachie, & Kaale, 2016). 2) We will also propose future directions to extend the usefulness of the BOSCC based on interactions across different adult social partners (e.g., parents vs. blind examiners) as well as varying contexts (e.g., lab vs. home).

Methods: Initial psychometric studies of the BOSCC and ADOS-BOSCC included 56 children with ASD ranging from 1-5 years of age. Inter-rater and test-retest reliability as well as convergent validity were examined. The feasibility of the BOSCC application across different social partners and settings were examined based on past and on-going studies of 72 young children with ASD.

Results: Initial studies of the BOSCC and the ADOS-BOSCC demonstrated high inter-rater and test-retest reliability (intra-class correlations ranging from 0.79-0.98) as well as strong convergent validity with measures of language and adaptive communication skills. Changes in social communication skills were observed in minimally verbal children using the BOSCC with parent-child and examiner-child interactions with medium effect sizes (Cohen's d= 0.3-0.6). A preliminary analysis based on 72 toddlers showed that the BOSCC scores obtained from the lab versus home environment did not differ significantly (t=.474, p=.492). Using a subset of children (n=49), the BOSCC scores based on examiner-child interactions were highly correlated with the BOSCC scores based on parent-child interactions (r=0.8, p<0.01).

Conclusions: The BOSCC could provide blinded observations of social communication changes in minimally verbal children with ASD under 5 years of age across different social partners and contexts with high reliability and validity. We hope to extend the usefulness of the BOSCC in future studies to further examine its strengths and limitations as well as the additive effects of the information gathered through different contexts on measuring treatment outcome.

92 **169.092** A 6-Year Trend Survey from a Childhood Autism Surveillance Program in Lagos, Nigeria

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Background:
The increased need for research to determine the burden of Autism in Africa also draws attention to the need to address the service gap and related challenges in autism care in many African countries. Stakeholder Collaboration can play roles at varying levels, a strategy which may herald the discovery of sustainable solutions which will evolve to address this challenge.

Objectives:

The report aims to describe some of the findings, processes and strengths of a stakeholder driven, community surveillance program over a period of 6 years (2013 to 2018).

Methods:

Clinical evaluation sessions held over 4-5 day periods each year. The evaluations were conducted by a multidisciplinary team of volunteers from different agencies/sectors. Assessments were made based on the DSM 5 Criteria for Autism.

Results:

The collaborative team drawn from the private sector (GTBank & NGO's), public sector and educational sector (University and other skilled volunteers) comprised multidisciplinary professionals committed to autism care. The 6-year experience had over 1050 attendees in total with varied neurodevelopmental disorders. Majorities were males with age range between 1 and 40 years

About a third were clearly not ASD (who were referred out) or had incomplete data. More than half proceeded for further evaluations each year

being: 58, 94, 134, 101, 72 & 104 consecutively.

For Majority this consultation was their first contact with formal orthodox care. Repeat attendees were noted from 2014 to 2018. This ranged between 7 and 35%. Caregiver burden was clearly evident each year amongst caregivers.

Conclusions:

This program highlights that much can be achieved through team work. In the face of scarce resources, a collaborative effort is a useful strategy to ensuring service delivery in Africa where there are little or no ASD relevant services. Monitoring, evaluation and quality assurance processes need to be continually included and reviewed in such programs going forward.

93 **169.093** A Comparison of Parent-Reported and Clinician-Reported Measures of Autistic Traits in Bilingual and Monolingual Autistic Children

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Background: There is a growing literature on the cognitive profile of bilingual speakers and its unique advantages and disadvantages. Current evidence suggests that bilingualism confers advantages in the area of executive function, specifically attention control, inhibitory control and cognitive flexibility (Bialystok & Majumder, 1998; Bialystok, 1999; Bialystok, 2003; Bialystok & Viswanathan 2009; Kovacs & Mehler, 2009; Carlson & Meltzoff, 2013). However, evidence from the language development of bilingual children suggests that exposure to more than one language may results in delays in first word acquisitions, compared to monolingual children, (Meisel, 2004) and smaller overall vocabulary size (Ben-Zeev, 1977). In light of the latter evidence, parents of children with primary language impairment or other communication difficulties such as autism have historically often been advised to restrict the language input to one language (Juarez, 1983; Thordardottir, 2002; Kremer-Sadlik, 2005). While evidence is converging that multilingual environments are not detrimental to development in ASD (Uljarevic et al, 2017), it is poorly understand how the convergence between differences in bilingual and autistic language development may impact assessments and interventions for autistic bilingual children.

Objectives: To perform an explorative investigation of parent-reported and clinician measures of autistic symptomatology in bilingual and monolingual children with ASD.

Methods: ADOS and parental SRS data were collected as part of a multi-centre intervention study (Bieleninik et al 2017; TIME-A consortium) and included 45 children with autism raised in a multilingual environment and 319 (314 for the SRS) monolingual children with autism. All children were between the ages of 4 and 7 (mean age = 5.4 years, sd ± 0.99). Multilingualism was identified by the researcher working with the particular child and based on whether the child was exposed to more than one language in their home environment.

Results: Preliminary analyses show that the mean SRS scores for bilingual children were marginally lower (152.31) than for monolingual children (160.53) (p=0.074), indicating less pronounced parent-reported autistic symptoms. On the other hand, ADOS Social Affect scores in the bilingual children were higher (15.84), compared to the monolingual children (13.49) (p=0.001). The differences were primarily the language and communication items (A1-A8) and a few social items (smiling, facial expressions and requesting). Advanced statistical analyses will be reported by the time of the conference.

Conclusions: While the severity of symptoms reported by parents on the SRS was not significantly different between the groups, the ADOS results from the clinicians suggested a higher level of autistic symptoms in the multilingual group. Importantly, the differences seem to arise from items measuring the language and communication of the child, suggesting that additional factors might have to be taken into consideration when clinicians do not have access to all of the languages spoken or comprehended by the children. Further understanding of how the interaction between bilingualism and autism may impact parent reporting and clinical assessments of autism should be our next research priority, to ensure that the currently available tools are appropriate for autistic bilingual individuals.

94 **169.094** A Comprehensive Psychometric Analysis of Factor Models of the Autism-Spectrum Quotient Using Two Large Samples: Model Recommendations and the Influence of Divergent Traits on Total-Scale Scores

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Background: Similar to clinically-diagnosed autism, autistic traits observed in the neurotypical population are heterogeneous. Psychometric measures of autistic traits, like the 50-item Autism-spectrum Quotient (AQ; Baron-Cohen et al., 2001), take this into account by providing scores on individual trait dimensions in addition to total-scale scores.

However, currently the factor models used for the AQ are diverse. This is an issue for researchers who use the AQ on two levels. First, inconsistencies are created as notionally similar dimensions have been defined in different ways. For example, there are at least ten different ways in which a 'social ability' factor has been defined using the AQ. Second, differences in the models also result in differences in the relationships between factors. Critically, a psychometrically sound model could contain some factors with low inter-correlations, suggesting significant heterogeneity between trait dimensions which would question the interpretability of total-scale scores.

Objectives: Our aim was to conduct a comprehensive large scale psychometric review of existing factor models of the AQ. This would serve to 1) provide guidance as to which models are and are not viable for research purposes, and 2) provide evidence as to whether total-scale scores are adequately interpretable for research purposes, or whether researchers should restrict themselves to observing and comparing individual differences on specific dimensions.

Methods: A series of confirmatory factor analyses were conducted on ten competing AQ factor models. We fitted each model separately to large samples of English-speaking undergraduate students (n = 1702) and individuals from the general population (n = 1280) to obtain indices of psychometric fit. Inter-factor correlations were also calculated for each model to assess the heterogeneity of the factors. Finally, the model that demonstrated the best fit indices was subject to a multi-group factorial invariance analysis, to determine if it showed comparable fit between the undergraduate and general population samples, and an analysis of internal consistency that accounts for inter-factor correlations.

Results: The 28-item three-factor model proposed by Russell-Smith et al. (2001) demonstrated superior fit indices across both samples.

Furthermore, the multi-group factorial invariance analysis indicated that the model fit both samples comparably, suggesting that it is appropriate for use in both samples. Inter-factor correlations for the model varied from weak-negative to moderate-positive. Whilst internal consistency of each of the factors was adequate, internal consistency for the full 28-item scale estimated using coefficient omega hierarchical was poor.

Conclusions: Based on our comprehensive analysis of the existing AQ factor models, we recommend that researchers interested in using the AQ to examine individual trait dimensions use the Russell-Smith et al. (2001) three-factor model, as this model showed the best psychometric fit and internal consistency of the individual factors.

Given that this model excludes a substantial proportion of items on the AQ (indicative of the heterogeneity of these particular items), that some of the inter-factor correlations of this model are low, and that internal consistency of full 28-item scale is relatively poor, we caution researchers against using total-scale AQ scores and instead encourage the use of individual factor scores.

95 **169.095** A Computer Administered Autism and Developmental Disorder Screen for Toddlers (CAADST) Efficiently Improves Identification at the 18-Month Pediatric Visit

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Background:

To achieve early identification, “autism specific” screening is recommended by the American Academy of Pediatrics (AAP) at both 18 and 24-month visits. The Modified Checklist for Autism in Toddlers- Revised (M-CHAT-R) screen has been shown to require a follow-up interview (M-CHAT-R/F) (Kleinman, 2008) and may be less accurate at the 18-month visit than 24-months (Pandey, 2008) (Sturner, 2017). Preliminary data suggested that algorithms of individualized item presentation with computer assisted administration and scoring may improve accuracy for younger toddlers. The AAP also recommends screening for other developmental disabilities at the 18-month visit using a “broadband developmental screen”. It has been suggested that “autism specific” and “broad band” items may have overlapping clinical value when considered together. Yet the predictive performance of combined screening has not been examined when screen positive cases as well as screen negative children are considered.

Objectives:

To develop optimal decision trees of parent administered items to improve the accuracy of detecting autism and other developmental disorders at the pediatric 18-month visit.

Methods:

Parents of 11,878 children 16-20 months old completed the M-CHAT-R before 18-month pediatric visits via an online system (CHADIS). Positive screens (96) and practice matched controls (314) were recruited and parents completed additional items derived from prospective studies of autism outcomes that showed promise for identification of autism (First Years Inventory (FYI); Parents Observation Checklist [POC]; MacArthur-Bates Communicative Development Inventory; Parent Observation of Social Interaction (POSI)). The children had diagnostic autism evaluations using the Autism Diagnostic Observation Schedule- Toddler version and Mullen Scale of Early Development with clinical impression of autism considered to be a positive for autism. Developmental disorder (DD) was defined as the typical entry criteria for early intervention services (score >1½ SD below the mean on >=2 subscales or >2 SD on 1 subscale). Optimized decision trees for predicting autism and DD diagnoses were created through application of recursive partition models (CART) of the potential predictor variables using a random selected subset of the dataset and tested with the holdback sample resulting in decision rules (Computer Assisted Autism and Developmental Screen for Toddlers or CAADST) for presenting varying numbers (7 to 21) of items to subgroups of parents.

Results:

ROC analyses of CAADST showed improved sensitivity (0.92) compared to both M-CHAT-R/F (0.27); M-CHAT-R (0.62) and M-CHAT-R + ASQ (0.75) and higher Negative Predictive Values (NPV; 0.92 compared to M-CHAT-R (0.76); M-CHAT-R/F (0.68); or M-CHAT-R + ASQ (0.81); with lower rates of specificity (0.60 vs 0.93) and PPV (0.56 vs 0.70) compared to M-CHAT-R/F but similar specificity and Positive Predictive Value (PPV) to both M-CHAT-R and M-CHAT-R + ASQ.

Conclusions:

An algorithm for computer administered parent report items correctly identified more toddlers with autism and/or developmental disorder with greater certainty that a child with a negative screen does not have a problem than the standard combination of broadband and autism specific tools in a community sample using fewer items and no follow up interview.

96 **169.096** A New Adult Screening Measure for Autism, an International Collaborative Project and Initial Results

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Background:

Despite increasing rates of autism diagnoses among children, evidence suggests that many adults with autism remain undiagnosed. Internationally, adults seeking diagnostic evaluations are sometimes screened with tools originally designed for children or adolescents, or that were designed as measures of autistic traits in the general population. Due to the proprietary nature of some tools, assessments can also be expensive, even in places with universal healthcare.

Objectives:

The aim was to make a free adult autism screening measure with collaboration from those with autism and other stakeholders. All participants took a preliminary version of the questionnaire and could offer feedback on items and wording.

Methods:

An English language questionnaire was made, based on the type of difficulties commonly experienced by autistic adults. As the autism spectrum

includes those who may not use spoken language or may have intellectual challenges, adult siblings, parents, care workers and others with extended close contact with an autistic person were invited to participate. To increase participation from several countries, social networking was used. There were 32 items focusing on typical areas of struggle for autistic adults. For most questions, the participant was given age ranges to indicate when the difficulty was first noticed: 2-5, 6-12, or 13 and older; never; or that the difficulty was no longer an issue. There were four open ended questions addressing difficulties with language, other medical diagnoses, mental health diagnoses and whether additional questionnaire items might be needed.

Results:

Participants were 780 adults (81% autistic). By age, 42% were between the ages of 18-24, 28% were 25-33, 19% were 34-45, and 9.5% were 46-60. Participants were from 25 countries, including all predominately English-speaking countries, several EU countries, India, Pakistan, Japan, Israel, South Africa and Brazil. Each open-ended question received several hundred responses.

For 27% of respondents, recognizing people by face was noticed as a struggle, and somewhat of a struggle for 40%. Anxiety or worry emerged as a struggle for 35.4% between ages 2-5; only for 2.5% was it never an issue. For 2.3%, suicidality began between the ages of 2-5, and for 21.4% it began between 6-12. Feelings of isolation for 23.5% began between the ages of 2-5, and for 40% of participants, it began between the ages of 6-12. Post-traumatic stress disorder was reported by 207 participants.

Full measure and responses with gender breakdown for male, female and non-binary will be presented, as well as analysis of qualitative responses.

Conclusions:

We believe this measure can aid with the differential diagnosis in autistic adults. The items together have the ability to characterize clinically important difficulties beyond DSM diagnostic criteria, such as isolation, anxiety, suicidality, prosopagnosia, academic issues, sensory issues and more. In our sample, autism in adults coincides with prosopagnosia in two-thirds of respondents, and with self-report of suicidality in almost a quarter in the teen years. The adult perspective on autism herein provided may also aid in guiding treatment plans for a younger cohort with this diagnosis.

97 **169.097** A Practical Model for ASD Screening By Eye Tracking: Combined Fixation on Human Faces and Pupillary Light Responses (PLR)

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Background: As a country with huge population and limited experienced pediatric psychiatrists on ASD, China has the need for auxiliary diagnostic technique on ASD to do large scale screening. In the field of early ASD detection, there are some prominent achievements in research, but few of them are turned into practicing, especially in China.
A.Klin and W. Jones who were the first using eye tracking for ASD research found 12-month high-risk ASD babies showed different interests on eyes and mouths. Pupillary Light Response (PLR) was another biomarker that was proved to be efficient in identifying ASD and TD.

Objectives: The goal is to design a practical model for ASD screening on children of 3-6 years old by eye tracking technique, the model features come from two experiments with different paradigms of fixation on human faces and pupillary light response (PLR).

Methods: The experiments use SMI desktop eye tracking system with frequency 250Hz. Experiment I consist of 12 pictures of human faces in same size and luminance with different gender and age. Starting with a 10 second black picture, 12 pictures were showed continuously with 5 seconds on each. Fixation time on Area of Interest (AOI) of eyes, mouths, and faces were collected, as well as pupillary data. Experiment II also consists of 12 pictures, but with 6 black and 6 white pictures. Starting with a 10 second grey picture, one black and one white picture were showed alternately. Pupillary data were collected. Data were analyzed later in SPSS and MATLAB.

53 ASD and 51 TD children of 3-6 years old were recruited. 34 ASD children passed the test on calibration of Eye Tracker and double checked by CARS (Child Autism Rate Scale). After deleting invalid data, 73 subjects with 26 ASD and 47 TD were left. Data from the 73 subjects were split into two sets of train and test. The train set has 36 subjects with 13 ASD and 23 TD, while the test set has 37 subjects with 13 ASD and 24 TD. The train set was used to train the model, and the test set was used to evaluate the performance of the model.

Based on the data of experiment I and experiment II, feature extraction and selection were carried out respectively. Two independent classifiers were constructed, whose outputs were combined for final results. ASD/TD decision was made only if output I and output II both gave ASD/TD judgement, otherwise no decision was made. Please refer to attached flow chart.

Results:

By applying the data of test set to the model, it showed a ratio of 73% on valid prediction for the 37 subjects, while no decision for the remaining 27% of the subjects. Among the valid predictions, the precision rate on ASD is 100%, and the precision rate on TD is 94.73%.

Conclusions: The model can be used for ASD screening on 3-6 years old children.

98 **169.098** A Six-Minute Measure of Canonical Babbling Status to Identify ASD in Toddlers

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Background: To improve our ability to identify autism spectrum disorder (ASD) early in development, we need objective, reliable, and accessible measures. Previous work by Patten and colleagues (2014) suggests that early vocal patterns may provide a window into diagnostic status as early as 9-12 months. Patten and colleagues used retrospective home-videos to look at canonical babbling ratios (CBR), or speech-like utterances relative to all vocalizations. Here we investigated whether CBR as measured during a standardized six-minute presentation of videos on a tablet in primary care settings can be used to identify ASD status.
Objectives: (1) To determine whether CBR can be assessed during a short video presentation, and (2) To assess whether CBR can be used to discriminate diagnostic status for ASD.

Methods: Typically developing children (TD), children with language or developmental delays (DLD), and children with ASD were recorded using the camera in a tablet while they watched six minutes of videos selected to elicit behaviors associated with ASD during their 18- or 24-month well-child visits. Videos from thirty-nine children (ASD: *n* = 16, 3 male, *M* = 26.4 months, *SD* = 4.2; TD: *n* = 16, 3 male, *M* = 26.1 months, *SD* = 2.6; DLD: *n* = 7, 4 male, *M* = 24.9, *SD* = 2.6) were coded offline in realtime for canonical babbling based on the methods and canonical babbling status of CBR >.15 used by Patten et al. (2014).

Results: All but three participants (2 TD, 1 DLD) vocalized during this procedure, allowing for calculation of CBR for 36 children. A one-way ANOVA showed a significant effect of diagnostic status on CBR, F(2,33) = 6.96, p = .003, driven by the difference between ASD and TD participants (*p* = .002). Whereas 86% of TD and 83% of DLD children had achieved canonical babbling status, only 44% of children with ASD had CBR > .15. Odds ratio for the likelihood of ASD diagnosis given canonical babbling status for ASD and TD participants was 7.71, *p* = .002 (95% CI: 1.28 to 46.36). See Figure 1.

Conclusions: These results suggest that canonical babbling status can be measured in a short period of time in the context of a video presentation in a routine clinical setting. Further, they lend support to previous findings that CBR can help identify diagnostic status of children with ASD early in development. Given the small sample, replication will be necessary to confirm the generalizability of these findings. Future efforts will explore automatization of coding of vocalizations for increased accessibility.

99 **169.099** A Social Motivation and Competency Scale for ASD: Confirmatory Factor Analytic Structure and Measurement Invariance of Quantitative Socialization Traits

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Background: The constructs of social motivation and competency are primary considerations when attempting to understand and target the interpersonal vulnerabilities inherent in autism spectrum disorder (ASD). Social motivation is particularly pivotal, as the desire to engage provides the experience necessary to increase social competencies and can yield favorable social experiences to further increase motivation (Chevallier et al., 2012). To successfully implement social intervention efforts, it is critical to understand each participant's unique profile of social motivation and associated competencies (Vernon et al., 2016). To date, qualitative judgements of these constructs have been the default strategy for individualizing autism intervention approaches; no measurement scale currently exists that attempts to quantify these attributes in a single instrument.

Objectives: The objective of the current study is to provide initial validation of a Social Motivation and Competency Scale (SMCS) as a parent- and self-report measure designed for youth and young adults with ASD through the use of confirmatory factor analysis.

Methods: The Social Motivation and Competency Scale (SMCS) is a 26-item measure that assesses an individual's motivation and competency in social communication situations. Separate parent- and self-report versions were developed with identical item content. Items pertaining to comfort in social interaction, conversation skill use, empathy, friendships, appropriate behavior, social contact, and social interest are rated on 1-5 Likert scales. A sample of 200 participants (108 teens and adults with ASD and 92 parents) completed the SMCS as part of a larger intervention study. Confirmatory factor analysis, internal consistency, model fit indices, factor loadings, and between-factor correlation matrix were conducted to determine construct validity.

Results: Results of the CFA on the total sample indicated that the two-factor model showed adequate fit across indices with the exception of CFI where fit was approaching adequacy (CFI=.896). Factor loadings for both factors were adequate and statistically significant (p < .001) with all loadings >.48. Comparing the configural confirmatory factor analysis model to the model with metric invariance across groups, there was a significant increase in model misfit ($\Delta\chi2$ (474, *N*=200)=928.12, *p*<.001) based on chi-square difference test, suggesting that the factor loadings are not equivalent across groups. We did not establish invariance across the child and parent groups.

Conclusions: We found that the two-factor structure of the SMCS proposed by the creators had adequate fit for the overall sample and child group. Being able to easily measure these two constructs has important future implications, as being able to understand baseline levels of these characteristics can help inform which specific areas of social skill to target for optimal outcomes. Although we failed to establish invariance between child- and parent-reports, these results are not surprising when theoretically examining why individuals with ASD and their caregivers might view these constructs differently. Future directions will examine the factor structure of the SMCS in a larger population and can also serve to collaborate with other researchers to identify indicators that more sensitively measure motivation and competency across raters so that accurate measures of these domains can be established and compared.

100 **169.100** A Systematic Review of Research Involving ASD Screening Tools: A Roadmap for Modelling Progress from Basic Research to Population Impact

P. Doehring*, ASD Roadmap, Chadds Ford, PA*

Background: Concerns about ASD's prevalence and delays in diagnosis mobilized $2.5 billion in research funding in the United States between 2008 and 2015. Yet recent reports indicate persistent and significant gaps in timely and accurate identification. We recently reviewed all projects funded through the National Institutes of Health from 2008 to 2013 focused on ASD identification. Only 9 projects (or 1% of total NIH funding for ASD research) focused on improving ASD identification among community providers. Do these apparent gaps in research funding in the United States reflect broader gaps in translating research into community practice? To understand these gaps, we have piloted a research roadmap for improved ASD identification that tracks progress from knowledge gained through basic research to demonstrated impact across large, diverse populations. Other presentations submitted to IMFAR demonstrate patterns of funding over time that are consistent with the roadmap.
Objectives: To further define a research roadmap for achieving large scale improvements in ASD identification, by evaluating its utility in capturing publication gaps and trends over time for one specific body of work: clinical and implementation research on ASD screening using the Checklist for Autism in Toddlers (CHAT) and its variants.

Methods: We defined the major categories of the roadmap (Basic and Applied Research) and sequentially-related subcategories of the latter (Clinical, Implementation, and Other Applied Research). We further defined each subcategory with respect to specific sub-types, objectives, and milestones for research. We conducted electronic database searches for all peer-reviewed publications involving the the development, validation,

or implementation of the CHAT or its variants. In Phase 1, we reviewed abstracts to eliminate articles that are not relevant, and assigned those remaining to subcategories of the roadmap. Full-text reviews currently underway in Phase II will involve more detailed coding of sub-types, objectives, and milestones.

Results: An initial review of almost 200 abstracts from 1992 to 2018 yielded more than 110 relevant research studies involving the CHAT and its variants. More than 80% were classified in Phase I as clinical research studies (e.g., exploring the tool's usefulness with different populations, evaluating a new variant or translation, and so on). Fewer than 20% were classified as implementation or other applied research, with most assessing potential barriers rather than seeking to overcome them. Few studies explored the tool's utility outside of medical settings, or its potential to improve rates of timely and accurate ASD identification across a designated region. Trends over time in publications of clinical and implementation research are consistent with the roadmap.

Conclusions: A systematic review of 25 years of clinical and implementation research involving the CHAT and its variants demonstrates the utility of the research roadmap in charting progress. The relative lack of emphasis on implementation research - especially research addressing implementation barriers - may begin to explain persistent gaps in timely and accurate identification, and help to reshape research priorities.

101 **169.101** Implementation Research Designed to Improve ASD Identification: A Comprehensive Review of Projects Funded in the US from 2008 to 2015

***P. Doehring**, ASD Roadmap, Chadds Ford, PA*

Background: Concerns about ASD's prevalence and delays in diagnosis mobilized $2.5 billion in research funding in the United States between 2008 and 2015. Yet recent reports indicate persistent and significant gaps in timely and accurate identification. We recently reviewed all projects funded through the National Institutes of Health from 2008 to 2013 and focused on ASD identification. We found only 9 projects (totaling $10 million, or 1% of total NIH funding for ASD research) focused on improving ASD identification among community providers, and few Principal Investigators (PIs) with extensive community experience. How could research lead to widespread improvements in identification? Have funders prioritized the implementation research needed to translate recommendations from research into community practice? Have the resulting projects achieved their stated goals?

Objectives: To review the level of funding and progress evident with respect to implementation research designed to improve ASD identification among community providers across the US between 2008 and 2015, and any possible relationship to the training and experience of the PIs. This review utilizes a new research roadmap (submitted separately to IMFAR) for improved ASD identification that tracks progress from basic research to population outcomes, with Implementation Research as one distinct stage.

Methods: We downloaded information on all research projects addressing ASD identification between 2008 and 2015 in the Autism Research Database (ARD). We identified projects focused on Implementation Research (i.e., seeking to demonstrate effective training of community practitioners, to identify and close gaps in community implementation, or to scale up programs of implementation) by reviewing principal aims of all projects not assigned in the ARD to categories clearly associated with basic research. We are also classifying the principal outcomes of the resulting publications on the research roadmap, and reviewing the resumes of PIs for evidence of clinical training and experience.

Results: Of 399 research projects focused on ASD identification funded for $278 million between 2008 and 2015, the majority (220) were assigned to categories in the ARD associated with Basic Research. Project summaries were available for 156 of the remaining 179 projects. A detailed review of the principal aims revealed 14 projects potentially involving Implementation Research, totaling $9 million (or 3% of all funds allocated to improve ASD identification). Allocations over time supported the research roadmap, with increasing emphasis on implementation research in later years. Analyses of the associated publications, training, and background of the 14 PIs are underway. Preliminary results suggest that most PIs have little or no experience delivering services in community settings.

Conclusions: Little research funded between 2008 and 2015 to improve ASD identification appears to have focused on improving implementation in community settings, and additional analyses underway will clarify whether the projects funded actually achieved their stated aims. The relative lack of focus on implementation research, compounded by the limited experience of project PIs, may begin to explain how gaps in identification have persisted despite significant investments in ASD research. Progress captured by the research roadmap suggests, however, an increasing focus on implementation research in future years.

102 **169.102** Research Grants to Develop Tools to Improve ASD Identification: A Comprehensive Review of Projects Funded in the US from 2008 to 2015

***P. Doehring**, ASD Roadmap, Chadds Ford, PA*

Background: Concerns about ASD's prevalence and delays in diagnosis mobilized $2.5 billion in research funding in the United States between 2008 and 2015. Yet recent reports indicate persistent and significant gaps in timely and accurate identification. We recently reviewed all projects funded through the National Institutes of Health from 2008 to 2013 and focused on ASD identification. We found only 9 projects (totaling $10 million, or 1% of total NIH funding for ASD research) focused on improving ASD identification among community providers, and few Principal Investigators (PIs) with extensive community experience. How could research lead to widespread improvements in identification? Have funders prioritized the development of clinical tools for identification, and have the resulting projects achieved their stated goals?

Objectives: To review the level of funding and progress evident with respect to clinical research designed to improve tools for ASD identification across the US between 2008 and 2015, and any possible relationship to the training and experience of the PIs. This review utilizes a new research roadmap (submitted separately to IMFAR) for improved ASD identification that tracks progress from basic research to population outcomes, with Clinical Research as one distinct stage.

Methods: We downloaded information on all research projects addressing ASD identification between 2008 and 2015 in the Autism Research Database (ARD). We identified projects focused on Clinical Research (i.e., seeking to develop, validate, improve, or extend tools or protocols for ASD screening or diagnosis) by reviewing principal aims of all projects not assigned in the ARD to categories clearly associated with basic research. We are also classifying the principal outcomes of the resulting publications on the research roadmap, and reviewing the resumes of PIs for evidence of clinical training and experience.

Results: Of 399 research projects focused on ASD identification funded for $278 million between 2008 and 2015, the majority (220) were assigned

to categories in the ARD associated with Basic Research. Project summaries were available for 156 of the remaining 179 projects. A detailed review of the principal aims revealed 32 projects potentially involving Clinical Research, totaling $34 million (or 12% of all funds allocated to improve ASD identification). Allocations over time supported the research roadmap, with increasing emphasis on more advanced clinical research in later years. Analyses of the associated publications, training, and background of the 28 PIs are underway. Preliminary results suggest that most PIs have little or no experience supervising the delivery of clinical services outside of specialized university or hospital settings.

Conclusions: Little research funded between 2008 and 2015 to improve ASD identification appears to have focused on improving tools for ASD identification, and additional analyses underway will clarify whether the projects funded actually achieved their stated aims. The relative lack of focus on clinical research, compounded by the limited experience of project PIs, may begin to explain how gaps in identification have persisted despite significant investments in ASD research. Progress captured by the research roadmap suggests, however, an increasing focus on clinical research in future years.

103 **169.103** An Item Response Theory Evaluation of the Autism Diagnostic Interview-Revised (ADI-R)

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Background: Early and accurate diagnosis of autism spectrum disorder (ASD) is essential for access to interventions and subsequent improvement in children's outcomes (Itzchak & Zachor, 2011; Stone & Yoder, 2001). Yet, the Autism Diagnostic Interview- Revised (ADI-R; Rutter, Couteur & Lord, 2003), one component of the gold standard assessment, has been shown to have reduced diagnostic agreement with clinical impressions across contexts (de Bildt et al., 2015; Zander, Sturm, and Bolte, 2015). There is additional evidence that parental factors such as level of ASD concern can may be related to the sensitivity of the ADI-R (Havdahl et al., 2017).

Objectives: This study aims to determine if the age at which parents were first concerned about their child's development influences their report of their child's ASD symptoms on the ADI-R.

Methods: A sample of 3557 individuals with ASD (Mage= 101.15(46.25), 79% Caucasian), was culled from two large national data repositories (NDAR and Simons Simplex Collection). A categorical variable representing parental concern was created: early (first concern before 12 months of age), average (first concern between 12 and 36 months) and late (first concern after 36 months). Differences between the three time of concern groups on ADOS severity scores and age were tested using a one-way analysis of variance (ANOVA). Factor structure of the ADI-R was evaluated using exploratory factor analysis with half the sample, followed by confirmatory analyses to cross-validate findings with the second half. To compare groups on the latent variables, multiple group models were tested including non-verbal IQ as a covariate to identify items that showed statistical redundancy and confirm the overall similarity of the groups across latent traits. Differential item functioning using item response theory was then applied to examine ADI-R item bias between the three timing of concern groups following procedures of Hansen et al (2014).

Results: There were minimal group differences on ADOS severity and age between concern groups (h^2 = .004; h^2 = .02 respectively). A two-factor structure representing social communication (SC) and restricted and repetitive behavior (RRB) domains was found to best fit the data (RMSEA= .056, CFI= .958, TLI= .955).

Six items demonstrated substantial statistical redundancy (i.e., local dependence) with other items and were excluded from evaluation of factor mean differences. These items were adjacent to each other on the test form (e.g. items 30 and 31). The latent variable means for the SC and RRB factors were higher in the early concern group compared to the late concern groups (.69 and 1.22 SD higher, respectively). The same pattern was observed when NVIQ was included as covariate (.37 and 1.05 SD higher), despite no group differences on ADOS scores. Eleven SC domain items and three RRB domain items were biased (i.e., DIF) based on parental concern group.

Conclusions: This study demonstrates that the timing of initial parent concern about their child's development influences parents' item-level responses on the ADI-R. This suggests that excluding items with item bias by age of concern may strengthen the independent diagnostic accuracy and precision of the ADI-R.

104 **169.104** Application of the Brief Observation of Social and Communication Change (BOSCC) to ADOS Assessments in the Preschool Autism Communication Trial

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Background:

Commonly used outcome measures in autism intervention trials are often insensitive to subtle, yet meaningful, changes in the child's social and communication behaviours. The BOSCC has been recently developed with the aim of providing a more sensitive tool. This study is among the first to retrospectively apply the adapted BOSCC-for-ADOS scheme to ADOS assessments from a previously conducted trial. The Preschool Autism Communication Trial (PACT) is the largest trial the BOSCC has yet been reported on.

Objectives:

To explore the psychometric properties of the BOSCC as applied to ADOS assessments in the Preschool Autism Communication Trial.

Methods:

The study included 152 children (aged 2-4 years 11 months) with a diagnosis of core autism. 117 children (77.0%) were ADOS module 1 and 35 children (23.0%) were module 2. The BOSCC was scored from recordings of the ADOS assessments from the PACT study. The BOSCC module 1 scheme was applied to all children.

Results:

Item distributions

Most social and communication items had a good spread of scores with some skew observed on items related to vocalisations, most likely on account of the characteristics necessary for eligibility. Restricted and repetitive behaviours (RRB), mannerisms and unusual sensory interests were skewed items, in line with previous research. The spread and overall pattern of distribution did not change when module 2 children were removed.

Inter-rater reliability

Four coders scored 15 videos. Intra-class correlations demonstrated high reliability across total scores: total score 0.93 (95% CI: 0.85-0.97), social and communication subscale 0.93 (0.84-0.97) and RRB subscales 0.82 (0.66-0.92).

Correlations – cross-sectional (baseline)

The BOSCC social communication subscale score strongly positively correlated with the ADOS communication and social score (r = 0.72, p <.001). The BOSCC RRB subscale was more moderately positively correlated with the ADOS RRB subscale (r = 0.46, p < .001). The BOSCC total score was weakly correlated with the ADOS CSS score (r = 0.33, p <.001).

Factor analysis

We conducted a confirmatory factor analysis using all Core items (Items 1-13) to test the two-factor model (SC and RRB) identified in previous literature. Our model fit was poor with root mean square error approximation (RMSEA) of 0.130 and comparative fit index (CFI) of 0.85. In line with previous literature, RRB items had lower factor loadings.

Correlations – change (TAU group only)

BOSCC total score change weakly correlated with ADOS CSS change (r = 0.35, p<.004). This is in line with previous research.

Sensitivity analyses

Analyses with module 2 participants removed did not change the interpretation of results.

Conclusions:

The BOSCC-for-ADOS when applied to a large group of children with core autism with minimal language, provides a good spread of scores across items, reliable coding and correlates in the expected directions with the ADOS in line with previous research. Potential reasons for the poor fitting factor analysis will be discussed.

105 **169.105** Are Visuospatial Strengths Observable in Autistic Preschoolers with Aggravating Symptoms?

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Background: Adult autistic people (Caron, Mottron, Berthiaume, & Dawson, 2006) and school-age children (Van der Hallen, Chamberlain, de-Wit, & Wagemans, 2018) present strengths in various visuospatial tasks. Courchesne et al. (2015) demonstrated a similar profile in minimally verbal preschool children. However, no studies have examined the presence of visuospatial strengths in minimally verbal preschool children with behavioral difficulties that negatively impacting their adaptation to their physical and social environment. As a result, specialized services for this population do not use the strengths of these children in intervention.

Objectives: To document the presence of visuospatial strengths in autistic preschool children with associated conditions aggravating their adaptation. An exploratory study.

Methods: Ten autistic children (31 to 51 months of age) admitted in Day Hospital Services for major food selectivity, sleep difficulties, aggressivity or self-injury participated in the present study. The severity level according to the DSM-5 was established between 2 and 3 for all children by a child psychiatrist. Verbal language level was measured by Mc Arthur, Reynell or CELF according to their chronologic age and ADOS-2 module used in the diagnostic evaluation process. Non-verbal intelligence was assessed with the Preschool Embedded Figure Test (*PEFT*; Witkin, Oltman, Raskin, & Karp, 1971). A descriptive statistical analysis provided a group portrait of the participants regarding their performance on the PEFT and their developmental age in terms of oral language.

Results: All but one child presented a major speech onset delay (developmental speech level: 16.5 months (SD=11.2). Six children could complete the PEFT. The average number of successful items was 16.75 on 24 (SD=2.99) for four 3 years old children and 16.5 on 24 (SD=3.54) for two 4 years old children. This performance outranged that of the normative sample (10.58, SD=4.93 and 12.87, SD= 3.43 respectively). A t-test revealed a significant difference between groups at 3 years old (t=2.41; p=0.02), while it was not significant at 4 years old (t=1.47; p=0.15).

Conclusions: Non-verbal autistic children with major aggravating symptoms present a superior performance in target detection in the same extent as those without such symptoms. The next step of the present study will consist in testing interventions addressing these symptoms using their specific strengths.

106 **169.106** Does the Factor Structure of IQ Differ between the DAS-II Normative Sample and Autistic Children?

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Background: Intellectual disability commonly co-occurs with ASD, and the DAS-II (Differential Ability Scales, 2nd Edition) is frequently used as part of an intellectual disability assessment in school-age children with ASD. Like most IQ assessments, the DAS-II was developed with a nationally representative normative sample. Despite widespread use, it remains unknown whether the normative DAS-II measurement model (e.g., factor structure, loadings) holds for the autistic population (Wicherts, 2016). In other words, it is not known if the DAS-II measures the same construct in the same way for autistic and neurotypical children. If not, then the often discussed "IQ splits" in ASD (e.g., high matrix but low verbal similarities subtest scores, Nowell et al., 2015; Klin et al., 2005; Seigel et al., 1996) might be due to measurement bias and artifacts rather than intelligence (Thompson, 2016). Thus, measurement invariance requires that the relationship between DAS-II scores and the latent construct of intelligence should not be affected by autism (Thompson, 2016; Wicherts & Dolan, 2010).

Objectives: To determine whether the normative structure of the DAS-II, which influences score calculation and interpretation, holds in individuals

with ASD.

Methods: We obtained the raw DAS-II normative data for 2,400 individuals, as well as the raw DAS-II data from the Simons Simplex Consortium (SSC) for 1,317 autistic individuals and a replication sample of 416 autistic individuals from The Children's Hospital of Philadelphia's Center for Autism Research (CAR). Using the three-factor structure specified in the DAS-II technical manual as a baseline model, we combined normative and SSC datasets for multigroup confirmatory factor analyses to assess how well that measurement model fit both samples (Chen, Sousa, & West, 2005). We analyzed configural invariance (subtests loading on the same factors for each group), metric invariance (subtests loading at equal levels between groups), and scalar invariance (mean subtest scores equal across groups). Additional analyses including subtest correlations, exploratory structural equation modeling, and replication with the CAR ASD sample will be completed by May 2019.

Results: Both normative and ASD sample data showed excellent fit with the 3-factor model (normative: CFI=1.000; TLI=1.000; RMSEA=0.000; ASD: CFI=0.998; TLI=0.995; RMSEA=0.034). The configural and metric models showed excellent fit (CFI>0.995, TLI>0.995, RMSEA<0.025), but the scalar model showed a decrease in fit statistics (ΔCFI=0.010; ΔTLI=0.016; ΔRMSEA=0.038) that exceeded recommended thresholds (ΔCFI<0.010 or ΔRMSEA>0.010; Chen, 2007), suggesting measurement bias. A likelihood ratio test confirmed significantly worse fit of the scalar model compared to metric and configural models (metric: $\chi^2(5)=107.7$, $p<0.00$).

Conclusions: Preliminary analyses suggest only weak factorial invariance (i.e., configural and metric, not scalar invariance) and measurement bias in autistic DAS-II scores. Although the factor structure and loadings do not vary significantly between groups, the pattern of subtest means does; consequently, the lower mean DAS-II subtest scores of the autistic population cannot be attributed only to lower levels on the latent constructs of verbal, nonverbal, or spatial intelligence. These results have important clinical implications, namely that artifacts may influence DAS-II scores for autistic patients. Recommendations for appropriate interpretation of DAS-II scores from children with ASD will be discussed.

107 **169.107** Gender Differences in Vineland Domain Scores in ASD

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Background:

An understanding of gender differences in the presentation of ASD has important implications for tailoring assessment measures to the potentially unique presentations and needs of males and females. Adaptive behavior, which was incorporated into DSM5 criteria for the establishment of an ASD diagnosis, is a crucial area of assessment for individuals with autism spectrum disorder (ASD). Saulnier and Klin (2007) found no relationship between verbal IQ scores, severity of autism and adaptive functioning in older higher functioning children with ASD, supporting the necessity for including the assessment of adaptive functioning when evaluating ASD, as higher cognitive ability is not always related to real-life adaption. Paul et al. (2004) and Szatmari et al. (2015) found discrete correlations among Vineland domain scores and autism symptomatology by analyzing Vineland age equivalent scores rather than standard scores. Hartley and Sikora (2009) investigated gender differences in the presentation of ASD and found no differences in adaptive functioning in toddlerhood. The present study extends these studies by assessing older, newly-diagnosed ASD and IQ matched school-aged boys and girls using age equivalent domain scores as a method of identifying gender differences in adaptive functioning in ASD.

Objectives:

The aims of this study are (1) to examine similarities and differences in adaptive functioning in school-aged, newly-diagnosed boys and girls; (2) to investigate relationships between domain scores, autism severity, and behavior profiles in later diagnosed boys and girls with ASD.

Methods:

Participants included 30 newly-diagnosed school-aged children (M=9.378; SD=2.4; boys M=9.04; SD=1.83; girls M=9.53; SD=2.22) who are part of a larger study focused on comparing gender differences among children who receive a diagnosis of ASD for the first time when they are school-aged and those diagnosed as toddlers/preschoolers. A complete diagnostic evaluation included assessing intellectual and adaptive functioning, characterization of autism symptomatology and behavioral profiles. For the present study, the male and female participants were matched on chronological age and IQ functioning.

Results:

Significant gender differences were found in Vineland domain age equivalents only. Boys performed significantly better than girls overall (VABS composite: t(27)=1.738; p<0.05) and in activities of daily living (t(27)=2.677; p<0.01). Specifically, boys' age equivalent scores were higher in domestic skills (t(24)=3.420; p<0.05), personal skills (t(24)=1.684; p<05), and the socialization domain in play skills (t(24)=2.438; p<0.05).

Distinct behavior profiles emerged for boys and girls, with the male profile revealing significant correlations among Vineland domain scores and severity of repetitive and restrictive behaviors. Behavior problems were significantly related to severity of symptoms on the ADOS social and affective scale for boys, while behavior problems were associated with Vineland scores for the girls.

Conclusions:

This research emphasizes the importance of adaptive functioning as an additional element in understanding the differences between boys and girls with ASD. Distinctive adaptive profiles emerge by focusing on school-aged children who receive an initial ASD diagnosis, pointing to the need to individualize interventions to the unique needs of males and females with ASD at this age.

108 **169.108** Accumulated Experiences of a Dutch Autism Expert Team for Toddlers & Pre-Schoolers

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Background:

Although diagnosing a child with ASD is possible at a young age, the diagnostic process is complex. For, the child is subject to rapid behavioral developmental changes and potential regressions, and is very sensitive to changes in its immediate environment. Therefore, it is important to do an extensive and thorough assessment.

International guidelines for ASD diagnosis in young children recommend: 1) a multidisciplinary specialist autism team, preferably consisting of a pediatrician/clinical psychiatrist, a psychologist, and a speech therapist, 2) working with experts in autism diagnostics and young children, 3) a

case coordinator, 4) start assessment within 3 months after referral, 5) using different information sources (home life, nursery/playground/school, ...), 6) mapping physical health and medical history, and 7) consideration of co-morbidity and differential diagnostics.

Diagnostic assessment exists of questioning parental concerns (based on child behavior in various environments), a developmental history (specifically aimed at joint attention skills, executive functioning and sensory information processing), skill observation(s), details on day-to-day functioning (home life and day care/education), a medical history and a profile of strengths and weaknesses (including cognition and language) (Dutch clinical best estimate, 2017).

Objectives:

Sharing clinical experience in diagnosing ASD in young children.

Methods:

Our team exists of 18 professionals: 1 child psychiatrist, 1 pediatrician, 1 clinical psychologist, 4 health care psychologists, 5 (educational) psychologists, 1 speech/language therapist, 3 home treatment specialists, 1 play therapist, and 1 case coordinator.

From April 2013 until May 2018, we assessed 360 children, following the above mentioned guidelines for autism diagnostics in young children, also using the ADOS-2, language and intelligence tests. Observations were done both at our center (structured play), at home (free play) and at day care or school.

Results:

Of the 360 children, 72% were boys and 28% girls. We regularly see children from other cultures (e.g. African, Antillean, South American, Eastern European, Filipino, Indian, Pakistani and Russian).

The first assessment occurred on average 2 weeks after referral. In 58%, an ASD diagnosis was confirmed. In the youngest children, often a DC0-5 diagnosis was made, which at a later age, after reassessment, was often changed into ASD. In 14% of the cases, no diagnosis was made. These children were kept under review. Reassessment occurred in 34% of the children, which occurred 1-2 years later, when new concerns were raised.

Co-morbidity was often present, such as a developmental delay (45%) or language deficits (55%). Often, there were additional problems concerning sleeping, eating, potty training, motor skills and/or parent-child interaction. Children were regularly referred to clinical genetics, to look into underlying genetic causes.

Over the years, we came to see more girls with ASD. Their profile seems somewhat different.

Conclusions:

Despite the good reliability of ASD classifications at a young age, it is important to keep track of children in their development and to evaluate them regularly. Re-assessment is strongly recommended in young children (<4 years), because the development of young children is rapid. Cognitive and language skills are still developing strongly and there is a great intertwining with the environment.

109 **169.109** Measures of Effectiveness for Single-Question Sleep Problem Screeners in Children with ASD

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Background:

50-80% of children with ASD have sleep problems, which are associated behavioral issues and negatively affect well-being in both children and parents. Given this high prevalence and impact on child and family functioning, developing brief and rapid screeners for parents of children with ASD for sleep problems is important.

Objectives:

To evaluate the effectiveness of two single-question sleep issue screeners compared to the Composite Sleep Disturbance Index (CSDI).

Methods:

U.S.-based primary parents of children with ASD were recruited from a validated/verified national autism registry. Parents completed an online survey on co-occurring conditions that incorporated:

- The CSDI, a validated tool that scores the frequency/duration of six sleep habits (scored 0-2) over the previous month; total score range=0-12; score≥4 indicates a severe sleep problem.
- A seventh, non-scored, question on the CSDI asks how satisfied/dissatisfied the parent is with their child's current sleep pattern (5-category Likert scale).
- A question about the degree to which the child had experienced sleep problems during the past 30 days (4-category Likert scale).

Results:

Demographics

610 parent/child dyads were analyzed. Responding parents were primarily female (94%), white (89%), and non-Hispanic (92%); mean age of 43.3 (*SD* 7.2; range 25-65) years. Children were primarily male (81%), white (84%), and non-Hispanic (88%); mean age of 12.1 (*SD* 3.6; range 3-17) years.

Distribution of Scores and Responses (See Table and Figure)

- CSDI scores, parental dissatisfaction, and severity of sleep problems were highly correlated, n=610, p=.000; CSDI-dissatisfaction: r=0.783; CSDI-degree sleep problems: r=0.734; dissatisfaction-degree sleep problems, r=0.750.
- 377 (62%) children had a CSDI score≥4.
- CSDI scores differed between age groups, $\chi^2(2) = 12.292$, $p = 0.0021$. Young children had higher CSDI scores than both school-age children (p=0.0033) and teens (p=0.0002); however, there was no difference between school-age children and teens (p=0.1571).
- 116 (19%) of parents were completely satisfied with their child's current sleep pattern; of these, 109 (94%) had CSDI score<4. 246 (40%) were neither-satisfied-nor-dissatisfied or dissatisfied; of these, 235 (96%) had CSDI score≥4.

- 181 (30%) of parents indicated their child had no sleep problems; of these, 153 (85%) had CSDI score<4. 229 (38%) had moderate or severe sleep problems; of these, 215 (94%) had CSDI score≥4.

Evaluation

When intermediate categories (parent satisfaction/dissatisfaction="mostly satisfied" and degree sleep problems="mild") *were excluded,* parent satisfaction/dissatisfaction compared to degree sleep problems proved to be a superior predictor of CSDI severe vs. non-severe sleep problems (satisfaction/dissatisfaction: PPV=96%, NPV=94%, LR+=10.59, LR-=0.03, J=88%; degree sleep problems: PPV=94%, NPV=85%, LR+=10.55, LR-=0.13, J=80%). It is notable that 54% of children whose parents are "mostly satisfied" with their child's current sleep pattern have a severe sleep problem, and that 67% of children whose parents rate their child's degree of sleep problems as "mild" have a severe sleep problem.

Conclusions:

Single-question sleep-issue screeners are useful as a preliminary screener for sleep problems. Children with ASD can generally be correctly categorized as having a severe vs. non-severe classification *unless they have an intermediate response*, such "mostly satisfied" or "mild" degree sleep of problems. Parents may benefit from education relating to recognition of sleep problems.

110 **169.110** Next-Generation Emotion Recognition Markers for Autism Spectrum Disorder

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Background: The factors driving recognition of facial emotion, and the impairment of this ability in some autistic individuals, are poorly understood. This lack of understanding may partially reflect psychometric challenges associated with static faces. Static faces are heterogeneous, have potentially limited dynamic range, and have an underexplored relationship to real, dynamic facial expressions. Each of these challenges motivates innovations in the development of more sensitive, generalizable, and clinically-useful markers of non-verbal receptive communication for autistic people.

Objectives: This work addressed the above challenges by designing a next-generation emotion recognition task (ERT) for use in clinical trials with autistic participants, leveraging computational and "participatory design" methods alike.

Methods: Starting with systematic review of the ERT literature, a candidate task was designed according to those task features most commonly associated with significant individual differences in real-world functioning (as quantified by adaptive behaviour) or with pharmacological effects (focusing on oxytocin/vasopressin manipulations in particular). Optimal stimuli for the task were selected using a Bayesian item-response theory (IRT) model of "norming" data from typically-developing volunteers. A series of focus groups were then conducted with the task, in two different countries, to directly incorporate feedback from individuals with Autism Spectrum Disorder. Finally, adaptive psychophysical algorithms were constructed to address the focus group feedback, and the algorithm's performance characteristics were confirmed through Monte Carlo simulation.

Results: Our systematic review revealed that the majority of tasks eliciting either an association between ERT performance and a pharmacological intervention or individual differences in real-world functioning (as quantified by adaptive behaviour skills) occupy a relatively restricted design space. A task was proposed on this basis, with adaptations for frequent, low-burden administration on smartphones in a home-based setting. Specifically, individuals are asked to classify non-masked, static faces displaying 7 emotions (including a "neutral" emotion) of varying intensity in a self-paced manner. A Bayesian IRT was developed which correctly predicts static ERT performance from dynamic ERT training data, and further revealed psychometric advantages to using Emotient FACET coding (as compared to nominal emotional intensity ratings) for calibration of individual stimuli. Based on qualitative feedback collected from autistic individuals the task length was shortened by introducing an adaptive psychophysical staircase algorithm for determining the optimal intensity of the displayed emotion stimuli based on individuals' previous responses, without losses to estimation accuracy (Monte Carlo simulations). The final assessment, involving all of these features, is now deployed to autistic individuals enrolled in two clinical trials (one interventional, one observational).

Conclusions: A combination of modelling methods and participatory design is needed to create next-generation marker tasks which are both powerful and feasible for high-frequency, at-home testing in clinical trials. Our application of these methods has yielded a promising assessment of non-verbal receptive communication, currently being validated in two deployments. Ultimately, we plan to make this assessment available to the field at large.

111 **169.111** No Gender Differences in Cognitive or Adaptive Functioning Abilities for Toddlers Diagnosed with DSM-5 ASD

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Background: Prior studies indicate that females are less likely to have autism spectrum disorder (ASD), but when affected tend to have more severe impairment than males with ASD. Limited, if any, studies currently exist comparing functioning between male and female toddlers with a Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) ASD diagnosis.

Objectives: To compare cognitive, adaptive, and language functioning in male versus female toddlers at time of diagnosis of DSM-5 ASD.

Methods: We conducted a retrospective chart review of toddlers (18-36 months) diagnosed with DSM-5 ASD via a standardized assessment at Boston Children's Hospital from July 2013-July 2015. Children were included if they were seen by both a developmental-behavioral pediatrician and a psychologist for developmental testing and if they met DSM-5 diagnostic criteria for ASD. The primary outcomes were standard scores from cognitive, adaptive, and language measures, specifically the Bayley Scales of Infant and Toddler Development, Third Edition, and the Vineland Adaptive Behavior Scales, Second Edition. Due to provider preference, rather than specific patient characteristics at presentation, a subset of patients (N = 99) received an additional language measure, the Receptive-Expressive Emergent Language Test, Third Edition. We conducted

statistical comparison of scores between genders via independent two-sample t-tests.

Results: We abstracted data for 500 subjects; 21% were female (N = 104) and 79% were male (N = 386). There was no statistical difference in the average age at diagnosis for males versus females (26.1 versus 25.5 months, respectively; p = 0.211), the Bayley Scales of Infant and Toddler Development cognitive standard score (80.8 versus 80.0, respectively; p = 0.585) or the Vineland adaptive behavior composite standard score (75.0 versus 73.8, respectively; p = 0.283). There were no gender differences in the Bayley Scales of Infant and Toddler Development language standard score (63.8 for males versus 60.7 for females; p = 0.108), although in the subset of patients who had the Receptive-Expressive Emergent Language Test administered (N=99), males had higher receptive language scores (65.2 versus 59.5 respectively; p= 0.023) and higher expressive language scores (65 versus 59.7 respectively; p = 0.045) compared to females.

Conclusions: We found no significant gender difference in cognitive or adaptive functioning of toddlers at time of DSM-5 ASD diagnosis. This is in contrast to prior studies suggesting lower cognitive and adaptive functioning in female patients when compared to males. We did find lower receptive and expressive language scores among females in a subset of toddlers who received a separate language measure, suggesting that gender differences may exist in some developmental domains.

112 **169.112** Predictive Effect of Handwriting Impairments and Adaptive Function on Autism Diagnosis

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Background: Children with Autism Spectrum Disorder (ASD) frequently exhibit impairments in handwritten letter formation. Why are these deficits potentially relevant in the current age of digital literacies? Research suggests that writing letters by hand helps typically developing children learn to build stable representations in memory and conceptualize information. Children with ASD often exhibit deficits in conceptual adaptive behavior relative to their cognitive skill level, and these deficits may provide important clinical prognostic information. Thus, investigating the interplay of handwriting and conceptual adaptive skills may benefit researchers and clinicians in assessing autistic symptom severity.
Objectives: To determine if handwriting letter formation moderates the relationship between adaptive functioning and ASD diagnosis.

Methods: Participants included 159 children aged 8-16 years (85 ASD; 119 male; M_{age}=10.43). Three conditions of the Minnesota Handwriting Assessment (MHA) were completed on a digital tablet: participants were presented with one sentence that would be copied (copy), traced (trace), and traced as quickly as possible (fast-trace). Handwriting data was analyzed using Large Deformation Diffeomorphic Metric Mapping (LDDMM) and a letter-form score was given to quantify the participant's deviation from a template for each condition. Higher scores indicate poor performance. Caregivers of participants completed the Adaptive Behavior Assessment System, Second Edition (ABAS-II). The Conceptual domain of the ABAS-II (ABAS-c) was used for analysis, consisting of three sub-categories: communication, functional academics, and self-direction. Lower scores indicate poor adaptive functioning.

A multiple regression analysis was used to determine how each MHA condition predicted diagnosis. The best predictor was then used in a two-step moderated regression analysis to first examine the effect of the ABAS-c and this predictor separately, and then to measure the combined effect of those predictors on diagnosis.

Results: Multiple regression indicated that, among the three handwriting conditions, fast-trace (FT) letter-form score was the best predictor of ASD diagnosis (see Table 1). A regression model including ABAS-c and FT letter-form scores was significant, with the ABAS-c being a slightly better predictor of ASD diagnosis than FT (see Table 2). Given these results, a moderated regression was used to determine the effect of FT letter-form on the relationship between adaptive functioning and ASD. We observed that the combined effect (i.e, product) of FT letter-form and ABAS-c accounted for significantly more variance in ASD diagnosis than just ABAS-c or FT letter-form alone (see Table 2), suggesting that FT letter-formation moderated the relationship between adaptive functioning and ASD.

Conclusions: Children with ASD struggle with letter formation even when the visual-spatial transformation demands of printing are minimized, as in the FT condition. The moderation analysis further suggests that considering poor adaptive functioning and poor FT letter-formation together was more informative of ASD diagnosis than considering only adaptive functioning or FT letter-formation alone. Therefore, it may be useful to collect handwriting measures as part of an ASD diagnostic evaluation. Handwriting assessments are easy and quick to administer, and as opposed to most parent-report adaptive function measures, are direct measures from the child. Thus, they could provide for a more complete diagnostic picture.

113 **169.113** Replication and Validation of the Brief Autism Detection in Early Childhood (BADEC) in a Clinical Sample

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Background: Because ASD can be reliably diagnosed as early as 18 months, pediatricians are recommended to use ASD screeners during 18 and 24 month wellness checks. Despite this, most children are not diagnosed until after age four, which is partially due to the inconsistent use of screeners. Reasons for this include short appointment times and clinicians' limited knowledge of available screeners. One screener, the Autism Detection in Early Childhood (ADEC) is a 16-item, play based screener for 12-36 month olds. It has good reliability and validity, requires minimal training, and can be administered in 10-15 minutes. Despite these strengths, the ADEC has not been widely implemented. Since tools such as this it would still consume most of a standard 9-16 minute visit, there is a need to abbreviate it further. The BADEC, a five-minute version of the ADEC was therefore developed using a research sample (Nah et al., 2018).
Objectives: To evaluate the BADEC in a clinical sample by a) calculating the Nah et al. BADEC's sensitivity and specificity b) replicating their procedures to determine if the same five items from the original ADEC are identified as best predictors, and c) evaluating the screening ability and validity of abbreviated version we identified.

Methods: Participants were 107 children aged 14-36 months (*M* = 28.70 months, *SD* = 5.40) with confirmed final diagnosis of ASD (n = 48) or who had ASD ruled out (NASD; n = 59), and had complete ADEC data. Participants were screened and evaluated at a pediatric hospital. Screening ability of the Nah et al. (2018) BADEC was assessed in the current sample. Following Nah et al. (2018), Receiver Operating Characteristic analysis was

performed on all 16 ADEC items to identify five items associated with best area under the curve (AUC) values. These were then combined into one overall current BADEC score, and sensitivity, specificity, and concurrent, predictive, and diagnostic validity were calculated.

Results: The following items emerged with highest AUC values: Gaze Monitoring (.82), Task Switching (.75), Response to Name (.74), Reciprocity of a Smile (.74), and Following Verbal Commands (.73). Our findings are in agreement with Nah et al. (2018) on the inclusion of three items. While Nah et al (2018)'s data supported a cutoff of 4, our data supported a cutoff of 5 (Se = .77, Sp = .86, PPV = .82, NPV = .82, AUC = .82). Both versions of the BADEC had strong concurrent, predictive, and diagnostic validity.

Conclusions: An abbreviated version of the ADEC can effectively screen for ASD in children under age three. Short tools such as these are particularly amenable for inclusion in wellness checks given that they are easy to use. This can facilitate timely access to supports for those who go on to receive a diagnosis. There is value in evaluating screening tools in clinical contexts given that the majority of available screeners are developed using research samples. Future research evaluating brief screeners should evaluate whether adherence to screening guidelines increases after pediatricians are trained in its use.

114 **169.114** Age-Based Diagnostic Tracks Are Effective in Interdisciplinary Team Evaluation for Autism Spectrum Disorder

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Background: Diagnostic evaluations for autism spectrum disorder (ASD) follow a range of processes that can be lengthy and contribute to long wait times. At Seattle Children's Autism Center (SCAC), we utilize an interdisciplinary team evaluation model with two providers of different disciplines after an initial neurodevelopmental intake. This model has high provider satisfaction, maintains consistency in ASD diagnostic rates, and results in significantly fewer billed hours than a traditional psychology-only evaluation (Gerdts, et al., 2018). SCAC provider feedback in working in teams has centered on two themes for improved processes: streamlining evaluations for younger children, and identifying different approaches for patients with clinically complex diagnostic profiles.

Objectives: We will explore the effectiveness of a single day team evaluation model for patients 5 years, foregoing the initial neurodevelopmental intake; and determine whether intake providers can reliably predict the length of time needed for evaluation of children 6+ (regular versus "complex").

Methods: Two diagnostic tracks are being piloted: 1) Patients 5 years, who generally have less history and fewer records to review. Patients are sent directly to an interdisciplinary team evaluation involving an assessment of adaptive functioning, record review, and developmental/ASD-related history, as well as a direct assessment with feedback provided to families on the same day. For this track, outcome variable of interest is the ratio of incoming:outgoing referrals.

2) Patients 6+ years receive an initial clinical intake to obtain developmental history and collect records, and subsequent referral to an interdisciplinary team evaluation (Gerdts et al., 2018). In our pilot, intake providers indicated whether they anticipate the patient could participate in a regular team evaluation or whether the evaluation would need to be longer. Data from 27 patients 6+ years seen thus far in our pilot were tracked. Blind ratings from intake providers (*n*=10) were compared to evaluation outcomes from interdisciplinary teams (*n*=19 teams). Patients ranged in age from 6-18 years (*Mean*=10.55 years, 67% male).

Results: The ratio of incoming:outgoing referrals for children 5 years over the past 4 months has been decreasing despite an increase in the number of diagnostic referrals coming into SCAC (Figure 1: Aug=1.58, Sept=1.99, Oct=1.21, Nov=0.70). In the 6+ year track, there was 70.3% agreement between intake provider rating and ultimate team process. Mismatches were often when intake provider rated a patient as needing a lengthier evaluation, when teams were actually able to complete their evaluation in standard time. Patients with mismatched provider ratings were older than those with matched (13.1 years v 9.8 years).

Conclusions: Efficiency in evaluating children 5 years at SCAC has been improving since the pilot launch. Expediting young children is particularly important for accessing early intervention services. Referral for patients 6+ into two tracks based on clinical impressions at intake is 70% accurate. Further information and pilot data are necessary, but outcomes thus far suggest that specialized evaluations completed by appropriate providers (e.g., a psychiatrist/psychologist, developmental pediatrician/speech-language pathologist) could be helpful in optimizing clinical time and provider expertise. We plan to analyze full pilot data and efficiency data over time.

115 **169.115** The Reliability of Computerized Neurocognitive Assessments in Autism Spectrum Disorder

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Background: The administration and implementation of computerized neurocognitive assessments is emerging, however, the reliability of such assessments remains in question (Vrana & Vrana, 2017). The feasibility of computerized assessments has been demonstrated in typically developing populations, although its use is not considered a substitute for clinician-administered assessments (Butcher, Perry, & Atlis, 2000; Gualtieri & Johnson, 2006). The reliability of computerized neurocognitive assessments in comparison to clinician-administered assessments has yet to be studied in individuals with autism spectrum disorder (ASD).

Objectives: This study explores the performance of children with ASD and their unaffected siblings on both computerized and clinician-administered measures of intellectual functioning.

Methods: Thirty-six individuals participated in this study, including 17 individuals with ASD (ages 6-24 years) and 19 unaffected siblings (ages 6-27 years). ASD diagnoses were confirmed via gold-standard tools and expert clinical judgement. Computerized administrations of the Peabody Picture Vocabulary Test-4 (PPVT-4) and a Visual Reasoning (VR) (testmybrain.org) task were completed on a laptop in the clinic. All participants were administered the Wechsler Abbreviated Scale of Intelligence-II (WASI-II). Probands also completed a comprehensive developmentally-appropriate test of cognitive functioning (Wechsler Adult Intelligence Scale-IV, Wechsler Intelligence Scales for Children-5, Stanford Binet-5, Mullen Scales of Early Learning). Developmental quotients were calculated for participants who completed the Mullen.

Results: T-tests were run between clinician-administered and computerized measures. Results revealed that probands' performance did not differ significantly between assessment modality (i.e., clinician-administered versus computerized) across domains, except for one comparison (WASI-II

Perceptual Reasoning Index standard score (SS) vs. VR SS), with significantly stronger performance on the clinician-administered WASI-II (p=.04). In contrast, unaffected siblings performed significantly better on all clinician-administered assessments compared to computerized assessments (p<.01).

Conclusions: This study demonstrated that children with ASD performed similarly on computerized- and clinician-administered assessments, whereas their unaffected siblings performed significantly better on clinician-administered assessments. Results suggest that individuals without ASD may respond better to human social interaction and prompting. Future directions include further examination of the reliability of computerized cognitive assessments in larger and more homogenous subgroups of individuals with ASD.

116 **169.116** Validity of the Aberrant Behavior Checklist

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Background: Autism spectrum disorder (ASD) is considered a life-long disorder with incredibly heterogeneous symptom presentation. The prevalence of ASD is estimated at 1 in 68 in the United States as identified in 2010, and the World Health Organization has listed ASD as one of three top priorities. Further, the socioeconomic burden of this developmental disorder to the U.S. economy is estimated at $126 billion. Given the individual and societal impact of this disorder, an increased effort has been placed on developing interventions to lessen the severity of the core symptoms of ASD. To date, there is no agreed upon outcome measure for measuring change in core autism symptoms in response to clinical trials. Objectives: One measure that has been proposed as an outcome measure is the Aberrant Behavior Checklist (ABC; Aman et al., 1985a), specifically the Social Withdrawal scale to measure core symptoms of ASD. However, it is unclear if and how well this subscale truly measures core symptoms of autism. Thus, the purpose of this project is to expand upon existing psychometric work on the ABC and examine the validity of the ABC subscales in relation to other measures designed to assess core symptoms of autism.

Methods: Participants were drawn from a sample of children with an ASD diagnosis who participated in the Simons Simplex Collection. The primary measure of interest for this project is the Aberrant Behavior Checklist (ABC; Aman et al., 1985a) which contains 58 items that comprise five subscales: Irritability, Social Withdrawal, Stereotypic Behavior, Hyperactivity/Noncompliance, and Inappropriate Speech. A total of 2709 participants have a completed ABC and were included in this project. Preliminary analyses included correlations between the subscales of the ABC and other measures of core symptoms of autism including the Autism Diagnostic Observation Schedule, Repetitive Behavior Scale Revised, and the Social Communication Questionnaire.

Results: Small to medium significant correlations were observed between the five subscales of the ABC and all measures of core autism symptoms listed above. To examine the validity of the ABC using multiple methods of assessment and multiple constructs, additional analyses will be conducted using confirmatory factor analysis and exploratory structural equation modeling. Further, measures expected to diverge, or measure constructs other than core autism symptoms will be included in the final analyses.

Conclusions: Several studies have examined the factor structure of the ABC; however, the methodology and statistics used have been limited. The current project extends upon previous work by examining the construct, convergent, and divergent validity of the ABC in a large sample of individuals with ASD using more sophisticated statistical techniques. This approach allows for examination of possible relationships between scores on the ABC and measures expected to converge and diverge with the ABC whereas traditional correlational methods cannot examine underlying constructs which assessment tools are designed to measure. Better understanding what constructs the subscales of the ABC measures, with an emphasis on the Social Withdrawal scale, is imperative as it is being used as an outcome measure in treatment trials.

Poster Session
170 - Epigenetics
11:30 AM - 1:30 PM - Room: 710

117 **170.117** Autism Spectrum Disorder Associated with Mutations in Srcap Upstream of Those Associated with Floating-Harbor Syndrome Generate Overlapping Yet Distinct Functional DNA Methylation Signatures

ABSTRACT WITHDRAWN

Background: Autism spectrum disorder (ASD) is an etiologically and phenotypically heterogeneous neurodevelopmental disorder. Genetic causes have been identified (>200 ASD-risk genes), but no single gene mutation accounts for >1% of all ASD cases. A role for epigenetic mechanisms in ASD etiology is supported by the many ASD-risk genes that function as epigenetic regulators and evidence that epigenetic dysregulation can interrupt normal brain development. We have identified two individuals with ASD who carry variants of unknown significance (VUS) in the Snf2 Related CREBBP Activator Protein gene (*SRCAP*). *SRCAP* encodes the core catalytic component of the SRCAP complex, which is involved in chromatin remodelling and acts in the Notch signalling pathway, important during development. Heterozygous variants in exons 33 and 34 of *SRCAP* are known to cause a rare genetic disorder, Floating-Harbor Syndrome (FHS; OMIM #136140), although not all FHS cases have an identifiable genetic cause. FHS is characterized by distinctive facial features, short stature, intellectual and speech impairments, and delayed bone age. ASD is not commonly comorbid with FHS, but the two disorders share some overlapping physical, cognitive and behavioural features.
Objectives: Given that SRCAP functions as an epigenetic regulator within important developmental pathways, we investigated whether aberrant epigenetic marks, specifically DNA methylation (DNAm), contribute to the molecular pathophysiology of FHS and if such specific DNAm patterns will distinguish between the two phenotypes observed in individuals with independent variants in the same gene.

Methods: To test this, we assessed for genome-wide DNAm patterns using the Illumina MethylationEPIC array in whole blood DNA from patients with a clinical diagnosis of ASD and *SRCAP* VUS (n=2) or FHS and pathogenic *SRCAP* variants (n=3).

Results: Despite a small number of cases, we identified an FHS-specific DNAm signature comprised of >2,000 CpG sites (FDR corrected p-value<0.001) that distinctly separated FHS cases from age- and sex-matched neurotypical controls (n=59). Pathway analysis performed on the differentially methylated genes in this signature revealed enrichment in neuronal differentiation and fibronectin production, biological pathways relevant to the pathophysiology of FHS. The FHS DNAm signature was used to classify the two individuals with ASD in order to better interpret the

pathogenicity of the *SRCAP* VUS, classifying them as intermediate between FHS signature cases and controls, reflecting the partially overlapping phenotypic features described.

Conclusions: In summary, we have demonstrated functional and biological utility of the FHS DNAm signature: it can be used as a molecular biomarker to inform pathogenicity of VUS and thus FHS diagnosis, and to elucidate the underlying biological mechanisms that will help us to better understand, diagnose and treat FHS and other disorders with overlapping features, such as ASD.

118 **170.118** Correlations between Psychological Assessments and RNA Concentrations in Saliva of Adolescents and Adults with ASD

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Background: The prevalence rates of autism spectrum disorder (ASD) have steadily increased over the past two decades, nearly tripling since 2002. Current assessment procedures rely on behavioral assessments and parent-report surveys that can be influenced by situational variables. An objective molecular indicator of ASD symptom severity could inform treatment plans. Recent literature suggests that epigenetic factors, such as poly-omic RNA levels in saliva, can accurately distinguish school-aged children with ASD from their peers. We examined concentrations of salivary RNAs in a cohort of adolescents and young adults with ASD and compared RNA patterns with non-ASD peers to determine whether saliva RNA markers informed symptom severity and adaptive functioning.

Objectives: The current study compared ASD symptom severity and adaptive functioning to concentrations of human saliva RNAs, including mature/precursor microRNA (miRNA), piwi-interacting RNA (piRNA), long intergenic non-coding RNA (lincRNA), and ribosomal RNA (rRNA), to identify saliva RNA markers that correlate with behavioral phenotypes.

Methods: 53 individuals (26 ASD, 26 non-ASD; M = 12 yrs) were assessed using the Autism Diagnostic Observation Schedule (ADOS) and the Vineland Adaptive Behavior Scales 2nd Edition (VABS-II). Approximately 3 mLs of saliva were collected during a non-fasting state via expectoration into an Oragene RNA collection kit (DNA Genotek, Ottawa Canada). RNA was sequenced using an Illumina TruSeq Small RNA Prep protocol and a NextSeq500 instrument (Illumina; San Diego, CA, United States). Quantification of RNA reads were determined using the SHRiMP2 and Bowtie aligners in Partek Flow (Partek; St. Louis, MO, United States). Reference databases used for transcript assignment included miRBase version 21, RefSeq Transcripts 84, and the Human piRNA sequence v1.0 reference index. After alignment, a data transformation was applied to reduce batch effects and to study the full expression range of the RNAs. Sequencing data was transformed by applying an inverse hyperbolic sine transformation followed by cumulative sum scaling normalization. Associations between behavioral assessment scores and miRNA concentrations were performed using Spearman's Rank Correlation. In total, about 200 transcripts per RNA category were compared to 9 independent behavioral scores derived from the ADOS and VABS-II assessments.

Results: Results show significant correlations ($p < .05$) between sequencing data and both the VABS-II Socialization score and the ADOS-2 composite score. Spearman correlation coefficients ranged from +/- 0.5, suggesting relationships of weak to moderate strengths. Statistically significant correlations were found in each RNA category investigated (miRNA, piRNA, lincRNA, and rRNA), with mature/precursor microRNAs containing the strongest relationships between transcript counts and behavioral scores. Some of these microRNAs were the same as those identified in our previous pilot study of salivary microRNAs from an independent cohort of ASD and control subjects.

Conclusions: Poly-omic RNA levels are associated with both symptom severity and adaptive functioning in adolescents and young adults with ASD. This finding suggests that RNA profiles are a promising molecular marker with the potential to provide useful clinical data informing patient management and treatment plans.

119 **170.119** Epigenetic Changes Are Associated with Prenatal Air Pollution Exposure and Autism-Related Quantitative Traits

C. Ladd-Acosta[1], *J. I. Feinberg*[1], *F. Lurmann*[2], *L. A. Croen*[3], *I. Hertz-Picciotto*[4], *C. J. Newschaffer*[5], *A. P. Feinberg*[6], *M. D. Fallin*[1] *and H. E. Volk*[1], *(1)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (2)Sonoma Technology, Inc., Petaluma, CA, (3)Division of Research, Kaiser Permanente, Oakland, CA, (4)University of California at Davis, Davis, CA, (5)AJ Drexel Autism Institute, Philadelphia, PA, (6)Johns Hopkins University, Baltimore, MD*

Background: Prenatal exposure to air pollution has been associated with increased risk of autism spectrum disorder (ASD). Identification of biologic mechanisms of this association can provide molecular targets for intervention. Evidence from the fields of environmental and autism epidemiology supports DNA methylation as a plausible biologic mechanism linking air pollution exposure with ASD risk.

Objectives: The main goal of this study was to identify DNA methylation changes, in two developmentally relevant tissue types, associated with prenatal exposure to air pollution and with autism-related quantitative traits. Secondary objectives included identifying sex-specific DNA methylation changes related to prenatal air pollution exposure and evaluate whether air pollutant related methylation changes show tissue-specificity or not.

Methods: Early Autism Risk Longitudinal Investigation (EARLI) is a US multi-site enriched-familial risk pregnancy cohort study. Genome-scale DNA methylation measurements for 133 placenta and 175 cord blood samples were obtained using the Infinium HumanMethylation450k platform. Ambient nitrogen dioxide (NO_2) and ozone (O_3) air pollutant exposure levels were estimated from prenatal address locations of EARLI mothers using inverse distance weighting via measurements from the Environmental Protection Agency's monitoring network. ASD-related quantitative traits include the Social Responsiveness Scale (SRS), Vineland Adaptive Behavior Scales (VABS)-2 composite, and the Mullen Scales of Early Learning (MSEL) composite scores at 36 months. Bumphunting was performed to identify differentially methylated regions (DMRs) associated with prenatal O_3 and NO_2 exposures in each tissue and by sex, adjusting for technical and biological sources of variation. Permutation testing was applied and a family wise error rate (FWER) statistic was used to assess statistical significance. Exposure-associated DMRs were then examined for associations with 36 month outcomes.

Results: We identified 9 DMRs in either cord blood or placenta, including 6 sex-specific, associated with prenatal O_3 or NO_2 exposures. Among these 9 air pollution associated DMRs, 2 also showed a significant (FDR < 0.05) and 1 showed a suggestive (FDR < 0.10) difference in methylation associated with a poorer 36-month outcome and in a direction that is consistent with air pollution – outcome main effects. For example, increased prenatal exposure to NO_2 and low VABS scores are both associated with a 9% loss of methylation in placenta, on average, at the *ZNF442*

locus. Formal mediation analyses are underway and will also be presented.

Conclusions: We observed locus and sex-specific methylation changes associated with prenatal NO_2 and O_3 exposures, providing potential biologic targets for a wide range of child health outcomes, including ASD. Associations, in the same direction, of some DMRs with both prenatal air pollutant exposure and quantitative traits, suggest DNA methylation may mediate the effects of prenatal air pollution exposure on child developmental function.

120 **170.120** Impact of Endocrine Disruptors on Mirna Expression in Sperm: A Risk Factor for Autism?

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Background: The rapidly rising prevalence of autism spectrum disorders (ASD) in the U.S., now as high as 1 in 40 individuals, suggests that environmental factors may be increasing risk for ASD. However, there is a critical gap in our knowledge regarding the nature of environmental factors and the biological mechanisms through which they may influence susceptibility to ASD. Recent studies by our group and others suggest that endocrine disrupting compounds (EDCs), many of which are ubiquitous in our environment, may be contributing to the rising prevalence of ASD. Moreover, germline exposures to EDCs in animal models have been reported to induce lasting phenotypic changes in offspring which are, in some cases, transmitted transgenerationally and potentially through epigenetic mechanisms.

Objectives: The overarching goal of this study is to test the hypothesis that miRNA expression in sperm is associated with measured levels of 1,1-dichloro-2,2-bis(p-chlorophenyl) ethylene (p,p'-DDE) in the serum of young sperm donors from the Faroe Islands, whose diet includes pilot whale meat and blubber which predisposes them to higher than average levels of long-lived environmental EDCs, which accumulate in fatty tissues. Specifically, we investigated differences in the expression of miRNAs in sperm from men with the highest (third tertile) and lowest (first tertile) exposures with respect to blood p,p'-DDE levels, and performed bioinformatics analyses on the differentially expressed miRNAs to identify target genes and pathways that may predispose offspring to ASD.

Methods: Sperm from men with the highest and lowest levels of DDE exposure (8 samples per group) was isolated from whole semen using a density gradient protocol. Total RNA was obtained from cell lysates (after DNA extraction) using Ribozol followed by chloroform extraction. The isolated RNA was submitted for small RNAseq analysis. RNAseq data was analyzed using the MicroRNA Analysis app within Illumina's BaseSpace Sequence Hub. Ingenuity Pathways Analysis (IPA) software was used to identify the potential target genes of differentially expressed miRNAs, which were then analyzed for pathways and functions using the Core Analysis feature of IPA.

Results: Fifty-five and 132 differentially expressed miRNAs were identified by the DESeq2 and RankProd software packages, respectively, in the MicroRNA Analysis app, with 25 miRNAs represented in both datasets. Approximately 6300 potential target genes were identified for the 25 overlapping miRNAs, of which 347 were represented in SFARI Autism Gene Database (hypergeometric distribution p-value ≤ 0.015 for enrichment in autism risk genes). Network prediction analysis of the 347 overlapping genes revealed GABA receptor signaling (p-val: 5.5E-06) and PTEN signaling (p-val: 1.1E-05) as the top canonical pathways represented within the gene set, with an overabundance of genes involved in developmental disorder (100 genes, p-val: 4.8E-05 – 1.2E-39), neurological disease (211, p-val: 6.2E-05 – 5.4E-35), and nervous system development and function (50, p-val: 1.7E-05 – 1.8E-13). Seventy of these genes are directly linked to autism/intellectual disability (p-val: 1.2E-39).

Conclusions: The results of this pilot study show that higher levels of exposure to p,p'-DDE are associated with differentially expressed microRNAs in sperm. These miRNAs potentially target genes involved in pathways and functions implicated in ASD.

121 **170.121** Impact of Endocrine Disruptors on the Sperm Methylome: A Risk Factor for Autism?

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Background: Although autism spectrum disorders (ASDs) are among the most heritable of neurodevelopmental disorders, the rapidly rising prevalence of ASDs worldwide suggests that environmental factors may interact with genetic risk for ASD. Environmental factors may impact the expression of genes associated with ASD through epigenetic mechanisms which could lead to intergenerational effects influencing risk for ASDs. This study addresses environmentally associated epigenetic modifications in spermatocytes as a result of exposure to a class of ubiquitous endocrine disrupting compounds (EDCs), the organochlorines. EDCs are of particular interest with respect to risk for autism because of their ability to interfere with hormonal signaling, which has been implicated in the regulation of *RORA*, a gene that our laboratory has previously shown to be differentially methylated in ASD and a master regulator of many other ASD risk genes.

Objectives: Here, we examine DNA methylation patterns in sperm from young men in the Faroe Islands (Denmark) with higher than average exposure to environmental organochlorines as a result of a diet that includes pilot whale meat and blubber. Organochlorine compounds, with long half-lives both in the environment and bodily tissues, have been associated with methylomic modifications. Specifically, we investigated differences in DNA methylation in sperm from men with the highest (third tertile) and lowest (first tertile) exposures with respect to blood levels of 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene (p,p'-DDE), a stable breakdown product of the pesticide DDT. We then performed bioinformatics analyses on the genes associated with the differentially methylated regions (DMRs) to identify genes and pathways that may predispose offspring to ASD.

Methods: Sperm cells were purified from semen by density gradient centrifugation, and DNA was extracted from lysates using a Qiagen AllPrep DNA kit. Whole genome bisulfite sequencing (WGBS) was performed on 32 samples (16 samples from the first and third tertiles of DDE exposure) on the Illumina HiSeqX sequencer giving roughly 4x coverage after stringent quality control and quality analysis. A bioinformatics pipeline fine-tuned for low-coverage WGBS data (<https://github.com/ben-laufer>) was used to determine differential methylation between low and high DDE exposure groups. Gene ontology and pathway analyses were performed using GREAT and Ingenuity Pathway Analysis (IPA) software, respectively.

Results: Preliminary analyses revealed 674 differentially methylated regions (DMRs, permutation p ≤ 0.05) distributed across all genomic annotations. The most significant DMR was located in exon 7 of *PTPRN2* (p=7.7E-05), a diabetes-associated gene whose DNA methylation status in blood has been linked to pesticide exposure and to smoking in sperm. Moreover, gene ontology analyses implicate significant localization of genes at the terminal bouton and axon terminus of nerve cells (Adj p £ 5.2E-06). Pathway analyses further support the over-representation of nervous system genes (*ANKLE2, CNTNAP2, MBP, MYO16, PAX6, SPATA5*, and *TRAPPC9*) in the DMRs (Fisher's Exact p=3.9E-03). The top developmental

disorders revealed by IPA include autosomal dominant mental retardation (Fisher's Exact p=1.9E-04) and autism (Fisher's Exact p=5.2E-04).

Conclusions: Elevated exposure to certain organochlorines is associated with differential genome-wide DNA methylation patterns in sperm. The DMRs are enriched for genes involved in neurological functions and developmental disorders, including ASD.

122 **170.122** Parental Occupational Exposure to Solvents and Autism Spectrum Disorder: An Exploratory Look at Gene-Environment Interactions

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Background: There is some evidence that parental occupational exposure to solvents may be associated with autism spectrum disorder (ASD). Similarly, there are a number of genetic factors that are associated with ASD. However, little research has evaluated potential gene-solvent interactions in the etiology of ASD.

Objectives: To investigate the joint effect of genetic variants and parental occupational solvent exposure in ASD.

Methods: Demographic, health, genetic microarray analysis, and parental occupational history information were collected for 416 children with ASD, 298 typically developing (TD) children and their parents as part of the CHildhood Autism Risks from Genetics and Environment study. Solvent exposure was assessed by two industrial hygienists. For each job, the frequency and intensity of potential solvent exposure was estimated and a binary and semi-quantitative cumulative exposure variable was determined. To assess gene-solvent interaction, the total number of minor alleles at each locus was fit in a model that contained the single nucleotide polymorphism (SNP) alone, solvent alone, and a SNP x solvent interaction term. The ratio of odds ratios (ROR) and 95% confidence interval were used to assess the effect of gene-solvent interaction on a multiplicative scale on the risk of ASD. The relative excess risk for interaction (RERI) was used to estimate interactions on an additive scale. In this model, the dominant model was used to create binary genotype variables that were put into the logistic model described above.

Results: Statistically significant ($p \leq 0.05$) interactions were found for both the additive and multiplicative models. Multiplicative interactions were found between solvents and a number of serotonin, major histocompatibility complex, inflammatory, and metabolism gene variants in the risk of ASD (n = 35 variants; ROR > 2; $p \leq .01$). Similarly, there were a number of superadditive interactions between solvents and serotonin, major histocompatibility, inflammatory, and metabolism gene variants (n = 23 variants; RERI > 0). Monotonic superadditive interactions were found between solvents and two *HTR1A* serotonin gene variants and two *RORA* gene variant (RERI > 1; $p \leq 0.05$). There were also a number of subadditive interactions between solvents and antioxidant metabolism genes, major histocompatibility complex, inflammatory, and metabolism gene variants (*GLRX3, HLA-C*HLA-B, HTR2A, HTR7, TGFB2, TNXB, VEGFA*; RERI < 0, $p \leq 0.05$).

Conclusions: This study indicates that the joint effects of certain antioxidant metabolism, major histocompatibility complex, inflammatory, and serotonin gene variants and parental occupational exposure to solvents may be associated with ASD. This is one of the first studies to evaluate potential gene-environment interactions in the risk of ASD. Additional studies with a larger sample size to confirm and extend these findings are needed.

123 **170.123** Paternal Sperm DNA Methylation and Offspring 36-Month Outcomes from an Autism-Enriched Cohort

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Background: There is growing evidence supporting the contributions of both genetic and environmental risk factors for autism spectrum disorder (ASD). Epigenetic marks can reflect both genetic and environmental variation and have been implicated in ASD via multiple lines of evidence. We, and others, have reported DNA methylation associations with ASD and related traits, although the specificity of timing and tissue type (brain, blood, cord blood, placenta, sperm) is still unclear. Sperm is an important tissue for inquiry given its direct connection to germline DNA of the offspring and recent reports on relationships between genetic and paternal environmental experiences and sperm methylation. We previously reported associations between paternal sperm DNA methylation and 12-month ASD-related outcomes (AOSI) in the ASD-enriched risk Early Autism Risk Longitudinal Investigation (EARLI) cohort.

Objectives: We have now examined the associations between paternal sperm DNA methylation and three ASD-related quantitative outcomes at 36 months in the same EARLI sample.

Methods: We performed comprehensive genome-scale methylation analyses on DNA derived from semen samples contributed by 50 fathers enrolled in EARLI. Methylation was measured via the CHARM 3.0 array, which contains over 4 million probes and covers over 7 million CpG sites. We used a region-based approach to identify differentially methylated regions (DMRs) in paternal sperm genomes sampled prior to birth that associated with 36-month offspring scores on: the Mullen Scales of Early Learning (MSEL; 40 subjects), the Social Responsiveness Scale (SRS; 32 subjects), and the Vineland Adaptive Behavior Scales (VABS; 36 subjects). In addition to exploring relevant gene ontology for the associated regions, we identify regions that overlap across each of the 36-month assessments and also across the 193 DMRs previously associated with the Autism Observation Scale for Infants (AOSI) at 12-months in the same cohort.

Results: We identified 50 DMRs in the paternal sperm genome associated with MSEL, 154 sperm DMRs for SRS, and 67 sperm DMRs for the VABS at genome-wide significance (FWER $p < 0.05$); 25 DMRs overlap across at least two outcomes. Developmental outcome-associated DMRs include genes previously associated with ASD (e.g. *WWOX, SALL3*) and also overlap with DMRs previously reported to be associated with 12-month AOSI scores in the same EARLI sample.

Conclusions: These findings suggest paternal germ-line methylation around the time of pregnancy is associated with offspring cognitive and adaptive functioning in early development up to 3 years later. These prospective results for autism-associated traits, in an enriched familial risk sample, highlight the potential importance of sperm-based epigenetic mechanisms in ASD and neurodevelopment.

124 **170.124** Rare Epigenic Variations in Autism Spectrum Disorder

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Background: To date, epigenome-wide association studies have found few significant associations between the levels of DNA methylation and autism spectrum disorder (ASD). Identifying further case-control differences could be challenging in an etiologically heterogeneous disorder. Objectives: Our study tests if ASD is associated with loci showing extreme DNA methylation levels in a small fraction of cases, akin to the observations of the role of rare genetic mutations in ASD etiology.

Methods: As described in our previous work, DNA was isolated from dried blood spot samples (Guthrie cards) collected early postnatally from all newborns in Denmark, and archived in the Danish Neonatal Screening Biobank. The DNA extraction and subsequent DNA methylation profiling was performed at Statens Serum Institut, using a previously established method. Quality control steps included removal of samples with low signal intensities, low bisulfite conversion, or low detection P value, and probes within 5bp of known single nucleotide polymorphism. We also excluded all probes on the sex chromosomes. Data were normalized using the wateRmelon package.

Subsequently, a sliding-window approach was used to identify “epivariation”, i.e. regions where DNA methylation levels in cases or controls were outside the 99% confidence intervals in the set of independent, reference control samples, at a minimum of 3 consecutive probes within 1kb, with at least one of those probes deviating a minimum of 10% from the most extreme reference control.

Using permutation testing, we investigated the overall enrichment of such regions in cases compared to controls, as well as the differences in the characteristics of the underlying genomic regions (i.e., enrichment of either ASD-associated genes derived from the Autism Sequencing Consortium) or genes intolerant to mutation, defined as pLI >0.9.

Results: After quality control, there were 629 ASD and 634 control samples (both ~50% female) used in the analyses, with 456,725 autosomal probes analyzed. There were no significant differences in the rates of epivariation between cases and controls (p=0.084). However, cases had significantly more instances of epivariation in ASD FDR 0.1 genes (respectively, 0.003 and 0.001 per individual, p=0.015) and FDR 0.5 genes (respectively, 0.020 and 0.004, $p=2.3x10^{-8}$), and genes intolerant to mutation (0.074 and 0.059, p=0.035).

Conclusions: Our data indicate that ASD cases show a significant enrichment of epivariations in both genes previously linked with ASD, and genes intolerant to mutation, when compared to controls. Future studies will establish whether such epivariations could be causal in some cases of ASD, rather than marking other genomic alterations, e.g. copy number variations or aberrations of imprinting.

125 **170.125** Targeted Next-Generation Bisulfite Sequencing Identifies Differential Methylation in a South African ASD Cohort

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Background: DNA methylation is a well-recognised epigenetic modifier of gene expression that mediate transcription via conformational chromatin changes. DNA methylation is implicated in various biological processes, and has been investigated in the aetiology of disease, including Autistic Spectrum Disorders (ASD). A recent study done by our group, using a whole-genome bead-chip approach, identified over 800 genes to be differentially methylated between ASD and controls in a South African cohort, with many of these genes in canonical pathways involved in mitochondrial function. Mitochondrial homeostasis is fundamental and has been associated with numerous neurological disorders. A 50-fold increase in mitochondrial disease in children with ASD compared to the general population has been reported, implicating mitochondrial dysfunction in the pathophysiology of ASD.
Objectives: Firstly, to set up targeted Next-Generation Bisulfite Sequencing (tNGBS) for 30 to 40 loci using buccal cells, to identify assays that can accurately measure methylation at high quantitative resolution. Secondly, to confirm DNA methylation observed in our earlier whole-genome methylation screen in a locus-specific manner using pyrosequencing for the loci optimised using tNGBS. Lastly, this study aims to examine methylation of genes implicated in mitochondrial dysfunction in ASD.

Methods: The 898 genes from our methylation screen were compared with genes from the SFARI database and we identified 59 common genes. These included seven high confidence genes based on SFARI rankings, as well as genes involved in mitochondrial function and ubiquitination pathways, and these were selected for tNGBS. Only loci that passed assay validation QC criteria (e.g. r^2 >0.9) and minimal PCR bias were carried through for subsequent locus-specific pyrosequencing analysis. DNA samples were collected from the buccal cells of a homogenous, mixed race cohort of South African boys, aged 6 to 12, with 46 ASD cases, and 46 neurotypical controls.

Results: From the 59 common genes in the methylation screen -SFARI overlay, 40 met criteria to be selected for tNGBS and four loci were pyrosequenced. We confirmed differential methylation between ASD and controls, highlighting the importance of epigenetic changes. These results accentuate the role of mitochondrial and ubiquitination pathways in ASD.

Conclusions: This study showed that pyrosequencing is a cost- and labour-effective way to identify loci that show differential methylation of the promotor regions of genes. It demonstrates the importance of epigenetics in ASD and the dysfunction in pathways maintaining mitochondrial homeostasis.

126 **170.126** The Potential Role of a Retrotransposed Gene and a Long Non-Coding RNA in Regulating an X-Linked Chromatin Gene (KDM5C): Novel Epigenetic Mechanism in Autism

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Background: A growing body of evidence supports the potential role of the circadian system and chromatin remodeling genes in autism. Considering the heterogeneity in autism, and the complex nature of the epigenetic landscape, identification of biologically relevant epigenetic factors requires reducing heterogeneity using proper subtyping. Previously, we have reported that members of the KDM5 family of genes are involved in the circadian machinery. X chromosome inactivation (XCI) is one of the biological processes highly dependent on epigenetic steps. There is also a crosstalk between DNA methylation and gene regulatory processes, including alternative splicing. We have previously shown the trend of a higher degree of XCI skewness (XIS) in autistic females compared to controls.

Objectives: To investigate the role of circadian genes and their potential mis-splicing in autism.

Methods: In the present study, we used human blood samples (n=39) and a combination of whole genome (Exon array) and gene-targeted assays (PCR, TaqMan, Sanger sequencing) to characterize alternatively spliced KDM5 isoforms in controls and autism, stratified by XCI profiles (with or without XIS). Mouse brain samples were used to study isoforms circadian dependency.

Results: Several isoforms, including previously uncharacterized microexons and intron-retained variants, were identified for each gene. Overall, we found that the X-linked gene (*KDM5C)* undergoes a more complex splicing process than the autosomal genes (*KDM5A* and *KDM5B*). We also identified a *KDM5C* isoform (*KDM5C*-3'UTR-lncRNA) containing a novel 3'UTR originated from a retrotransposed gene of an autosomal methyltransferase (*SUV39H2*). This 3'UTR shows 83% sequence homology with lncRNAs and is located 32kb downstream of *KDM5C*. The *KDM5C*-3'UTR-lncRNA isoform was differentially expressed in autistic females with XIS compared with controls (Figure.1). Intriguingly, the XIS and noXIS autistic females presented different expression profiles, which indicates that such differences would have remained undetected without the subtyping. Since no differences were seen between the XIS and noXIS controls, the detected expression differences for *KCM5C*-3'UTR-lncRNA may be related to the underlying mechanism of autism, and not XIS itself.

This finding would ideally need to be studied in human brain samples collected at different circadian time-points, but it was impossible to do so. Therefore, we attempted to gather basic information about circadian dependent expression fluctuation of Kdm5 isoforms in wild type mouse brain samples (n=27). We characterized alternatively spliced isoforms of the Kdm5 genes and assessed their expression level in samples collected at different circadian time-points. In doing so, we showed that some Kdm5 isoforms follow a circadian oscillation pattern of expression (Figure.2).

KDM5C plays a crucial role in balancing histone H3K4 methylation states. The identified retro-*SUV39H2* originated lncRNA also shows H3K4 marks. LncRNA RNA-seq data from UCSC browser confirmed the expression of lncRNA from the region encompassing the retro-*SUV39H2* gene abundantly, in multiple tissues, including brain and blood.

Conclusions: This study provides the first evidence and a suggestive model for the potential role of retrotransposed elements in autism through linking methylases and demethylases, two functionally complementary components of chromatin remodeling, which may collectively contribute to disease etiology through lncRNAs.

127 **170.127** Use of Electronic Devices and Screen Exposure in a Population of Preschoolers with ASD

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Background: There is general concern in the pediatric medical community, about early screen exposure in children and its possible consequences in health. To date, literature considering the use of electronic devices and screen exposure in children with ASD is very limited. However, many studies suggest that early screen exposure has a negative impact in different areas of development, including language and social interaction. Given that the first years of live constitute a period of great cerebral plasticity, we consider for this study the hypothesis that early intensive screen exposure could have a negative impact in development and in susceptible individuals could condition the severity of ASD symptoms. The intervention in this variable could help modify developmental pathways.

Objectives: to describe the use of electronic devices and screen exposure in a population of preeschoolers with ASD diagnosis.

Methods: Descriptive, observational, trasversal study. The sample consists of 30 preeschoolers who have received attention in the outpatient clinic which specializes on ASD at Centro Hospitalario Pereira Rossell, Montevideo, Uruguay, in the period june 2017- june 2018. A questionnaire specially designed for this study was administered as well as CBCL 1 ½-5. ADOS 2 was administered to all patients above 30 months of age.

Results:

The whole sample was exposed to more than one electronic device. Exposure started before 6 months of age in 35% of patients, and between 6-12 months in 25%. Daily time of exposure is variable, with 28% of the sample watching more than 5 hours a day. 57% of the parents had recently reduced screen exposure in their children.

Conclusions:

There is an early exposure to screens in a large number of the subjects. Special care should be taken in exposure before six months of age. 81% of the subjects exceeded the American Academy of Pediatrics recommendation regarding screen exposure.

Poster Session
171 - Interventions - Non-pharmacologic - Infant, Toddler, and Preschool
11:30 AM - 1:30 PM - Room: 710

128 **171.128** Improvements in Motor Skills, Play, and Socialization in Young Children with Autism Spectrum Disorder Following a Motor Skill Intervention: Preliminary Results

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Background: Children with Autism Spectrum Disorder (ASD) experience challenges in social communicative skills and repetitive behaviours along with delays in motor skills. These challenges can act a barrier to participation in unstructured active play and organized sport; yet, there are few programs available to that focus on development of skills in multiple domains. Fundamental motor skill (FMS) interventions have been shown to improve motor skills as well as social and behavioural skills in children with ASD. Furthermore, motor skills may provide the foundation to lead to increased time in active play ultimately facilitating improvements in social skills.

Objectives: To determine whether improvements in motor skills are associated with increased socialization following a 12-week FMS intervention.

Methods: Participants with ASD (n = 14, 11 male, 3 female, Mage = 3.51, SD ± 0.52) were randomly assigned to an intervention group (n = 7, Mage = 3.64, SD ± 0.69) or waitlist control group (n = 7, Mage = 3.38, SD ± 0.13) prior to participating in the 12-week FMS intervention. The intervention ran

for 1 hour, 2 times per week for 12 weeks. The Vineland Adaptive Behaviour Scale: 2nd Edition and Test of Gross Motor Development-2 (TGMD-2) were completed before and after the intervention. The Vineland-II measures overall adaptive functioning across 4 domains; Communication, Daily Living Skills, Socialization (SOC), and Motor Skills. Play and Leisure Time (PLT) is a sub-domain of the SOC domain. The TGMD-2 measures fundamental motor skills and produces a Gross Motor Quotient (GMQ).

Results: Prior to the intervention, the intervention group had a GMQ mean of 81.57 (SD ± 19.09), SOC standard score mean of 73.86 (SD ± 9.86) and PLT V-scale score mean of 9.71 (SD ± 1.38) whereas the control group showed GMQ mean of 69.14 (SD ± 14.04), SOC standard score mean of 77.43 (SD ± 8.4) and PLT V-scale score mean of 10.57 (SD ± 16.18). There were no significant differences between the groups at the pre-test. Following the intervention, the intervention group displayed GMQ mean of 91.86 (SD ± 20.91), SOC standard score mean of 86.14 (SD ± 17.19), and PLT V-scale score mean of 12.71 (SD ± 3.59) while the control group presented GMQ mean of 76.86 (SD ± 12.93), SOC standard score mean of 76.14 (SD ± 9.17) and PLT V-scale score mean of 10.43 (SD ± 1.51). The intervention group showed significant change from the pre-test to post-test for GMQ ($p = 0.045$) and PLT V-scale score ($p = 0.022$). There were significant results of time by group for SOC ($p = 0.046$) and PLT ($p = 0.019$) as well as time for GMQ ($p = 0.028$) and PLT ($p = 0.03$).

Conclusions: According to the preliminary results, the intervention targeting fundamental motor skills also has a positive impact on socialization and play and leisure time in 3-5 year olds with ASD. Furthermore, early FMS interventions are important in providing opportunities for motor and social skills to develop in hopes of increasing participation in active play.

129 **171.129** Individual Differences in Developmental Gains across One Year of Early Intervention for Pre-Schoolers with Autism.

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Background: Many children with autism benefit from intensive early intervention. However, individual responses vary greatly and little is known about the profile of skills associated with more favourable outcomes. Age at intake and amount of intervention received are commonly identified as contributing to positive outcomes, as are symptom severity and developmental level. However, these factors have rarely been examined together, and among child characteristics, total scores are often used to measure skills, which may mask information about specific behavioural predictors.

Objectives: We aimed to identify specific behaviours associated with developmental gains across one year of intervention, and further examine the role of intervention dose and child age at intake, in a large sample. In this cohort, while we can control for the influence of intervention type, as all children received the same program - participant characteristics and intervention dose naturally vary, enabling us to examine the association of this variation on outcomes.

Methods: Participants were a cohort of 110 children (*M* age = 2.7 years at intake; range 1 to 4.8 years) who received approximately 1-year of Group-Early Start Denver Model (Vivanti et al., 2017) between 2015 and 2017. The Autism Diagnostic Observation Schedule (ADOS-2) was conducted at intake, and single items representing key foundational skills were examined as potential predictors (e.g., Pointing, Response to Joint Attention, etc.) of outcome. The primary outcome of interest was change in Mullen Scales of Early Learning (MSEL) Verbal and Non-Verbal age equivalent (V/NVAE) scores; administered at intake (T1) and exit (T2). Earlier cohorts have shown improvement on the MSEL through this program (Vivanti et al., 2014). Intervention dose was estimated as days/week*months enrolled.

Results: Large variability was evident in developmental gains on the MSEL (see Figure 1). Controlling for T1 AE scores, correlations were evident between younger age at intake and higher T2 NVAE ($r=21$, $p<.05$), and between higher intervention dose and T2 VAE ($r=.24$, $p<.05$). Hierarchical regressions examining the *unique* role of potential predictors, controlling for T1 AE scores, revealed higher T2 NVAE was predicted by ADOS Pointing and intervention dose and (less) ADOS Overactivity ($F(1,83)=54.53$, $p<.001$, $R^2=.72$). ADOS Response to Joint Attention was associated with higher T2 VAE ($F(1,88)=220.82$ $p<.001$, $R^2=.83$). Whilst correlated with outcomes, age at intake was not a significant *unique* predictor of T2 V/NVAE, nor were other ADOS social-communication skills (e.g., Play, Eye Contact and Language) when entered alongside the aforementioned significant unique predictors.

Conclusions: Identifying specific skills/behaviours associated with more favourable developmental outcomes can help inform future individualised treatment decisions. *Developmental* age may play a greater role in predicting gains than *chronological* age. Nevertheless, these data reinforce the importance of early intervention to ensure learning supports are in place to minimise the extent of the gap between chronological and developmental age over time. While examination of associated factors in a large cohort receiving a common intervention informs our understanding of predictors of outcome, replication of findings within a comparative study is required to disentangle genuine predictors of intervention outcome from broad indicators of good prognosis.

130 **171.130** Individual Treatment Change during the Early Social Interaction (ESI) Project Predicts Long-Term Behavioral Outcomes

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Background: Early intervention has been shown to improve language, cognitive, and/or social outcomes for toddlers diagnosed with ASD (Dawson et al.,2010; Kasari et al.,2010; Wetherby et al.,2014), as well as reductions in autism symptoms and adaptive behavior at school-age (Estes et al.,2015; Pickles et al.,2016). However, given substantial variability in children's responses to early intervention (Guthrie et al.,2016), it is also important to examine individual treatment change to elucidate maintenance of improvements and impact on long-term outcome.
Objectives: To examine how *individual-level* change in social interaction skills during treatment predicted child functioning at follow-up. Specifically, this study investigated the relationship between individual trajectories of children who received 18-months of parent-implemented early intervention and outcomes at school-age.

Methods: Toddlers with ASD (*N*=82) participated in a crossover RCT design in which they were randomized to receive either Individual-ESI or Group-ESI for 9-months (Condition I, ~18-27-months of age) and then crossed over to receive the other treatment for an additional 9-months

(Condition II, ~27-36-months of age). The CSBS was administered at baseline and every other month until the end of treatment. Sixty-five children returned for a long-term follow-up assessment between 5-8-years (*M*=6.79y), which included the ADOS-2, ADI-R, DAS-II (*Differential Ability Scales-II*), WJ (*Woodcock-Johnson Achievement*), Vineland-II, and BASC-3 (*Behavior Assessment System for Children*).

Results: At follow-up, children demonstrated average IQ, academic achievement, and behavioral functioning, with mild impairment in adaptive behavior and autism symptoms.

A piecewise hierarchical linear model was fit to model change during treatment; the final model included random intercepts, random slopes, fixed quadratic terms, and condition-by-slopes interactions. The resulting slopes were then used to predict school-aged outcomes via linear regression. Greater increases (i.e., steeper slope) in CSBS-Social composite scores during Condition I, but not Condition II, predicted *lower* ADOS-Social Affect scores at follow-up (*t*=-2.33, *p*.=.02). In contrast, greater increases in CSBS-Social during Condition II predicted *higher* ADOS-RRB scores at follow-up (*t*=3.11, *p*=.003). Finally, greater increases in CSBS-Social during Condition I, but not Condition II, predicted *moderately fewer* externalizing symptoms on the BASC at follow-up (*t*=-1.93, *p*=.06). Changes in CSBS-Social during treatment were not significant predictors of intellectual or academic functioning (DAS-II, WJ), adaptive behavior (Vineland-II), or parent-reported social interaction symptoms (ADI-R).

Conclusions: On average, children who participated in early ESI treatment as toddlers demonstrated age-appropriate intellectual and academic functioning at school-age follow-up. The degree of change in social interaction skills during treatment was a significant predictor of behavioral outcomes (i.e., autism symptoms, externalizing symptoms) approximately 3.5-years after treatment ended, but not of intellectual, academic, or adaptive functioning. While change during Condition I predicted ADOS and BASC scores, change during Condition II was generally not predictive of outcomes, likely due to the more limited gains observed in Condition II. The exception to this was the unexpected finding regarding the negative relationship between change in social skills during Condition II and school-age RRBs; we plan to examine this relationship further via parent-report (i.e., RBS-R). In sum, this study demonstrates the importance of examining individual changes during early treatment in predicting long-term outcomes.

131 **171.131** Informing an Early Intervention Model for Children at Risk of Autism Spectrum Disorder and Other Developmental Disabilities

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Background: Therapeutic playgroups are increasingly recognised as an important engagement point for vulnerable families accessing early intervention services for their children at risk of Autism Spectrum Disorder and other developmental disabilities. However, there is currently no clear description and specification for best practice in playgroup intervention which impedes effective playgroup implementation and evaluation. Researchers state inconsistent playgroup definitions, models and practice principles have hindered playgroup implementation and evaluation, calling for a common definition of playgroups components and identify the "active ingredients of playgroups to strengthen the evidence base for playgroup effectiveness. Therefore, the systematic development and evaluation of playgroups is novel and important to establish evidence based practice with findings being directly beneficial to children at risk of Autism Spectrum Disorder and other developmental disabilities.
Objectives: This study aimed to address a substantial evidence gap by providing a clear definition of therapeutic playgroups and playgroup practice principles that produce the most efficacious outcomes for children at risk of developmental disabilities and their families.

Methods: Using the Medical Research Council Framework for the Development and Evaluation of Complex Interventions this study identified the "active ingredients" of therapeutic playgroups. Initially, a scoping review was conducted to identify the evidence base for therapeutic playgroups. Secondly, parents (n=23) and health professionals (n=40) were consulted as stakeholders, and defined the "active ingredients" of playgroup intervention and theory. Finally, findings were triangulated to identify an overarching theoretical framework, modelling therapeutic playgroup process and evaluation.

Results: Therapeutic playgroups require a complex interplay of service provider (facilitator qualities), participant (shared experiences and social networking) and intervention characteristics (format, physical resources and information provision). The overarching frameworks that defined therapeutic playgroup intervention was family centred practice, self-efficacy theory and peer support theory.

Conclusions: These findings provide a definition of evidence based therapeutic playgroups with a clear description of the program, including theoretical frameworks, essential functions of the program and performance assessment. The program description enables the active ingredients to be taught, learned and implemented with good outcomes. Findings also contribute to our understanding about the role playgroups have in facilitating child and parent outcomes in children at risk of Autism Spectrum Disorder, whilst providing a protocol for how to develop and deliver effective playgroups which has implications nationally and international.

This study is the first to develop a therapeutic playgroup intervention framework using the Medical Research Council Framework, a critical step in establishing evidence based therapeutic playgroups for children and their families at risk of Autism Spectrum Disorder and other developmental disabilities.

132 **171.132** Intervention in the Assessment Clinic: Feasibility and Efficacy of an Abbreviated Group-Based Intervention Model for Toddlers

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Background: Recent evidence from parent-mediated early intervention models for toddlers with ASD has demonstrated child- and parent-level gains following 3-12 months of intervention. These models are relatively resource-efficient, but demand continues to grow and is outpacing capacity such that toddlers may be missing out on intervention at a key time in development when neuroplasticity is optimal. In response to this

increasing demand, our team developed an abbreviated, group-based version of our 12-week, in-home parent-mediated Social ABCs intervention. The Social ABCs parent-mediated intervention (standard model) is a 12-week in-home model, with demonstrated efficacy based on a cross-site RCT.

Objectives: To develop, pilot, and evaluate an abbreviated group-based model of an evidence-based parent-mediated intervention for toddlers with ASD or related social-communication challenges. The motivation for this work was to increase access to intervention, at the earliest signs of concern, for toddlers within the course of their clinical diagnostic care pathway, including before a diagnosis may be confirmed.

Methods: We adapted the original 12-week, one-on-one model to be delivered in a small-group format over six weeks (5 group-based didactics and 9 one-on-one parent coaching sessions in the clinic). Referrals were received from diagnosing clinicians (Psychologists or Developmental Paediatricians) or Social Workers within the clinical assessment service (Child Development Program) at Holland Bloorview Kids Rehab Hospital in Toronto, Ontario. To date, we have completed 4 groups (n = 12 toddler-parent dyads). Data from the first 3 groups were coded from video tape and analyzed, including measures of parent implementation fidelity (% correct use of strategies) and child responsivity (rate of responding to parent-provided language opportunities). Data from 20 dyads (6 groups) will be included for presentation at INSAR in May 2019.

Results: Interim analyses of group 1 led to program modifications which have been maintained for subsequent groups. Parents achieved implementation fidelity at a mean rate of 75% by the end of the program (week 6), increasing significantly from baseline, $t = 7.98$, $p < .001$. Child Responsivity increased by 43% from baseline to week 6 ($t = 6.32$, $p < .001$), at a pace commensurate with that reported in our previous RCT based on the original, 12-week one-to-one home-based model. Within the clinic-delivery model, our team has trained two Speech-Language Pathologists to provide parent-coaching. Parents and clinical staff have reported high levels of satisfaction with the program.

Conclusions: Findings reveal the feasibility and acceptability of our abbreviated group-based intervention model for toddlers with ASD and related social-communication concerns. Results demonstrate that the abbreviated model can be implemented in a clinical setting for toddlers within the context of a diagnostic assessment service. This abbreviated, group-based approach adds to the suite of services that can be offered to families very early in their diagnostic assessment journey, in many cases before a definitive diagnosis may be confirmed, and/or while awaiting more intensive intervention services. Weaving a brief intervention program into a clinical assessment pathway has the added value of providing clinicians with information about a child's response-to-treatment in cases of diagnostic uncertainty.

133 **171.133** Measure of Interactive Strategy Implementation – Caregivers (MISI-C): Preliminary Validity and Reliability

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Background: Early interventions for ASD use Parent Mediated Intervention (PMI) to teach parents interactive strategies targeting social communication in their children with ASD (Kasari et al., 2014; Pickles et al., 2016; Wetherby et al., 2014). Although individual treatments have attempted to use specific fidelity ratings to measure caregiver strategy implementation (Gulsrud et al., 2016; Rogers et al., 2018), there is no uniform measurement that can be used to examine caregiver strategies *across* different PMIs. This study provides initial validity and reliability of the Measure of Interactive Strategy Implementation-Caregivers (MISI-C), a novel outcome measure designed to capture changes in caregiver implementation of interactive strategies for toddlers with ASD over the course of various early interventions.

Objectives: We aim to (1) determine items for inclusion in the final MISI-C coding scheme, (2) explore the factor structure of the MISI-C items, (3) examine inter-rater (IRR) and test-retest (TRT) reliability, and (4) provide initial evidence for validity of the MISI-C in capturing changes in caregivers' strategy implementation during intervention and how those changes are associated with changes in children's social communication.

Methods: The MISI-C was applied to 116 observations of 43 caregiver-child dyads with minimally verbal children ranging from 1-5 years of age with varying language, cognitive, and ASD symptoms. All caregiver-child dyads participated in various PMIs (Kasari et al., 2010; Rogers et al., 2012; Wetherby et al., 2014) and were observed at two time points, on average 6 months apart. We constructed items in the MISI-C based on the interactive strategies commonly taught across different Naturalistic Developmental Behavioral Intervention ([NDBIs]; Schreibman et al., 2015). An Exploratory Factor Analysis (EFA) was conducted to determine statistically related domains of core strategies. Intraclass correlations (ICCs) were used for IRR and TRT reliability. Paired sample t-tests were used to assess changes in caregiver implementation of strategies over time quantified by the MISI-C domain and total scores. Correlations between changes in caregiver strategies (MISI-C) and changes in child social communication (Brief Observation of Social Communication [BOSCC]; Grzadzinski et al., 2016) were observed using Pearson's r.

Results: EFA results supported a five-factor model (CFI=0.09, RMSEA=0.59) (Table 1). Total score ICCs for IRR and TRT reliability were 0.80 and 0.92, respectively. Significant changes over time were observed for all five domains and total MISI-C scores ($p<0.01$), with medium to large effect sizes ranging from 0.5-0.9 (Figure 1). Statistically significant associations between changes in caregivers' implementation of interactive strategies (MISI-C) and changes in children's social communication (BOSCC) were found ranging from $r= -.33$ to $-.49$ ($p<.05$).

Conclusions: Results show promising, initial evidence for strong reliability and validity of the MISI-C as an outcome measure that captures changes in caregiver implementation of interactive strategies. Additionally, changes in caregivers' implementation of strategies were significantly associated with changes in children's social communication over the course of varying treatment models. This novel outcome measure could allow a uniform measurement approach to assessing treatment effects on caregivers, and thus enabling replications and the aggregation of samples across different intervention trials to increase statistical power.

134 **171.134** Parent Well-Being over 6 Months in a Randomized, Controlled Caregiver Mediated Intervention Study for Toddlers with Autism

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Background: Converging evidence suggests caregivers of children with ASD experience more stress than caregivers of typically-developing children or children with other disabilities (e.g. Hayes & Watson, 2013). Parenting stress potentially counteracts the effectiveness of early interventions, negatively impacting parental and child outcomes (Osborne et al., 2008). Kasari et al., (2015) examined differences in parental stress

between caregiver-mediated (JASPER) and parent education interventions (PEI) and found a reduction in child-related stress for the PEI group, and no change in parent-related stress for either group from entry to 10-week exit. Examining longitudinal follow-up data and specific subscales of parental stress will aide in better understanding of specific stress factors and their maintenance after an active treatment concludes.
Objectives: This study aims to extend previous work by Kasari et al., (2015) by exploring parent-subdomain scores as measured by the Parenting Stress Index (PSI; Loyd & Abdin, 1985) during the active treatment and follow-up phase of a randomized, controlled intervention study for toddlers with ASD and their caregivers.

Methods: Participants (n=86) were from a larger research study comparing effects of two treatment conditions on joint attention outcomes of toddlers with ASD (Kasari et al., 2015). The toddlers and their primary caregivers were randomized to one of the two treatment groups: parent psychoeducation (PEI) or 1:1 caregiver-mediated social communication intervention (JASPER). The present study examines Competence, Isolation, Health, Attachment, Role Restriction, Depression, and Spouse Relationship subscales of the parent-related stress domain of the PSI by treatment group at entry, 10-week exit, and 6-month follow-up. Generalized linear models were used to analyze changes in parent-subscale scores across the three timepoints. ADOS Calibrated Severity Score (CSS) was used to account for autism symptom severity.

Results: Significant time-by-group interaction effects were present for three of the parent-subscales: Isolation (b= 0.153, X^2= 6.89, p= 0.030); Attachment (b= -0.3083, X^2= 6.72, p= 0.034); Depression (b= -0.77, X^2= 6.87, p= 0.032). These effects were only present when analyzing across all three timepoints. No group-by-time interaction effects were found for the other four parent-related stress subscales.

Conclusions: Although Kasari et al., (2015) found overall reduction of parental stress in the child-related domain in PEI group with no change in the parent-related domain from entry to exit in either group, our analysis indicates that over a longer period of time (6 months), changes are present in sub-scales of the parent domain of PSI. JASPER parents reported higher scores for the Isolation subscale and lower scores for Attachment and Depression subscales when compared to the PEI group over time. This translates to JASPER parents reporting lower levels of depression and improved feelings of closeness (attachment) with their toddlers in comparison to PEI group. However, parents who received JASPER also experienced higher levels of isolation at follow-up. JASPER caregivers might have felt more isolated and less supported to independently implement intervention strategies without active coaching after exiting the study. Psychoeducation and booster sessions may help mitigate such perceived isolation after the active treatment period ends.

135 **171.135** Parent-Child Group Intervention Based on Esdm for Young Children with ASD

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Background: Despite strong evidence for the positive impact of early intervention that begins immediately following diagnosis (Koegel et al., 2014), access to high quality treatment is quite limited, and this is particularly true for very young children with ASD. One way of increasing access to intervention is to teach intervention strategies to parents immediately after diagnosis.
Objectives: The first aim of this project was to adapt an existing evidence based intervention, the Early Start Denver Model (ESDM) (Rogers and Dawson, 2010), to a parent-child group delivery in order to increase access to treatment in the period immediately following diagnosis, and thereby improve child outcomes. The second aim was to examine the progress of the children enrolled in the study. The third aim was to evaluate whether parents learned intervention strategies.

Methods: The Parent-Child group ESDM was delivered to 19 young children with ASD, between 24 and 51 months of age, and their caregivers. Each family participating in the study received one 1-hour session per week of the treatment, delivered in a group of 3-5 child-caregiver dyads, for 12 weeks. Social-communication behaviors were measured by the Brief Observation of Social Communication Change (BOSCC) (Lord et al., 2016). Parent learning of the therapy strategies was measured by the ESDM Parent Fidelity Measure (Rogers et al., 2012).

Results: Preliminary data indicated gains in social-communication behaviors in children as measured by the BOSCC. After 12 weeks of intervention the children demonstrated a decrease of 4 points in the BOSCC (t=7.9; p<.01). Changes in the BOSCC scores were negatively correlated to age (r= -.53; p<.05), indicating that the youngest children made the most gains in social communication. Parents improved in their therapy strategies as demonstrated by improved scores in the fidelity measure at the end of the intervention. Acceptability of the program was very good as indicated by retention of all participants. Moreover, results from a five-point Likert-based scale survey indicated that the caregivers agreed or strongly agreed that the program was useful and satisfying.

Conclusions: Our preliminary results suggest that the ESDM delivered in a parent-child group context may be useful to teach intervention skills to parents and to increase social communication in young children with ASD. Additionally, our results suggest that early intervention is most efficacious when started as early as possible in development.

136 **171.136** Predicting Differences in Age of ASD Diagnosis within a Multi-Stage Screening Protocol

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Background: Early detection of ASD is thought to promote better long-term outcomes, by enabling earlier uptake of ASD intervention; however, a roughly 1.5-year gap persists between the age at which ASD can typically be diagnosed (< age 2) and the national median diagnostic age (3 years, 10 months; Baio et al., 2014). Moreover, children of racial or ethnic minorities are diagnosed significantly later than White children (Mandell et al., 2009).
Objectives: The aim of the present study is to determine factors that distinguish children who receive an ASD diagnosis before 2 years of age from those who receive a later diagnosis.

Methods: This study occurs within the context of a multi-stage screening and assessment protocol aimed at decreasing disparities in ASD diagnosis and service receipt. The project partners with local Early Intervention (EI) agencies to identify children at risk for ASD by disseminating a two stage screening process. Partnering EI agencies administer Stage 1 parent-reported questionnaires of child functioning. Children who obtain scores above cut-offs or have a parent or EI provider express concern regarding ASD, were referred to Stage 2, a play-based observational assessment. Children who screened positive at Stage 2 were referred to a research-based diagnostic evaluation prior to 36-months of age, when children transition out of EI services.

The majority of the 395 (16.2% female) participants received a diagnosis between the age of 2 and 3 (mean: 28 months, range: 16-38 months). Participants were divided into three age groups: 14-23 months; 24-30 months; and 31-36 months at ASD diagnosis. The sample was diverse with respect to race/ethnicity (76 White non-Hispanic, 98 Black, 224 Latinx, and 25 Asian participants), immigration status (53.7%), English learner status (35.8%), and poverty status (58.7%). Performance on screening measures, level of parental concern, and family demographic factors were compared among age groups.

Results: Children diagnosed under 24 months were more likely to be White non-Hispanic than Black, Latinx, or Asian, $x^2(6)=17.27$, $p=.008$. However, groups did not differ by English language learner status, immigration status, household income, or parental education. A series of one-way ANOVAs indicated that diagnostic-age groups did not differ in Stage 1 scores of ASD-specific problems or competencies, nor did they differ in the presence of parental concerns about a) ASD, b) child language, or c) child behavior, emotions, and relationships.

Conclusions: Because the current study took place within the context of a screening protocol that is specifically designed to address and reduce health disparities in rates and age of diagnosis, we expected to see no differences in age of diagnosis. The fact that only race, but not other known social determinants of health such as income, English learner status, or parent education, related to diagnostic age, suggests that racial discrimination, race-related systemic factors, and/or ethnically and culturally-relevant barriers may be at play. Next steps include incorporating Department of Public Health data on EI referral reason and age of entry to further understand the sources of these age-related disparities.

137 **171.137** Predictors of Response to Early Parent-Mediated Interventions for Young Children with Autism: A Systematic Review

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Background: Autism is characterised by marked heterogeneity, with substantial individual variability evident in presentation and outcomes. There is a growing body of evidence supporting the effectiveness of early parent-mediated interventions for young children with autism. However, individual responses vary, with little known about child and familial characteristics predictive of outcomes.
Objectives: We conducted a systematic review to identify child and family characteristics associated with developmental outcomes for young children with/at risk of autism receiving parent-mediated early intervention.

Methods: Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and Covidence software platform, we identified relevant literature using Psych INFO, Medline, Pubmed, CINAHL and ERIC databases and manual review of reference lists from key papers. Eligibility for inclusion in the systematic review was the paper: (1) examined the efficacy/effectiveness of early parent-mediated behavioural interventions; (2) utilised a comparative design (e.g., RCT); (3) included participants with/or having high likelihood of developing autism, aged 0-6 years; and, (4) reported a statistical moderation between a child/family characteristic and a quantitative, established outcome measure of child development. Two independent reviewers screened titles and abstracts of all identified papers. Full-texts were accessed to confirm eligibility for papers meeting inclusion criteria. Relevant data were extracted for each paper by two independent reviewers. Discrepancies were identified and resolved through discussion and with the aid of an additional reviewer where necessary.

Results: Ten papers from eight individual studies met inclusion criteria. Each varied in the predictors, outcomes and interventions explored. There was some evidence that children who commenced interventions with lower skills made greater gains in language, adaptive behaviour and social communication, but not for all children. Two papers reported that higher parental stress and higher family income were associated with larger gains in child outcomes for the intervention group. Two papers (reporting on the same intervention study) also found associations between features related to higher quality parent-child interactions and better child outcomes following the intervention. However, a key drawback of the identified studies is the heterogeneity of predictors, outcomes and interventions, making it difficult to synthesise findings and draw strong conclusions. Additionally, risk of bias – particularly around lack of blinded outcome assessment – was an issue in some identified papers.

Conclusions: Identifying child and family characteristics that predict favourable intervention outcomes may help further our understanding of which children with autism may benefit most from which intervention. More tailored interventions could help optimise short and longer terms outcomes. Further well-designed studies, including larger sample sizes, are needed to identify differential predictors of intervention outcomes. Inclusion of additional parent-related predictors of parent-mediated interventions in future studies would also strengthen the literature

138 **171.138** Preliminary Outcome of the Early Start Denver Model for Young Children with Autism Spectrum Disorder in a Clinical Setting in Taiwan

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Background: The Early Start Denver Model (ESDM) is a comprehensive and naturalistic behavioral development early intervention program that has been shown to positively affect key outcomes for toddlers and young children with Autism Spectrum Disorder (ASD) following over 12 months of high-intensity intervention. However, most studies have been conducted in Western countries, with few conducted in East Asian settings, such as Taiwan. In Taiwan, clinical settings are the main resources of intervention services for young children with ASD. Public health policy regarding early intervention in Taiwan stipulates that there should be a multidisciplinary team in the clinical setting and encourages team members to work collaboratively. Team members should include clinical psychologists, occupational therapists and speech-language pathologists. This policy's focus on an interdisciplinary approach aligns with that of intervention programs such as the ESDM. Therefore, implementing the ESDM in clinical settings in Taiwan is pragmatic and important for young children with ASD.
Objectives: The purpose of this study was to preliminarily evaluate the effectiveness of an ESDM intervention based on Taiwanese public health policy for young children with ASD in the Greater Taipei area in Taiwan.

Methods: A total of 16 children with a DSM-5 diagnosis of ASD aged between 25 and 46 months (mean = 33.5 months) were recruited. Children received 9 hours per week of one-to-one ESDM intervention in clinical settings for 6 months. Interventions were delivered by clinical psychologists, occupational therapists, and speech-language pathologists trained by an ESDM accredited trainer. Outcome measures were

administered pre- and post-intervention, comprising the Mullen Scales of Early Learning (MSEL) and Autism Diagnostic Observation Schedule (ADOS). The MSEL was used to measure nonverbal (visual reception and fine motor), verbal (receptive and expressive language) and overall cognitive performance assessed by standardized developmental quotients (DQ), and ADOS was used to measure the severity of ASD symptoms.

Results: The average overall cognitive performance at entry of children with ASD was moderately delayed (mean DQ = 53.6). However, after receiving 6-months of the one-to-one ESDM intervention, children made significant improvements in nonverbal, verbal and overall cognitive performance, and the developmental gains were 6.9, 10.0, and 8.5 months, respectively, which were in excess of what may have been expected due to maturation. The effect sizes of improvement in receptive language and overall cognitive performance were large (>.80). Moreover, children's symptom severity of communication and play in ADOS were decreased significantly post-intervention, and the effect sizes were both nearly large (>.75).

Conclusions: This study provides preliminary findings on the implementation of ESDM in Taiwan. The results indicate that a low-intensity and short-term ESDM intervention directly delivered by a multidisciplinary team in a clinical setting may be a promising treatment for young children with ASD. The following steps in Taiwan are to incorporate a control group for comparison and follow up the 2 matched groups to determine the long-term effects.

139 **171.139** Preliminary Results of a 12 Week Motor Skill Intervention on Motor Skills for 3-5 Year Old Children with ASD

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Background:

Fundamental motor skills are the foundation skills required for children to engage in more complex games and activities; they include running, throwing, catching, kicking, etc. Fundamental motor skills are also critical to engagement in active play in early childhood. Active play is a critical venue where social, communication and even behavioural skills are developed in addition to engagement in age appropriate physical activity. Evidence indicates that children with ASD experience delays in fundamental motor skills. Well-controlled intervention studies that target fundamental motor skills are scarce.

Objectives:

The purpose of this study was to conduct a 12 week, 2x/week fundamental motor skill intervention for 3-5 year old children with ASD to examine if motor skills improve.

Methods:

14 children with ASD (11 male, 3 female, Mean age = 3.51 ± .52) were recruited for a 12 week, 2 hours/week, wait-list controlled fundamental motor skill intervention. Participants were randomly assigned to the intervention (n = 7, Mean age = 3.74 ± 0.69) or control group (n = 7, Mean age = 3.38 ± 0.13). As part of a larger ongoing study motor skills were measured 3 ways at pre-test and post-test. The Test of Gross Motor Development-2 (TGMD-2), the Peabody Developmental Motor Scales-2 (PDMS-2), and lastly the Vineland Adaptive Behavior Scales, 2nd Edition (VABS-2) parent/caregiver form (motor subscale) were used to triangulate the motor assessments of the participants and provide a comprehensive picture of skill. A 2x2 repeated measures analysis was conducted on each of the assessments.

Results:

At the pre-test assessment, all children with ASD were significantly delayed in their motor skills as measured by each of the TGMD-2, the PDMS-2 and the VABS-2 motor subscale with most scoring at or below the 1st percentile. There were no significant differences between the groups at the pre-test. For the gross motor quotient of the TGMD-2, there was a significant effect for time ($p = 0.002$) but the group by time interaction was not significant. For the PDMS-2 gross motor quotient there was a significant effect for time ($p = 0.03$) but no effect for the group x time interaction. For the VABS-2 motor scale the effect for time was approaching significance ($p=.09$) but again no effect for group x time.

Conclusions:

All the children demonstrated significant delays in motor skills at the baseline assessment. The delays were so significant that challenges in age appropriate active play would be impeded. This finding indicates that early intervention on gross motor skills in addition to traditional interventions (e.g. behavioural, speech and language) is warranted for 3-5 year old children with ASD. These preliminary results of the 12 week, 2 hours/week motor intervention indicate an overall positive effect but a much larger sample size is needed due to high variability in the performance of the participants.

140 **171.140** Psychiatric Live Animotion Intervention (PLAI) - Virtual Training for Preschool Children with Autism Spectrum Disorder

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Background: Autism Spectrum Disorders (ASD) are considered incurable. Studies have found that early intervention is crucial for the development and prognosis, and the existing early interventions are often extensive and costly, or in-effective. Therefore, there is an urgent need for the development and application of efficacious and cost-effective interventions. Virtual reality (VR) paradigms can be empowering for children with ASD, because it may overcome some of the barriers experienced in face-to-face interaction with humans. However, the effect of VR is still sparsely explored in children with ASD.

Objectives: The objectives are to explore the feasibility and effect of the newly developed Psychiatric Live Animotion Intervention (PLAI) for preschool children with ASD.

Methods: A therapist puts on a motion-capture suit (Smartsuit Pro©, Rokoko) that registers every movement of his/her body and transfers them to an animated character on a computer. The animated character is streamed through the Internet to the child's device at home and a live recording of the child is projected back to the therapist (Figure 1). It is hypothesized that the simplified and interesting playful universe may induce a greater level of social behavior and communication in children with ASD. Two boys with ASD, age 4 and 5, received 8 weeks of intervention with sessions twice a week (duration of 12-18 minutes). The treatment manual was developed with inspiration from Applied Behavior Analysis (ABA) and the Early Start Denver Model and consisted of eight activities that attempted to strengthen and encourage the use of both verbal and non-verbal communication, motor skills, social skills, and pretend play. The authors used a case study-design including both

qualitative and quantitative data. The study explored the effectiveness of PLAI in improving behavioral, social and communicative outcomes in preschool children with ASD.

Results: The participants showed a significant improvement in therapist rated problem behavior (Test Observation Form, TOF) and vocalization after participating in PLAI (Table 1). Furthermore, the children's vocabulary increased respectively with 5.5 % and 7.7 %. Significant improvements were seen in subscales on both parent and daycare rated problem behaviors (CBCL 1½-5 and C-TRF). No significant effects were found on ASD symptomatology (Social Responsiveness Scale 2nd edition, SRS-2). Parents expressed great satisfaction with the intervention and reported improvements in their offspring's greeting behavior, concentration level and communication skills. One of the parents stated "He has learned a simple thing such as how to wave goodbye. It is such a small thing, but still very important". The other family emphasized the effect on communication skills "We think he has become much better at answering our requests. Previously we could ask him about the same thing five times and he would not respond. We think that could be a result of this intervention".

Conclusions: These case studies support the feasibility of PLAI. The families had positive views on the intervention. Likewise, PLAI seems to have a potential impact on several verbal and behavioural measures both in and outside the intervention.

141 **171.141** Quality and Duration of P-Esdm Intervention Mediates the Developmental Outcomes of Toddlers with ASD

ABSTRACT WITHDRAWN

Background:

A clinical trial previously published our team indicated that Chinese ASD toddlers receiving 26 weeks of P-ESDM via regular coaching sessions significantly improved their developmental outcomes including social communications than those receiving community interventions.

Objectives:

To further explore how parents' duration and mastery of P-ESDM could influence the developmental outcomes of toddlers with ASD.

Methods:

We calculated the durations of P-ESDM (≥20hrs/week or ＜20hrs/week) according to the Intervention Record Sheet completed by parents and evaluated their mastery of P-ESDM (master-fidelity score≥3 or loose-fidelity score ＜3) based on their fidelity and their self-assessment. Considering the parents who mastered the techniques of ESDM well tended to implement the intervention more frequently, we performed repeated measure ANOVA and post-hoc t-tests comparing the developmental outcomes of ASD toddlers receiving P-ESDM intervention for more or less than 20 hours a week at home, and receiving the intervention by more or less skilled parents.

Results:

1. We perform 2 (Mastery: master, loose)*2 (Duration: ≥20hrs/week, <20hrs/week) repeated measure ANOVA. The results indicated that the interaction between the 2 factors is significant (F=21.135, P=0.019). Then post-hoc t-tests were applied and the results are listed as follows.
2. ASD toddlers receiving P-ESDM intervention for more than 20 hours(n=15) demonstrated greater improvement in general development than those for less than 20(n=8)(ΔGQ: 10.78±12.22 vs. 2.95±4.24， P=0.037), especially in Language domain.
3. ASD toddlers with relatively more-skilled parents(n=14) showed significant improvement in general development than those with less-skilled parents(n=9)(ΔGQ: 11.41±12.43 vs. 2.84±3.97， P=0.029) , especially in Language and Eye-hand coordination domains.

Conclusions:

Our results demonstrated that higher intensity of P-ESDM intervention with more-skilled parents would effectively improve developmental outcomes of toddlers with ASD, even with low-intensity professional coaching. We underscore the importance of regular parent training and actively participating in the early intervention for ASD toddlers in daily life.

142 **171.142** Randomized Clinical Trial of an Online Pivotal Response Treatment Training Program: Parent and Child Outcomes

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Background:

Despite advances in early interventions for autism spectrum disorder (ASD), disparities in access to contemporary evidence-based treatments remain a serious concern (Thomas et al., 2007; Liptak et al., 2008). Numerous barriers, including delays in translating research to community practice, cost of services, extensive time commitments, and geographical distance to trained providers limit the ability for families to take advantage of the latest scientifically based autism interventions (Johnson & Hastings, 2002; McIntyre & Barton, 2010). To address this, recent studies have begun to explore parent-implemented interventions via an online format. These approaches improve access to training for families, can fit into busy family schedules, and lower the cost of treatment (Nelson, Bui, & Velasquez, 2011; Ritterband et al., 2003). The current project examined the feasibility, utility, and preliminary efficacy of a newly developed online course designed to help parents implement an evidence-based natural developmental behavioral intervention, Pivotal Response Treatment (PRT), with young children with ASD. This new program was examined using a randomized clinical trial design.

Objectives:

This study's objective was to investigate the impact of an online course of PRT early intervention strategies on parent and child outcomes.

Methods:

Participants were 24 parent-child dyads with ASD, ages 12-56 months. PRT presentations consisting of informational slides, video examples, and brief quizzes were delivered through a Qualtrics-based digital platform each week. Topics focused on core intervention strategies to elicit communication and social engagement through playful interactions, motivational elements, natural environments, and behavior principles. Parents submitted weekly videos capturing their use of these treatment strategies, which were coded for PRT fidelity of implementation (FOI) and child social-communicative behaviors. FOI was defined as the parent properly demonstrating all PRT components with competency at least 80% of the time. Social validity measures were also obtained following course participation.

Results:

Preliminary data from families who have completed the course were analyzed. Analysis revealed that parent's treatment fidelity improved significantly from baseline (M= 65.40%, SD= 19.02) to Week 5 (M= 90.18%, SD= 7.59); *t* (9)= -5.57, *p*= .01. By the end of the program, 90% of parents met fidelity of implementation (80% or higher fidelity score). These results were supported by social validity data from families indicating high satisfaction with the course. On a 0-5 scale (0= Strongly Disagree, 5= Strongly Agree), all families reported that the course was clearly written and well organized (M= 4.5, SD=0.53), that they would recommend the course to a friend (M=4.5, SD=0.53), and that the course provided them with a clear understanding of Pivotal Response Treatment (M= 4.2, SD=0.42). Coding and analysis of child social-communication outcome measures is currently underway, with preliminary data indicative of increases in social engagement, prompted language, and spontaneous language use.

Conclusions:

The data indicate that parent fidelity significantly improved following participation in the online course. These results suggest that an online intervention may be a feasible approach to disseminating PRT strategies. This innovative format has the potential to reduce disparities in access to evidence-based intervention.

143 **171.143** Short-Term Outcomes for Pre-Schoolers with ASD Receiving Group-Based and One-on-One Early Start Denver Model (EDSM) Intervention

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Background:

The Early Start Denver Model (ESDM) is an intensive intervention for young children with Autism Spectrum Disorder (ASD). The individually delivered approach (i.e., one-on-one) has evidence of efficacy – from a published randomised controlled trial (Dawson et al., 2010) – for accelerating children's cognitive development and building adaptive behaviours. A group-delivery approach has also been developed for implementation within educational settings (G-ESDM; Vivanti et al., 2017), which has some published evidence of effectiveness via evaluation of pre-and post-treatment outcomes in a non-randomised design (Vivanti et al., 2014). Child gains from one or other format have not been directly compared, nor have G-ESDM gains been evaluated in the short-term (i.e., following 5-months).

Objectives:

In the context of an ongoing study comparing child outcomes following various approaches to ESDM delivery, we are comparing the short- and medium-term gains made by children within around 6- and 12-months of participation in either group- or individually-delivered ESDM.

Methods:

We are assessing developmental gains made by children receiving one of two ESDM programs – both provided by the same team – in either an autism-specific group setting, or delivered one-on-one in children's homes/local childcare. Developmental abilities are assessed using the Mullen Scales of Early Learning (MSEL) and adaptive behaviours using the Vineland Adaptive Behaviour Scales (parent interview; VABS) administered pre-treatment and again after around 6- and 12-months.

Results:

To date, 21 pre-schoolers (M=34 months, SD=5.4; 18 boys, 5 girls) are enrolled in the study (G-ESDM N=14; individual ESDM N=7). All have completed a 5-month mid-point assessment and two have completed 10-month end-point. By the time of INSAR, we will have 10-month end-point data for all. On average, children receiving G-ESDM and individual ESDM *appear to have* made similar age-equivalence gains within the first 6-months of their program for MSEL Visual Reception (respectively; M=3.9m gains, SD=6.5; M=3.6m, SD=5.3). By contrast, average gains for the individual ESDM group seem more substantial than those for the G-ESDM group for MSEL Fine Motor skills (respectively, M=7.8, SD=11.4; M=2.8, SD=4.9) and Receptive Language (M=13, SD=10.8; M=3.1, SD=10.1) and slightly so for Expressive Language (M=4.6, SD=4.7; M=2.9, SD=6.9). However, MSEL age equivalent gains were highly variable *within* each group (Figure 1). Children receiving G-ESDM group made substantial age-equivalence gains for VABS Personal skills (Figure 2a) such as feeding and dressing themselves (M=6.6m gains, SD=5.1) as well as VABS Domestic skills (Figure 2b) including cleaning up and safety awareness (M=8.4, SD=12.0). Children in the individual ESDM group made similar gains for VABS Personal skills (M=9, SD= 7.6) and Domestic skills (M=7.3, SD=8.0).

Conclusions:

Children receiving both types of intervention – G-ESDM in specialised playrooms or individual ESDM in the home/community – made gains in verbal and non-verbal development and adaptive behaviour within the initial 6-months of intervention. While preliminary results seem to slightly favour individual ESDM delivery, outcomes were highly variable within each group. Additional, and longer-term developmental and behavioural outcome data (i.e., at 10-month program exit) will be available by INSAR 2019.

144 **171.144** Social Communication Skills As a Possible Driver of General Developmental of Pre-Schoolers with ASD Who Received Esdm in a Community Setting in Austria

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Background: The Early Start Denver Modell (ESDM) seeks to focus on core-symptoms of ASD by social communication intervention to improve social engagement in young children with ASD. The main goal is to increase the social attitude and interest so that the child can use natural social environments for further development. Importance of parent reported outcomes is rising in the literature. The Pervasive Developmental Disorder Behaviour Inventory (PDDBI) is a widely used questionnaire to measure ASD related symptoms in children with ASD. Social communication skills are well described as crucial skills to be taught in early intervention programs.

Objectives: Investigation of the impact of social communication core skills on developmental trajectories and parental related stress. ESDM was

delivered in an Austrian community setting with weekly three appointments for 1.5 hrs in the centre, at home and in the kindergarten over a period of one year.

Methods: Subjects were children (n = 43, ages 28 to 54 months, mean age 42.4 months) consecutively diagnosed with ASD in a regional autism centre in Austria. Developmental status was assessed with standardized instruments (Mullen Scales-MSEL, PDDBI, Vineland Adaptive Behaviour Scales-VABS 2 and Parental Stress Inventory-PSI) at baseline and after intervention.

Results: The Intervention-Group showed improved language skills (t-tests) in the MSEL (Expressive Language: T(41)=-2.02, p=.05, ES=.34; and Receptive Language: T(39)=-3.24, p=.002, ES=.59) and highly significant general MSEL-Total-Score improvement (T(37)=-2.92, p=.006, ES=.62). Furthermore, highly significant reduction in parent-reported core autism symptoms (PDDBI-Autism Composite Score: T(42)=5.31, p<.001, ES=-.98) and gains in Social Communication skills (PDDBI-Social Approach (SOCAPP): T(42)=-3.82, p<.001, ES=.65) could be found. The SOCAPP gains significantly correlated with all MSEL-domain-gains (r's from .32 to .45; p's from .005-.046), VABS-Daily Living skills gain (r=.36; p=.017) and PSI-Children-scale gain (r=-.40; p=.016). Regression analyses were used to test if the SOCAPP-skills before intervention significantly predicted children's developmental gains. Two of the four MSEL-developmental gains (Visual Reception: β=.30, p=.049 and Expressive Language: β=.37, p=.015) were predicted by the SOCAPP-scale. No such prediction was found for PSI-Children-scale- or VABS-Daily Living skills-gains. Dividing the group in two samples with median split into a low-SOCAPP- and high-SOCAPP-gain-group and analysing for trajectory-differences led to one significant interaction effect of MSEL-Receptive Language (F(1,38)=4.85, p=.034).The high-SOCAPP-gain-group showed significant more Receptive Language improvements. No such group-effect was found for any other MSEL-scale-gain.

Conclusions: ESDM reduces reported ASD-symptoms and also showed strong effects on family reported social communication skills. Social Communication skills highly correlated with developmental domains and with parental stress level. Furthermore, Social Communication skills might be predictive for child's development. The SOCAPP scale of the PDDBI seems to be a highly relevant set of questions which reflect crucial information of children's development. Developmental gains seem promising, although further research with a control group design is needed. Further studies are needed to assess the predictive value of the SOCAPP scale and to evaluate the possibility of using a set of questions in screening procedures.

145 **171.145** Super Responders: Predicting Expressive Language Gains Among Minimally Verbal Children with Autism Spectrum Disorder

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Background: Research in autism spectrum disorders (ASD) has focused on developing efficacious interventions addressing core deficits of ASD. However, the heterogeneous nature of ASD complicates the development of such interventions. Due to this heterogeneity, it is unlikely that there is a one size fits all intervention. It is important to understand for whom an intervention works. Advancements in data analytics, in particular machine learning, provide new methods to identify subgroups among a given population, and can potentially help to identify for whom intervention works best. Of particular interest are minimally verbal individuals. A targeted social communication intervention known as JASPER (Joint Attention, Symbolic Play, Engagement, and Regulation) has shown promise for improving language outcomes among minimally verbal children with ASD and may provide the context to examine the question of for whom an intervention benefits.
Objectives: This study aims to develop a model predicting expressive language gains among minimally verbal, preschool aged children with ASD that received JASPER. This study also explores the utility of classification and regression tree (CART) analysis to identify relationships between child characteristics and gains in expressive language.

Methods: Secondary data analysis was conducted on a sample of 99 minimally verbal, preschool age children with ASD, collected from participants across five previous intervention studies. Expressive language gains were calculated using expressive language age equivalents from the Mullen Scales for Early Learning. Predictors for the analyses were taken from demographic and behavioral assessments completed prior to intervention. Using expressive language age equivalent change scores, 47% (n = 47) of the sample were identified as "super responders," children that exceeded expressive language gains expected through maturation. To predict responder status, all initial predictors were used to generate conditional inference forests, a machine learning process for variable selection.

Results: Conditional inference forest results identified three variables to be fitted into the final model; play diversity, requesting gestures, and fine motor age equivalent. A final conditional inference tree was created, with play diversity being the only significant predictor of responder status. Participants with higher entry play diversity scores (above 23) predicted super response while lower scores (23 or below) predicted slow response. Overall model accuracy was 67%, with a specificity of 55% and sensitivity of 78%. For comparison, stepwise logistic regression was run, and play diversity significantly predicted responder status (χ^2 (1) = 10.686, p = .001). Receiver operating characteristic curves were generated to compare model performance, and comparison of area under the curves for the two models showed no statistical difference (p = .82).

Conclusions: Overall accuracy of the conditional inference tree was moderate, and performed similarly to the more traditional logistic regression analysis. However, the conditional inference tree provides a cutoff point that may provide clinical utility over the regression results. Both models identify play diversity as an important predictor of expressive language gains from JASPER, a play based social communication intervention. Additionally, the model appears to be more sensitive to identifying slow responders. The role of play diversity and expressive language gains in JASPER is discussed.

146 **171.146** Targeted Parent Support of Social Behavior Among Toddlers with Autism

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Background: Autism spectrum disorder (ASD) affects 1 in 59 children in the United States (Centers for Disease Control and Prevention [CDC], 2018). Parent-mediated early interventions, which aim to support parent facilitation of toddler social communication, are a major focus of research (Green et al., 2017). Systematic review of the experimental literature revealed that out of 25 studies of parent-mediated interventions to improve toddler social communication outcomes, only seven (28%) used a measure designed to assess both parent and toddler behavior during observed parent-child interaction (Moore, Barger, Baggett, 2018). Measures reported in this literature tend to require high levels of training, are time burdensome to administer and score, and are not designed for repeated measurement. Consequently, they are of limited utility for community

early childhood practitioners in monitoring progress of parent support of toddler social communication within early intervention programs. To address this limitation, a progress monitoring measure designed for practitioners, was used for secondary coding and analysis of parent-child interaction video data from a recently published study of a parent-mediated intervention program (Schertz, Odom, Baggett, & Sideris, 2017).
Objectives: The aim was to examine whether or not a practical and psychometrically sound practitioner progress monitoring measure was useful for examining relationships between targeted parent support and toddler social communication among dyads enrolled in a parent-mediated intervention study. The following research questions were addressed: Is parent positive support behavior significantly and positively related toddler social behavior? Do toddlers whose parents engage in high levels of targeted support demonstrate more positive social behavior compared to toddlers whose parents engage in low levels of targeted support?

Methods: The sample consisted of 131 toddlers and their parents enrolled in a parent-mediated RCT (Schertz et al., 2017). Direct observation of 10-minute video recorded parent-child interactions at home were conducted using the Indicator of Parent Child Interaction-2 (IPCI-2; Baggett et al., 2011). Interobserver agreement was examined for 20% of coded videos. Mean percent agreement was 92.5%, Analyses were conducted to examine parent support of toddler social behavior at the time of enrollment. Descriptive statistics are provided for parent targeted support (Facilitators) and toddler Engagement with parents. Bivariate regression analyses were conducted to examine parent Facilitators and toddler Engagement with parents.

Results: Parents obtained a mean Facilitator score of 217.9 (SD= 59.8, range=285) and children obtained a mean engagement score of 126.37 (SD= 40.0, range= 190). Parent Facilitators and child Engagement were highly and significantly correlated, r=.747, p<.0001. Toddler engagement differed significantly depending upon whether their caregivers engaged in low, medium, or high levels of targeted support (facilitators), F (2, 128) = 47.72, p < .0001.

Conclusions: This study highlights the relevance of a practitioner monitoring measure to assess parent-child interaction. Results demonstrate that a practitioner observation measure, with high interobserver agreement, can be used to capture targeted parent support, crucial to promoting social engagement among toddlers with ASD.

147 **171.147** The Challenges of Individualizing Early Intervention in a Context of Large-Scale Services

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Background: For more than 15 years, the Quebec government, through health and social services organizations, has offered early behavioral intervention (EBI) to young children with autism. These services were organized on the basis of scientific knowledge, but also on the particular realities and challenges of each of the regions concerned. A provincial study has documented the different choices that institutions have made across the province, including the choice to offers EBI in inclusive child care settings for a majority of children (Dionne et al., 2016). However, to date, a limited number of studies have focused on large-scale community-based EBI services (Eikeseth, Långh, Hammar, Klintwall, & Bölte, 2018, Eikeseth, Klintwall, Jahr, & Karlsson, 2012). In a collaborative research perspective, studies conducted over the last few years with skateholders that are implementing EBI in context of large-scale public services in Quebec. One of the aspects of the intervention addressed in these studies is the individualization of practices in order to consider the unique needs of each child, the realities of his family and his living environment, as well as the resources available.
Objectives: General objective is to document the practices of clinical team members with respect to intervention planning in the context of EBI in the context of large-scale public services. More specifically, the following objectives will be addressed: 1) describe the level of individualization of EBI programs by analyzing intervention plans and evaluating their quality, 2) describe the variables considered by professionals when choosing strategies for intervention, 3) describe the decision-making process with respect to these choices.

Methods: A mixed method, combining data from various sources (interviews, questionnaires, intervention plans analysis) was used. A total of 23 participants (supervisors and practitioners) from 3 rehabilitation centers participated in the project. In addition, a total of 37 intervention plans were analyzed.

Results: Most frequently targeted areas of development for intervention plans are communication, followed by cognitive skills. A variety of evidence-based intervention strategies are implemented (eg, discrete trial teaching, reinforcement, visual support). When it comes to choosing these strategies, according to the results to the questionnaire, respondents consider child characteristics (m = 4.35), family characteristics (M = 4.31), as well as those of the child care setting (M = 4.17) as very important. All the supervisors interviewed mentioned the need to consider a set of child characteristics. Among those mentioned by a majority : level of language and communication (100%), the progression of the child (100%), impairments or associated health problems (88.9%), level of development (88.9%), but also, sensory characteristics (66.7%), chronological age (66.7%), interactions and social skills (66.7%), attention span (55.6%), ASD severity (55.6%) and child interests (55.6%).

Conclusions: The choice of intervention strategies is a complex process based on the analysis of a large number of factors. The absence of a clear protocol to frame EBI services certainly contributes to complicate this process. The clinical support offered by the organizations is therefore essential, although very variable across organization. Different clinical supports should be developed to support teams implementing EBI within community services.

148 **171.148** The Effect of “the Transporters” Intervention Program on the Expression of Empathy during Social Interaction in Children with ASD

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Background: Children with ASD often struggle to express concern towards others’ distress and to provide instrumental support to others’ need. However, the behavioral examination of these abilities in children with ASD during social interaction has been limited.
Various intervention programs attempted to target cognitive empathy deficits in children with ASD. *The Transporters* (TT) animated series is such an intervention that was found to be effective in several controlled trials. However, the generalization of its taught skills and their expression in social interactions were not studied.

Objectives: (1) to examine the differences between children with ASD and their typically developing (TD) peers on empathic concern and provision of support during social interaction; (2) to examine the effects using TT intervention has on the empathic and pro-social behaviors during social interaction in children with ASD.

Methods: To examine question (1), two groups of 4-7 years-old children, 37 (9 girls) with ASD and 28 (5 girls) TD children, matched on age, gender and cognitive abilities, were recruited. Question (2) was examined with twenty 4-7 year olds (2 girls) with ASD who watched TT daily for 8 weeks. They were compared to a matched group of 22 participants (6 girls) with ASD, who watched a control series. Children were presented with two empathy prompts during a 20-minute play schedule: a pain paradigm (e.g., the experimenter allegedly bit by a mosquito); and a help paradigm (e.g., the experimenter allegedly fails to find the toys for the next activity). For the examination of the second research question, participants undertook similar activities before and after 8 weeks of watching the series. Interactions were video-recorded and micro-analytically coded for children's affect, gaze direction, verbal response, assistive behaviors, as well as ignoring and freezing.

Results: Children with ASD exhibited less adaptive empathic responses, compared to their TD peers. During the pain paradigm, as a reaction to the experimenter's distress, participants in the ASD group expressed positive affect for a longer duration, compared to the TD group. In addition, the ASD group exhibited freezing or ignoring behaviors for longer duration, compared to the TD group. In both pain and help paradigms, The TD group exhibited more adaptive assistance behaviors that the ASD group.

An examination of the effect of TT intervention on the pain paradigm, revealed that following the intervention, children from TT group increased their verbal responses to the experimenter and decreased their ignoring and freezing behaviors. No such change was observed in the control group. In addition, following the intervention, children from TT group increased the time they spent looking at their interaction peer, and effect that was not found in participants who watched the control series.

Conclusions: Our findings show children with ASD demonstrate empathic response deficits in an ecological social scenario. In addition, the study provides support for the effectiveness of TT in promoting pro-social behaviors in children with ASD, including a shift from a passive to a more active stance, an enhanced search for social cues in others' faces.

149 **171.149** The Effectiveness of Brief Community-Based Parent Coaching in Pivotal Response Treatment

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Background: Parent coaching is a cost effective and important element of early autism intervention. We examined the effectiveness of brief parent coaching in Pivotal Response Treatment (PRT) for 4-5 year-old early communicators. Coaching was provided by community clinicians at the beginning of a publicly funded intervention program in Nova Scotia, Canada. Parents received four, two-hour coaching sessions within the same week. Trainers reviewed a handout with parents that described PRT principles and provided 10-minute blocks of individualized coaching using strategies such as suggestive prompting, reinforcing parent initiations, and providing frequent, specific, positive feedback.
Objectives: *1)* Our primary objective was to determine if training led to increases in parents' skills providing clear, developmentally appropriate language opportunities. This was defined as gaining shared control of preferred objects or activities and providing either model prompts (e.g., "spin"), leading prompts ("e.g., ready, set..."), choice questions (e.g., "milk or juice?"), or time delays (e.g., holding onto a bubble wand and giving an expectant look). 2) We also examined changes in parents' fidelity using the following PRT techniques: following child lead, ensuring child attention, and being contingent on reasonable attempts at correct responding.

Methods: Parents of 27 children were included in analyses. Children were 4 to 5 years old (M = 4.78, SD = 0.14) and were included if they were non-verbal (48%), used single words (22%) or used 2-word combinations (30%). If more than one caregiver from a family participated in training, a single caregiver was randomly selected. Participants were 17 mothers, 8 fathers, 1 aunt and 1 grandfather. Ten-minute videos of parent-child interaction were obtained pre- and post- training (at each, parents were asked to encourage communication through play). Inter-rater reliability of video coding was moderate to strong (ICC = .90 for objective 1; κ = .59-.77 for objective 2).

Results: 1) Prior to coaching, parents presented a mean of 4.3 clear, developmentally appropriate language opportunities in 10 minutes (40% presented none, 19% presented one). A large increase in frequency was seen after coaching, to a mean of 15.2 clear opportunities (all but one parent presented at least two). 2) Parent fidelity improved for attaining child attention, demonstrated in 15% of intervals prior to coaching and 59% of intervals four days later, $t(26) = 5.47$, $p<.001$. Fidelity for contingency also improved, from 11% to 66%, $t(26) = 7.61$, $p<.001$. Following child lead was high at baseline and did not change (85% to 91%; $t(26) = 1.00$, $p=.327$).

Conclusions: Brief parent coaching in PRT by trained community clinicians led to substantial changes in parents' interactions with their children with ASD. In four days, parents learned to present frequent, clear, developmentally appropriate language opportunities. Parents also demonstrated the PRT techniques of attaining child attention and contingency much more frequently following coaching. These findings support PRT as an intervention model readily implemented by parents. They add to a growing body of research supporting parent coaching in natural developmental behavioral interventions as a cost-effective approach to improving outcomes for children with ASD.

150 **171.150** The Efficacy of "Play-Based Communication and Behavior Intervention" Very Early Intervention Model on Toddlers with Autism Spectrum Disorder

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Background: Children with autism spectrum disorder(ASD) who participated in the "Play-based Communication and Behavior Intervention(PCBI)" were studied explore the efficacy of the PCBI very early intervention model.
Objectives: To investigate the short-term efficacy and the caregiver factors of the PCBI model on toddlers with autism spectrum disorder.

Methods: Seventy-four ASD toddlers aged from 19 to 30 months were recruit in this study. Toddlers who participate in this study were randomly assigned to PCBI group and ABA group, then intervened weekly by PCBI or ABA in total 12 weeks. The Autism Treatment Evaluation Checklist, Gesell Developmental Schedules and Portage Early Development Checklist were used to evaluate the efficacy of the PCBI. Parenting Stress Index Short

Form, General Self-Efficacy Scale, and the self-developed Caregiver Training Course Evaluation Scale and the Homework Completion Level Scale were used to assess the level of parental stress, self-efficacy, curriculum satisfaction and acceptance. The t-test was used to reveal whether there was significant difference between two groups before and after interventions. A pair of sample t-test was used to analyze the ASD symptoms, developmental level and caregiver factors of ASD children before and after intervention. Multivariate regression analysis was used to analyze the caregiver factors and the effects of PCBI.

Results:

- Compared to the ABA group, there was a significant increase in cognitive scores (D_{PCBI}=9.03, D_{ABA}=4.27, t=3.997) and a significant decrease in social behavior scores (D_{ABA}=16.91, D_{PCBI}=8.87, t=-4.022) of the Portage Early Development Checklist after 12 weeks of intervention in the PCBI group (P<0.001); While the total score and the scores of language, movement, and self-care subscale of Portage Early Development Checklist were also increased after PCBI intervention but not significant (P>0.05).
- Compared to the ABA group, after 12 weeks of PCBI intervention, the scores of social, perception, behavior of ATEC was decreased, but difference was not significant (P>0.05); while the total score of ATEC scale ($D_{ABA\ total}$=22.22, $D_{PCBI\ total}$=14.89, t=2.209) and the scores of language subscale ($D_{ABA\ language}$=6.43, $D_{PCBI\ language}$=2.89, t=2.515) was decreased significantly (P<0.05).
- After the end of PCBI, there was a significant decrease in the scores of Parenting Stress Index Short Form (P < 0.05). There was a significant positive correlation between the effect of PCBI and acceptance of the intervention model, and mastery of the skills in the caregiver factors (P < 0.05).

Conclusions: After 12 weeks PCBI very early intervention, the ASD toddlers all improved in clinical symptoms and developmental level. Compared with ABA intervention, the treatment efficacy of parenting-direct PCBI was comparable and used less medical rehabilitation resources. PCBI could reduce the parenting pressure of the caregiver; and the better the mastery of skills and the completion of homework the better the efficacy of intervention.

151 **171.151** Change in Family Empowerment Following ABA Early Intervention Associated with Changes in Practical Adaptive Skills

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Background: Applied Behavior Analysis (ABA) therapy is the standard of care for children with Autism Spectrum Disorder (ASD). The ABA Early Intervention Program (ABA EI) at Seattle Children's Autism Center is a 12-week, multidisciplinary, classroom-based program that includes 12 hours per week of center-based, 1-1 ABA therapy, weekly SLP services, and a parent education/support package including didactics, coaching in ABA methods, and case management. Naturalistic Developmental Behavioral Intervention (NDBI) is the primary ABA methodology being used (Schreibeman et al., 2015). Previous research supports the efficacy of ABA interventions in increasing adaptive skills in children with ASD (Smith & Iadarola, 2015) and emerging research supports associated improvements in family empowerment and stress (Minjarez, et al., 2012). However, research is limited regarding the relationship between child improvements in adaptive functioning and parent functioning.

Objectives: To investigate how changes in adaptive skills relate to changes in family empowerment following participation in behavioral intervention.

Methods: Participants included parents and their children diagnosed with ASD (n=32) aged 19 to 65 months (M=40.69, SD=12.26) that completed the ABA EI program. Paired sample t-tests were used to compare baseline and post-intervention ratings of adaptive skills (Adaptive Behavior Assessment System (ABAS-3): General Adaptive Composite (GAC), and Conceptual, Social, and Practical composites) and sense of family empowerment (Family Empowerment Scale (FES)). Backwards stepwise linear regression (p=0.05 entry, p=0.10 removal) was used to investigate how changes in adaptive skills (conceptual, social, practical), combined with baseline characteristics (GAC, FES), predicted changes in sense of family empowerment.

Results: Paired sample t-tests revealed improvements in FES scores from baseline (M=3.79, SD=0.54) to post-intervention (M=3.98, S=0.57); t(31)=2.16, p=0.039. Similarly, there were improvements in GAC: baseline (M=68.50, S =18.10), post-intervention (M=73.96, SD=21.24), t(23)=2.73, p=0.012. All ABAS-3 composite scores were also significant. The backwards regression model with the most parsimonious predictor variables excluded change in the social composite: FES change=1.84 – 0.31 conceptual change + 0.33 practical change + 0.12 baseline GAC – 0.668 baseline FES + e, F(4, 17)=4.441, p=0.012, adjusted R^2=.396, with practical change (t=2.279, p=0.036), baseline GAC (t=2.334, p=0.032), and baseline FES (t =-3.311, p=0.004) significant. Conceptual change (t=-1.836, p=0.084) was marginally negatively related to FES change.

Conclusions: These results are consistent with prior work showing improvements in adaptive skills following ABA intervention. Change in practical skills, but not conceptual skills, was positively associated with family empowerment. This may be due in part to ABAS-3 items at this age which inquire about skills explicitly taught in the intervention program (e.g., community use, health/safety, self-care) that could lead families to feel more able to manage daily routines. These findings are consistent with previous work (e.g., Noh, 1989) which found an association between child inability to interact with the environment and parental stress. Surprisingly, conceptual skills showed a marginally negative association with family empowerment, suggesting empowerment is more closely associated with daily living and community-related skills than communication and task management skills. This is a preliminary investigation and the study is ongoing.

Poster Session
172 - Family Issues and Stakeholder Experiences
11:30 AM - 1:30 PM - Room: 710

175 **172.175** Development of a Brief, Family-Centered Transition Intervention Using Caregiver Input

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Background:
Despite the influx of students with Autism Spectrum Disorder (ASD) into postsecondary transition (Smith & Lugas, 2010), supports are limited, lack cohesion, and do not sufficiently address the population's broad and complex needs (Wehman et al., 2014). Increased availability of feasible, low-cost, evidence-based parent education targeting postsecondary transition for individuals with ASD is essential. Some extant programs (e.g., Transitioning Together, SPECS) demonstrated significant improvements in parent and child attitudes and problem-solving (Hagner et al., 2012; Szidon & Kraemer, 2015). However, these programs require a significant time commitment and material and personnel resources that may limit their uptake in community settings. Moreover, evidence supporting the success of these programs is largely the result of standardized, researcher-controlled investigations. Adoption and sustainment of evidence-based practices in community settings requires understanding of stakeholder perspectives and real-world conditions that support or impede intervention implementation (Owens et al., 2014).

Objectives:

Describe findings from a pilot investigation of a brief, family-centered transition program, Planning for your Loved One's Future (PLOF).

Methods:

Participants. Seven caregivers of adolescents with ASD participated in the program.

Design. A single group, pre-post mixed methods design was used.

Procedure. PLOF was implemented in a single, 4-hour session by a licensed psychologist, who developed the program. Information was provided to caregivers on several transition-related topics, including school transition planning, parent and child advocacy, adult housing, recreation, employment and college/technical school, and legal/guardianship issues. Information was conveyed through discussion and visual supports (i.e., Power Point, handouts).

Measures. Quantitative and qualitative data were collected to measure parent transition knowledge (Transition Knowledge Scale) and empowerment (Family Empowerment Scale), as well as transition planning efforts and program acceptability (caregiver interviews).

Data Analysis. Quantitative data (n = 5) was analyzed descriptively and with paired samples t-tests. Caregiver interview data (n = 7) will undergo systematic thematic analysis.

Results:

Descriptive statics indicated an increase in means for all items related to transition knowledge. There were statistically significant increases in parents' knowledge of employment options (t (4) = .374, p<.05) as well as college and technical school options (t (4) = .316, p<.05). Parent advocacy and community transportation were approaching significance. There were no significant changes on the Family Empowerment Scale.

Preliminary qualitative analysis indicated parents were satisfied with the intervention and valued the opportunity to connect with other parents. Interview data inform further program development, such as increasing opportunities for parents to exchange knowledge. Parents also commented on the importance of introducing transition-related knowledge early, "making it part of a conversation with any age" (Parent 2). Parents noted a sense of empowerment in sharing information from the workshop with other parents, and efforts to advocate for school services for which they previously did not know their child was entitled.

Conclusions:

Despite the brief, low-intensity nature of PLOF, findings suggest gains in caregiver transition knowledge and advocacy efforts following their participation.

PLOF may have utility as a supplement to current transition services for students with ASD.

Parent feedback provides avenues for increasing the potential effectiveness of PLOF.

176 **172.176** Differences between Mothers and Fathers in Parent-Child Free-Play Interactions with Preschoolers

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Background:
Fathers are the primary caregivers for 21% of preschoolers in the US (US Census Bureau, 2013). Although this number has increased over the past 30 years, fathers of children with ASD remain underrepresented in early intervention research. Research comparing mothers and fathers of children with ASD tends to focus on differences in stress and coping strategies; few studies have examined differences in intervention strategies and language use. Fathers tend to be more directive in language and play (Elder et al, 2003), but our understanding of father-child interactions is still relatively limited. Understanding baseline differences between mothers and fathers may help inform parent training in interventions for young children with ASD.

Objectives:

To determine if parent strategies and parent language use differs in parent-child free-play interactions based on parent gender.

Methods:

This study uses baseline data from a social communication intervention RCT. Participants included 53 primary caregivers (38 mothers, 15 fathers) and their preschoolers with ASD (*Mage*=45.13 months, *SD*=5.37). Children used <30 spontaneous words at baseline.

Each parent-child dyad completed a videotaped 10-minute free play assessment (PCX). PCXs were coded (ICCs=.75-.88) for parents' use of strategies common across ABA-based interventions, namely:

1. Responsiveness: Supportively responding to child's verbal and nonverbal cues
2. Pacing: Timing and appropriateness of actions and language
3. Prompting: Quality and appropriateness of prompt usage (e.g., prompt hierarchy)
4. Environmental arrangement: Placement of body and materials in relation to child

Items were rated on a 5-point Likert scale; higher ratings indicated more fluent and more appropriate use of strategies. PCXs were also transcribed and analyzed for parent language (total utterances, MLU, number of different words).

One-way ANCOVAs were conducted to determine the effect of parent gender on parent strategies and parent language, controlling for child age, non-verbal IQ, and number of different words. Bonferroni post-hoc tests were conducted as needed.

Results:

Estimated marginal means for parent outcomes are reported in Table 1. There was a main effect of parent gender on pacing, $F(1,48)=7.12$, $p=.008$. Mothers ($M=3.55$, $SE=.17$) were significantly more likely to appropriately pace interactions compared to fathers ($M=2.61$, $SE=.28$). Parent gender was also associated with prompting, $F(1,48)=5.09$, $p=.029$. Mothers ($M=3.35$, $SE=.15$) were significantly more likely to prompt appropriately compared to fathers ($M=2.71$, $SE=.24$). Parent gender was not associated with responsiveness, environmental arrangement, or parent language.

Conclusions:

Mothers and fathers did not differ in the amount of language they used; however, when compared to mothers, fathers' pacing and prompting tended to be less appropriate within the context of free play. These findings are practically significant, given the importance of parents' appropriate pacing (e.g., Gulsrud et al, 2016) and prompting (e.g., Hardan et al, 2015) in facilitating children's social communication. Understanding these baseline differences between mothers' and fathers' interactions provides valuable information for parent training, highlighting areas where fathers may need additional support to facilitate their children's social communication skills.

177 **172.177** Differences in Parenting Stress between Mothers and Fathers Following an Autism Diagnosis

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Background: Incorporating fathers into parenting research is a recent and important development (Flippin & Crais, 2011). Results of studies comparing stress levels of mothers and fathers of children with autism are mixed, with some evidence supporting similar levels of stress (e.g., Hastings, Kovshoff, Ward, et al., 2005), and other data supporting higher maternal stress (e.g., Dabrowska & Pisula, 2010). Only one study has specifically compared levels of stress in parents newly adjusting to the diagnosis (Davis & Carter, 2008). Clearly, additional research on the topic is needed. Furthermore, it is important to better understand sources of parenting stress in order to tailor autism intervention to meet the needs of both parents (Flippin & Crais, 2011). Given that social interaction deficits are a core, underlying feature of the disorder, child social impairment may be one particularly salient source of stress.

Objectives: (1) To compare parenting stress in mothers and fathers of children newly diagnosed with ASD. (2) To examine associations between child social impairment and parenting stress for both parent genders.

Methods: Participants included 29 mother-father pairs who enrolled in a parent education program designed to teach families about ASD. The children of enrolled parents ranged in age from 2-10 years ($M=4.5$ years). Parents completed the Parenting Stress Index–Short Form (PSI-4-SF; Abidin, 2012), comprised of three subscales: Parental Distress (PD), Parent-Child Dysfunctional Interaction (P-CDI), and Difficult Child (DC). Parents also completed the Social Responsiveness Scale, 2nd Edition (Constantino, 2012), comprised of five subscales: Social Awareness (Awr), Social Cognition (Cog), Social Communication (Com), Social Motivation (Mot), and Restricted Interests and Repetitive Behavior (RRB). Paired samples t-tests were conducted to examine differences in stress between mothers and fathers. Pearson correlations were conducted separately for mothers and fathers to examine associations between child social impairment and parenting stress.

Results: The current sample revealed that 41.4% of mothers and 20.7% of fathers had a Total Stress score within the clinically significant range. There was a significant difference between mothers and fathers on the DC subscale ($t(28)=2.552$, $p<.05$, Mother>Father). There were no group differences on PD ($p=.17$) or P-CDI ($p=.17$) subscales. For mothers, P-CDI scores correlated significantly with Com ($r=.42$, $p<.05$), and DC scores correlated significantly with Cog ($r=.55$, $p<.01$), Com ($r=.60$, $p<.01$), and RRB ($r=.42$, $p<.05$). For fathers, there were no significant correlations between child social impairment and parenting stress (p's=.07-.94; see Table 1).

Conclusions: Following a child's diagnosis of autism, mothers and fathers experience comparable levels of stress with regard to personal factors (e.g., social support, spousal conflict) and the parent-child relationship. However, as compared to fathers, mothers perceive the child's behavioral characteristics to be more difficult. Moreover, maternal stress was related to several aspects of child social impairment, including cognition, communication, and restricted interests and repetitive behavior, while no significant associations were found for fathers. Additional research on the mechanisms underlying these differences is critical and may be related to mothers' increased involvement in the care of the child with autism, more adaptive coping strategies utilized by fathers, or different parental expectations.

178 **172.178** Division of Caregiving Responsibilities Among Caregivers of Children with and without ASD

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Background:

Parenting children with ASD requires greater demands relative to parenting typically developing children (TD; Ingersoll & Hambrick, 2011) and mothers report increased need for support from family relationships and outside sources compared to normative data (Johnson, Frett, Feetham, & Simpson, 2011). However, literature suggests that parents of children with ASD who are primary caregivers may receive less support from their spouses compared to parents of TD children, even though parenting demands may be greater (Bristol, Gallagher, & Schopler, 1988). Furthermore, Johnson et al. (2011) demonstrated that when mothers and fathers feel their family social support needs do not match their support received, their stress levels increase and mental health worsens in both parents. Social norms around parenting continue to shift, and it is becoming more common for both parents to take equal share of parenting responsibilities.

Objectives:

The current study sought to explore whether primary caregivers of children with ASD receive less support from secondary caregivers compared to primary caregivers of TD children, and whether disagreement exists between primary and secondary caregivers in how often the secondary caregiver is involved in caregiving.

Methods:

The current online study included 67 mother-father dyads of a child with ASD and 48 mother-father dyads of TD children. The Child Caregiving Involvement Scale (CCIS; Wood & Repetti, 2004) is a 10-item questionnaire that assesses perceptions of caregiver responsibility for specific child-care activities. Secondary caregivers were asked to report on their own responsibility and primary caregivers were asked to report on the

secondary caregiver's responsibility. Correlations and paired sample t-tests were conducted to compare the involvement of secondary caregivers reported by primary and secondary caregivers and between ASD and TD groups. Discrepancies were determined as mean differences that exceeded one half standard deviation (as in Tomeny et al., 2018).

Results:

In the ASD group, 15% of secondary caregivers reported they spend less time caregiving relative to their spouse's report, while 25% reported they did more than their spouse reported. In the TD group, 13% of secondary caregivers reported they spend less time caregiving relative to their spouses' report, while 18% reported they did more than their spouse reported. There was no significant difference between primary (M=22.78, SD=9.28) and secondary (M=22.25, SD=8.03) caregiver's report of how much the secondary caregiver shared responsibilities in the ASD group, $t(66)$=.69, p=.506. Additionally, there was no significant difference in share of responsibilities reported by primary caregivers of children with ASD and primary caregivers of TD children, $t(113)$=.665, p=.508. Secondary caregivers of children with ASD and TD children also did not differ on their report of shared responsibilities, $t(113)$=1.476, p=.143.

Conclusions:

Overall, analyses illustrated that secondary caregivers and their spouses were generally in agreement about levels of involvement of secondary caregivers. ASD and control groups did not differ in the amount of caregiving provided by secondary caregivers, regardless of reporter. Although past research has shown negative effects on stress and mental health when caregivers do not agree on shared responsibilities, our results show promise of perceived equality of childcare responsibilities.

179 **172.179** Effects of Caregiver-Focused Programs on Psychosocial Outcomes in Caregivers of Individuals with ASD: A Meta-Analysis

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Background: Caregivers of individuals with autism spectrum disorder (ASD) experience greater negative psychosocial outcomes than caregivers of individuals with other developmental disabilities. The majority of interventions for this population have focused exclusively on the offspring with ASD. Few studies have specifically targeted the caregivers of individuals with ASD, and the effectiveness of these interventions is not clear. Objectives: To fill the gap, the current study used meta-analytic techniques to comprehensively review interventions that directly target psychosocial outcomes in caregivers of those with ASD and to explore potential moderators of effectiveness.

Methods: The initial literature search was conducted in September 2017 in multiple sources (e.g., ERIC, MEDLINE, PubMed). Backward and forward searches and e-alerts were conducted for additional relevant studies. Articles generated from e-alerts were screened for inclusion criteria until July 2018. The search encompassed published and unpublished empirical studies, systematic reviews, and conference proceedings. A random-effects model was used to calculate the mean effect size, Hedges' g. The mean effect sizes from both pre-post intervention comparisons and group comparisons between treatment and control groups were calculated. Subgroup analyses and meta-regressions were conducted to examine potential moderators.

Results: A total of 41 unique studies met the inclusion criteria, targeting 1771 caregivers. Overall, the interventions had a small positive effect on improving psychosocial outcomes in caregivers of individuals with ASD (within-subjects: Hedges' g = .44; between-subjects: Hedges' g = .28). A variety of intervention approaches were identified: cognitive behavioral therapy (CBT), acceptance and commitment therapy (ACT), mindfulness-based intervention, psychoeducational intervention, social support, positive psychotherapy, written emotional disclosure, and multicomponent interventions. Intervention impact was associated with type of intervention. Specifically, CBT and ACT/mindfulness-based interventions were more consistently effective in improving caregivers' overall psychosocial outcomes. The strongest pre- to post-treatment effect size impacts were noted for decreased perceived stress/distress (Hedges' g = .56) and parenting stress (Hedges' g = .55) and improved general well-being (Hedges' g = .54). The largest between group caregiver effect sizes were for decreased parenting stress (Hedges' g = .49), reduced depressive symptoms (Hedges' g = .32) and anxiety level (Hedges' g = .42), and improved general well-being (Hedges' g = .65).

Conclusions: Overall, interventions were effective in improving caregivers' psychosocial outcomes with a small, significant effect size. Most of the intervention approaches demonstrated some evidence of effectiveness although there was inconsistency in demonstrating significance for both within- and between-subjects analyses. The most consistent evidence was for ACT and mindfulness-based interventions which were moderately effective in improving caregiver psychosocial outcomes in both pre-post and group comparisons. The results indicate some evidence for the effectiveness of caregiver-focused interventions, however more studies with larger sample size, rigorous research design, and long-term follow-up assessments are needed.

180 **172.180** Emotional Experience and Perception of Immigrant Families through Their Diagnosis Trajectory and Anticipation for the Future

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Background: Immigrant families having a child with autism spectrum disorder (ASD) face multiple challenges associated not only with their diagnosis, but also with cultural differences (e.g., in communication, values, perceived needs; Dyches, Wilder, Sudweeks, Obiakor & Algozzine, 2004; Millau, Rivard & Mello, 2018). Literature indicates that challenges encountered by theses families are mostly related to accessing services, joining services and poor quality of life (Mandell & Novak 2005; Millau, Rivard & Mello, 2018; Roth 2016). However, little information exists about emotional experience and perceptions of immigrant families having a child with ASD during their diagnosis trajectory.
Objectives: The present study aims to document the subjective experience of immigrant families in getting access to an ASD diagnosis for their child, in the area of Montréal (Québec, Canada).

Methods: Twenty-four families having a child with an ASD diagnosis completed a socio-demographic questionnaire and a questionnaire evaluating their trajectory. They also participated in semi-structured interviews in which they talked about their experience and perception through their trajectory in the health services to obtain a diagnosis for their child.

Results: This poster will present results from semi-structured interviews documenting families emotional experience and perception relating to the diagnosis process, relating to their child and the progress achieved, their apprehension for the future and the presence of social support and family members when they arrived in the province of Quebec.

Conclusions: These results help us to better understand the particularities experienced by immigrant families and gives us pathways for improvement to adapt the type of support offered to immigrant families and to better accompany them in the critical periods of their trajectory.

181 **172.181** Enhancing the Parent Experience While Waiting for an Autism Spectrum Disorder (ASD) Evaluation

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Background: The Autism Spectrum Disorder (ASD) diagnostic process is lengthy and anxiety-provoking for many families. Retrospective research has focused on families' experiences including satisfaction during the evaluation process (e.g., Howlin & Moore, 1997, Crane et al, 2016). However, none have assessed caregiver experiences while actively going through the assessment process.
Objectives: This two-phase project surveyed caregivers during their child's ASD assessment. The objective was to evaluate caregiver experiences prior to their child's appointment and test whether providing education prior to the appointment impacts thoughts, knowledge, and emotions compared to the control group.

Methods: Participants included caregivers of children being evaluated in an interdisciplinary ASD clinic at a Midwestern children's hospital (typical clinic age 2-6 years). Participants completed a voluntary, anonymous survey during their child's diagnostic appointment. In Phase 1 (N=42), participants were asked questions including age of first concern, awareness of ASD resources, resources they wished for before the appointment, and emotions felt while waiting. In Phase 2 (N=26), caregivers received a one-page "fact sheet" prior to their appointment including ASD symptoms and testing-day information (including testing rooms visuals). They received the same survey as Phase 1; with additional questions on the helpfulness of the fact sheet.

Results: See Table 1 for demographic information. There were no significant group differences between the current age of the child or caregiver, age of first concern for overall development, or age of first concern for ASD ($p>.05$ for all). Both groups reported similar familiarity with a national and local ASD resource ($p=.496$). Twenty-two caregivers reported receiving the fact sheet prior to their appointment. The majority of them reported the fact sheet as very helpful (mean=4.09 on a 5-point Likert scale). Analyses were conducted to compare Phase 1 and 2 group differences on requests for information and feelings experienced while waiting (see Table 2 for frequencies). Surprisingly, despite finding the fact sheet very helpful, Phase 2 caregivers reported wanting significantly *more* information about child development, ASD information, ASD resources, the appointment, treatments, school connections, cost, and connection to other families ($p<.01$ for all) than Phase 1 caregivers. Phase 2 caregivers also reported being significantly more anxious, sad, confused, alone, scared, stressed, and frustrated ($p<.03$ for all) but interestingly also reported being significantly more relieved and hopeful ($p<.03$ for each).

Conclusions: Research has demonstrated the stressful nature of the diagnostic process (Crane et al, 2016). Surprisingly, even though this study provided (caregiver-reported) helpful information in advance, caregivers still reported wanting more. They also reported significantly more negative emotions than those that did not receive the fact sheet. Findings suggest that perhaps the stress and active challenges families experience while waiting may not be allayed by providing standardized information. Encouragingly, caregivers also reported positive feelings, suggesting that there are opportunities to continue to support and encourage families. To date, research has neglected to examine caregiver emotions, particularly positive emotions, during the ASD evaluation waiting period. Additional research is needed to enhance our understanding of these experiences to help improve caregiver and child outcomes.

182 **172.182** Examining Differences in Family Impact Among a Racially and Ethnically Diverse Population of Parents of Children with Autism Spectrum Disorder

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Background: Raising a child with autism spectrum disorder (ASD) has a substantial influence on family caregivers' emotional and physical health and wellbeing. A recent meta-analysis reported that parents of children with ASD experienced significantly higher levels of parenting stress compared to parents of children with other and without developmental disabilities. Existing literature rarely addresses culture and the possible role that race and/or ethnicity (as a proxy for culture) might contribute towards family impact. Little is known about how families from different racial and ethnic backgrounds report family impact beyond individual stressors associated with caregiving.
Objectives: The purpose of this study was to examine a following research question: What differences in family impact exist among a racially and ethnically diverse population-based sample of caregivers of children with ASD? Additionally, we explored differences between English- and Spanish-speaking Hispanics.

Methods: Using publicly-available data from the 2005-2006 and 2009-2010 National Survey of Children with Special Health Care Needs (NS-CSHCN; CDC, 2005, 2009), this retrospective, cross-sectional study examined family impact among caregivers (N= 5,178) of children with ASD. Family impact was defined by the financial impact, time spent caregiving, and work impact variables, and evaluated in five racial and ethnic groups: 1) white, non-Hispanic; 2) any race, English-speaking Hispanic; 3) any race, Spanish-speaking Hispanic; 4) black, non-Hispanic; and 5) other race, non-Hispanic. Multivariate logistic regression in Stata 14.1 was used to analyze the association of race and ethnicity with family impact variables, while controlling for child and family covariates.

Results: In logistic regression models adjusted for characteristics of the child and family, English-speaking Hispanic caregivers were 2.0 times more likely (95% CI: 1.14-3.55) to report spending 11+ hours caring for their child as compared to white, non-Hispanic caregivers. Examination of time spent caregiving revealed that white non-Hispanic caregivers were significantly more likely to spend $500 or more on their child's care than black (OR=1.8, 95%CI: 1.18-2.80), Spanish-speaking Hispanic caregivers (OR=3.60, CI: 1.69-7.64), and caregivers of other racial/ethnic backgrounds (OR=2.32, CI: 1.55-3.49). No significant differences were observed in job impact variables between racial/ethnic groups.

Conclusions: The unique contribution of this study is that financial and time spent caregiving impacts differed between racial/ethnic groups within this U.S. population-based sample. Further investigation into caregiver preferences for spending on services and supports between caregivers of different racial and ethnic backgrounds can clarify how and why caregivers make decisions about care. Additional research is needed

to determine whether caregivers who reported spending greater than 11 hours a week were compelled to engage in this level of caregiving due to lack of finances or lack of other support, or whether the caregiver chose to engage in caregiving based on preference, cultural expectations, or family norms. Racial and ethnic differences exist in providing and spending more for direct care, but they do not necessarily represent disparities. With other demographic variables controlled for, these findings suggest the need to support caregivers in the most meaningful way in their preferred methods of providing care.

183 **172.183** Examining Potential Developmental Consequences of Parental Decisions to Disclose Their Child's Autism Diagnosis to Their Child

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Background: A large body of literature examines effects of parenting an autistic child, often focusing on parental interpretations of the diagnosis. Initially, research focused on the difficulties, stress, and conflict that can accompany parenting an autistic child (e.g., Dumas et al., 1991), with more recent works focusing on positive outcomes and perspectives offered by families (e.g., Hastings & Taunt, 2002). Positive interpretations of autism by parents have been found to lead to desirable parent (e.g., self-efficacy) and child outcomes (e.g., reciprocal play, attention, and affect; Pakenham et al., 2004; Wachtel & Carter, 2008). However, research linking parents' descriptions of autism with their children's understanding of autism and autistic identity development has not been conducted.
Objectives:

1. Analyze if parental decisions to disclose/withhold their child's autism diagnosis influence adolescents' perceptions of autism
2. Evaluate how autistic young adults reflect on and learn from parental disclosure.

Methods: Adolescent participants (n = 15, M_{age}= 16.2) and their mothers were recruited from an informal educational program in New York City. Adolescent participants completed in-person, semi-structured interviews; mothers completed online questionnaires containing identical questions. A second sample of autistic college students (n=19, M_{age} = 20.9) recruited from a mentorship program answered semi-structured interviews and online surveys. Qualitative analyses of adult data focus on these interview questions: "How old were you when your parents first told you about autism? What did they tell you?" and "If you had a child with autism, when would you tell them about autism and what would you tell them?"

Results: Only participants whose parents disclosed their diagnosis voluntarily (n=6) described strengths (n=3) or neutral differences (n=3) when asked to define autism. Participants (100%) who were told about their diagnosis by a parent involuntarily (n=6) or not yet been informed of their diagnosis (n=3) focused solely on challenges associated with autism, compared with a third (n=2) of those whose parents voluntarily disclosed (Table 1).

Most (14; 73.7%) autistic college student participants were told about their diagnosis by a parent; three (16%) reported that they sought their own diagnosis or discovered their diagnosis within paperwork. When asked how they would tell their own child about an autism diagnosis, many described sharing challenges associated with autism (n=7; 36.8%), telling their child about autism in the same way they had been told (n=5; 26.3%) and self-disclosing (n=4; 21.1%). Only three (16%) planned to tell their child at a *younger* age than they were told.

Conclusions: Data suggest that parental decisions to disclose their child's autism diagnosis to their child impact their children's perceptions of autism and anticipated parenting decisions. Although benefits of parents choosing to disclose their child's diagnosis to their child were observed, autistic young adults often planned to inform their own children about their potential autism diagnosis similarly to how they themselves had been informed. Future longitudinal research should examine how parental disclosure decisions contribute to autistic identity development over time.

184 **172.184** Examining Primary Care Experiences for Adults with Autism Spectrum Disorder

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Background: Primary care is associated with positive outcomes for society, including improved access to health care services, health outcomes, and cost savings. However, few studies have documented the experiences of adults with autism spectrum disorder (ASD) in the primary care system. Of those, adults with ASD report multiple challenges with the receipt of primary care, decreased satisfaction, and increased unmet physical and mental healthcare needs. As adults with ASD represent a growing segment of society, the number who require primary care is expected to increase over the next decade. Consequently, there is a pressing need to improve the quality of primary health care for adults with ASD with empirically validated, client-centered strategies and tools.
Objectives: To identify perceived barriers and strategies to facilitate successful primary healthcare encounters for adults with ASD, as reported by adults with ASD, caregivers of adults with ASD, and primary care providers (PCPs) treating adults with ASD. These findings will identify potential areas to address obstacles to the provision of successful primary healthcare services for adults with ASD.

Methods: As part of a larger mixed methods design, adults with ASD (n=34), caregivers of adults with ASD (n=31), and PCPs treating adults with ASD (n=13) completed surveys. Survey topics included barriers to care as well as strategies previously utilized by the adult with ASD, caregiver, or PCP; the success of those strategies; and the potential of those strategies to improve care in the future. Participants were primarily located in Los Angeles, CA and Philadelphia, PA; this dual location enabled the collection of information from two underserved minority populations, Latinos and African Americans. For descriptive purposes, frequencies and percentages were calculated for all survey items.

Results: Multiple barriers to primary care were reported by adults with ASD and caregivers, including communication and sensory challenges. Adults with ASD and caregivers reported minimal use of strategies during primary care visits, but that those used were helpful to improve care (e.g., social story, environmental adaptations, practice visits). Expert PCPs reported utilizing strategies more frequently than novice PCPs. All consumer and provider respondent groups endorsed that multiple strategies had the potential to improve care in the future for adults with ASD

(e.g., list of patient needs, visual schedule, environmental adaptations).
Conclusions: Adults with ASD experience challenges in the access to and provision of primary care, but believe multiple strategies have the potential to improve this care. These findings help identify priorities for intervention development in order to improve patient-centered care for this population.

185 **172.185** Exploring Well-Being in Young Adults with Autism Using Photovoice

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Background: Much of the literature has focused on the challenges faced young adults with autism during post-school transition. However, little is known about how this population defines a good life and what they desire for themselves. Research taking into considerations the perspectives of individuals with autism and recruiting their meaningful participation is essential for the autism community and different stakeholders to understand the wants and needs of this population (Pellicano, Dinsmore, & Charman, 2014).
Objectives: The current study used a participatory action research (PAR) approach to explore how young adults with autism perceive and define their own well-being during school-to-adulthood transition.
Methods:
This project took place within the context of a year-long community-based transition program that aims to support post-school outcomes in young adults with autism. Thirteen young adults with autism between 19 and 25 years of age volunteered to participate. All participants had adequate verbal and communication abilities to participate in the project. This project took a participatory action research (PAR) approach to support participants' active participation and to allow meaningful expression of their first-person perspectives. Specifically, the author approached the group of young adults expressing an interest in using a photography-based methodology, Photovoice (Wang & Burris, 1997), to explore how participants understand and describe their own "well-being." Throughout the research processes, participants provided input into decisions about the research questions, design of activities, and their own level of commitment to the project. After an initial training about the ethics and instructions of camera use and photography, participants took pictures during their daily lives for two months to capture and express their ideas about well-being. Weekly group discussions and individual interviews were conducted to review participants' photographs and discuss their views of well-being. Researcher and participants conducted a thematic analysis to identify themes and patterns from the photographs and discussions. On-going data analysis and feedback from the participants are still in progress.
Results:
Preliminary findings suggested an overarching theme of "connections" with family, friends, and animals. Specifically, participants displayed a sense of connectedness with their family members through their everyday encounters with them. Through the photo-taking activities, participants acknowledged the opportunities to meet up with current friends and mentors and to review past friendships in adolescence. Citing their stories with pets, stray animals, and cartoon characters, participants also expressed their love of animals and how much they enjoyed caring for them as they found them loyal, respectful, and non-judgmental. Lastly, participants identified action plans to help the local community understand the perspectives of people with autism, including presentations to parents and other stakeholders, photo exhibitions, and advocacy campaigns.
Conclusions:
Findings from this Photovoice project reveal an autism-sensitive conceptualization of well-being informed by the participants' active participation and multimodal input (visual, verbal, and written). Results help identify resources and barriers in community settings that could improve well-being in young adults with autism during post-school transition. Practical strategies for future research to encourage meaningful participation of the autism community will be discussed.

186 **172.186** Exploring the Impact of Selective Eating on Key Life Domains Among Transition-Age Youth with Autism Spectrum Disorder

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Background: Eating can be a way to establish and build social connections and a means of expressing affection, sociability, and hospitality. However, it is not understood how selective eating, common among youth with autism spectrum disorder (ASD), may impact their mealtime experiences, social opportunities and general well being. Transition to adulthood has emerged as an important focus for supporting youth with

ASD, particularly since relatively few ongoing supports and services exist for this population after they age out of school. Despite the high level of parental concern about selective eating and a growing literature that suggests that proxy reporting misses important information that only individuals themselves can report, no systematic studies to date have queried youths themselves about their experiences with selective eating. Objectives: The objective of this qualitative study was to explore the impact of selective eating on key life domains of transition-age youth with ASD who self-identified as being food selective. One key goal of the study was to inform the development of supportive strategies to address food selectivity and navigating social and other opportunities that involve eating.

Methods: We conducted 19 in-depth interviews with transition-age youth with ASD. Recruitment occurred through schools, listservs, and organizations that serve youth with ASD and their families. A semi-structured interview guide was developed with questions about selective eating and its impact on mealtimes with family, activities with peers that involve food, and other social situations. Participants were also asked about their feelings about their selective eating and their interest in support. Data were analyzed using descriptive thematic coding.

Results: The mean age of participants was 21 years (SD 1.67 years). Fourteen were male, three were female, one was transgender, and one identified as non-binary. Twelve lived at home with their parents, five lived at school, and two lived with a roommate. A major theme that emerged was that the impact of selective eating on participants' lives diminished with age. Participants' perceived that this resulted from gentle pressure from parents, internal pressure, or just the passage of time. Participants described common strategies for coping with their selective eating in social situations, including picking out disliked foods, learning about the menu prior to an occasion, focusing on the foods they do like, eating ahead of time, carrying snacks, eating enough of disliked foods to avoid hunger, and occasionally going hungry. Many participants described family and peers as accommodating, but not necessarily understanding, their food selectivity. Most participants said that they were able to manage social situations that involved eating well enough and most youth were not especially interested in receiving help.

Conclusions: The transition-age youth interviewed indicated that they have developed coping strategies to manage social situations involving food. A responsive approach to supporting such youth would likely involve recognizing the effort and skills that the youth have already developed around this issue, respect for their growing autonomy, and could potentially involve a peer support network with other youth with ASD who understand the challenges and can share helpful strategies.

187 **172.187** Seeking Information and Support Online: The Development of an Online Resource 'Pathways Beyond Diagnosis' for Parents of Children Diagnosed with Autism Spectrum Disorder

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Background: The world wide web provides an ideal avenue to share information, advice, and support about an autism diagnosis. However, many websites lack quality control and do not provide a one-stop resource for families to access necessary information.
Objectives: The aim in this study was to use participatory action research (PAR) with end users (parents, clinicians) and our research team to develop an online resource to improve timely access to, and better quality, information and support for families post-diagnosis.

Methods: The PAR approach has been successful in generating research evidence to address community-based challenges. It involves four major phases: (1) cooperative researcher-stakeholder planning, (2) stakeholder-based action, (3) stakeholder-observation, and (4) cooperative researcher-stakeholder reflection. In the present study, each phase included Participatory Design (PD) workshops, where participants attended individual and/or group meetings; this was followed by translation of knowledge and ideas generated during workshops to produce mock-ups of webpages and content; rapid prototyping; and one-on-one consultations with end users to assess usability of the website.

Results: Three PD workshops were held with 15 end users (parents of children with autism n=3, health professionals and researchers n=12). Each workshop was followed by a knowledge translation session. At the conclusion of this PAR cycle, the alpha prototype of the website was built, and one round of one-on-one end user consultation sessions was conducted. The PAR cycle revealed the importance of six key topic areas (e.g., understanding autism, accessing services, support, gaining funding, putting it all together, looking into the future) associated with the time of diagnosis.

Conclusions: The development of this website using PAR presents a promising approach to assure that families receive practical and evidence-based information about the steps to take following a child's diagnosis. Without re-inventing what already exists, 'Pathways Beyond Diagnosis' seeks to inform families of where they can access relevant and reputable information but also summarises important challenges encountered post-diagnosis (i.e., grief, sharing the diagnosis).

188 **172.188** How My Life Is Different: Sibling Perspectives of ASD

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Background: The impact of autism spectrum disorder (ASD) on the family is a growing area of research interest. Studies have primarily focused on family impact from a parental perspective, with much less emphasis on other family members' experiences. Existing research on the sibling perspective, specifically, is relatively limited and mixed. Some studies have demonstrated that neurotypically developing siblings have positive experiences toward their siblings with ASD (e.g., Rivers & Stoneman, 2003), whereas other studies have revealed disparate findings, particularly when siblings with ASD exhibit challenging behaviour (e.g., Mascha & Boucher, 2006). Further research on the sibling experience is warranted.
Objectives: The purpose of the current study was to understand the lived experiences of a sample of typically developing siblings of children with ASD.

Methods: Nine typically developing siblings (5 male, 4 female) of children with ASD (8- to 17-years old, mean age = 12.2 years, SD = 3.4 years) participated in the study. Siblings with ASD were 9- to 17-years old (mean age = 13.2 years, SD = 2.2 years) and were predominantly male (1 female). Open-ended questions were used to flexibly guide the interviews, which took place at participant homes. Initial interview questions were strategically broad (i.e., "What is it like to be (child with ASD)'s brother/sister?") as a means of allowing each participant to start at his or her own place of lived experience. Additional questions were used to gather a descriptive perspective of each sibling's experience (e.g., "How do you and your brother/sister get along?"). Thematic analysis (Braun & Clarke, 2006) was used to analyse the interview data.

Results: Preliminary results yielded three major themes: (1) "My family is different", (2) "I am a caregiver", and (3) "I accept that my sibling has ASD

but sometimes I wish they didn't". The first theme encompasses participants' understanding that having a child with ASD in the family made their family unique. Participants acknowledged that they needed to make adjustments as a result of having a family member with ASD. They also described how role expectations were different compared to families that did not have family members with ASD. The second theme highlighted the protective role that participants assumed over their siblings. Many participants described a sense of responsibility toward their family member with ASD. The third theme revealed an array of positive (e.g., love, amazement, pride) as well as negative feelings (e.g., frustration toward challenging behaviour) surrounding the experience of being a brother or sister to a sibling with ASD.

Conclusions: The current findings highlight a sample of neurotypically developing siblings' perspectives regarding their siblings with ASD and the family dynamic. Participants described rich perspectives surrounding their experiences. Further research examining sibling relationships may have important implications on the development of supports for siblings of children with ASD.

189 **172.189** Identifying Health Disparities in Young Women with Autism Spectrum Disorder through Patient-Centered Research

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Background: Autism spectrum disorder (ASD) currently impacts 1 in 59 youth. Within this population, an estimated 450,000 youth with ASD ages 16-24 in the United States transition to adulthood. While ASD is thought to be more common in males than females, emerging literature shows that females with ASD may be under-diagnosed and receive much later diagnoses. This absence or delay in diagnosis can potentially result in severe consequences to health outcomes of females with ASD. Further impacting their health outcomes are the limited resources and treatments available upon transitioning to adulthood. Few studies have examined gender differences during transition to adulthood. Moreover, the existing studies predominately utilize quantitative methods. Thus, young women with ASD and their experiences are often unheard.
Objectives: The purpose of this study was to engage young women with ASD, caregivers, and stakeholders to identify health disparities encountered during the transition to adulthood.

Methods: A Patient-Centered Outcomes Research (PCOR) design was used to develop research capacity and build the infrastructure necessary to conduct future research responsive to the needs of females with ASD. Caregivers and females with ASD ages 15-32 were identified using purposive sampling to participate in monthly engagement groups over 12 months. Each engagement session included 8-14 females with ASD. Discussions centered on the unique challenges to females with ASD during the transition phase. Researchers collected field notes during engagement groups to capture the young women's perspectives. An advisory board of patients and stakeholders met monthly to provide project guidance. Advisory board members included females with ASD, psychologists, healthcare providers, educators, caregivers, and researchers.

Results: Results of this study highlight the process of engaging young women with ASD, caregivers, and stakeholders to identify health disparities. Findings indicate disparities in the following domains for females with ASD transitioning to adulthood: mental health, LGBT, and gender-based healthcare differences. Participants also identified several patient-centered comparative effectiveness research proposals to address these domains, including better screening tools, peer navigators, and mentor models.

Conclusions: Healthcare transition from childhood to adulthood can be difficult for most, but especially for females with ASD. Little is known on gender-related differences during transition to adulthood and subsequent impacts on health outcomes. Findings from this patient engagement study are an initial step towards better understanding these disparities and overcoming them from a patient-centered outcomes research perspective. Results of this study have the potential to create change for young women with ASD within the healthcare field through patient-informed care. These findings are expected to form the basis for future research aimed to improve health outcomes of young women with ASD.

190 **172.190** In-Home Oral Care Habits in Latino Children with Autism: An in-Depth Look

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Background:
Dental care is the most prevalent unmet health need in US children. Children from underrepresented and underserved groups (i.e., Latinos, those with Autism (ASD)) are at increased risk for experiencing oral health disparities. When intersected, Latino children with ASD face unique, unresearched oral care challenges. Literature discussing these disparities recognizes a need for further research, but little centers on promoting successful home-based oral care strategies, nor focuses on other factors (i.e., diet, culture, systemic barriers) that may impede oral health.

Objectives:

The purpose of this study was to explore the factors that affect oral care routines and impede overall oral health in Latino children with ASD using data collected via videos, visual food journals, and narrative interviews.

Methods:

This study employed a qualitative approach. Ten Latino families with a child with ASD aged 6-12 were interviewed to identify the factors that impact their oral health, including how the presence of ASD may alter their child's habits. Each parent/caregiver completed two interviews, and each child completed one interview (n=30 interviews). All interviews were audio recorded and transcribed verbatim, and thematically analyzed by the researchers. Additionally, each family video recorded their child performing typical oral care routines for 3 days. Two research assistants blindly coded 37 videos using a checklist of dental behaviors, noting unique aspects of the routines. Lastly, families submitted photos of their child's meals as part of a visual food journal (n=95 photos). One research assistant documented content of photos and noted overlapping food patterns.

Results:

The interviews yielded three themes related to factors impacting overall oral care and routines. *"Estoy sóla"* described how parents of children with ASD felt isolated. From finding an appropriate dental provider to getting their child to complete oral care activities, parents felt like they were the only ones who could ultimately help their child. "*Wait, there's more"* portrayed tooth-brushing as the only routine often performed by the child; parents labeled activities such as flossing and mouthwash as too difficult to incorporate. "*It's a Battle"* described how parents had a precarious relationship with their child's oral care habits, and forcing self-care activities led to disagreements. From the videos, two themes pertaining to oral care practices were observed. *Parent Involvement* identifies parents as partners in the oral care process, helping facilitate the

activity physically or with verbal cues. *Sensory modifications* describes being aware of the sensory needs of the child, and modifying the activity to meet those needs, including altering the activity environment. Lastly, from the photos, the lack of water consumption was noteworthy, as none of the families submitted any pictures where their child drank water. Instead, children drank more cariogenic beverages (i.e., soda, juice).

Conclusions:

Together, these data provide rich content regarding the factors impacting oral care routines and overall oral health in Latino children with ASD. This research is novel in addressing the occupation of oral care itself, while also considering the influence of cultural contexts, diet, family and child descriptors, performance patterns, and systemic restrictions on the activity.

191 **172.191** Interventions to Improve Outcomes for Parents of Individuals with Autism Spectrum Disorder: A Meta-Analysis

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Background: Parents of children with autism spectrum disorders (ASD) tend to experience greater psychological and emotional distress than parents of typically developing children. Interventions directed toward parents and caregivers have traditionally consisted of skills training and/or knowledge building interventions designed to ultimately improve child outcomes. More recently, researchers have begun to recognize the needs of parents and the importance of developing interventions to support them directly in addition to their children. However, the extent to which parent outcomes are improved by existing parent interventions is unknown.

Objectives: The purpose of this study was to conduct a meta-analytic review of existing interventions for parents of children with ASD in an effort to examine the degree to which they improve parental outcomes.

Methods: A total of 24 peer-reviewed, empirical studies containing 81 effect sizes published between January 1946 and November 2018 were identified from literature searches in relevant databases. Included studies were randomized controlled trials of interventions for parents of children with ASD in which one or more parental psychological outcomes were quantified. Studies were standardized to a common effect size (Cohen's *d*) and then subjected to a random-effects multilevel meta-analysis using inverse variance weighting. Meta-regression was conducted to examine potential study-level moderators of intervention efficacy.

Results: Analyses revealed that participation in parent interventions led to small but significant improvements in parent outcomes (d = .26 [95% CI = .08 - .43], p = .004). There was significant heterogeneity in effect sizes, suggesting wide variability in efficacy between studies, Q = 294.53, p < .001. When analyzed by outcome type, the overall effect was driven primarily by improvements in parenting confidence (d = .57, p = .000) and mental health symptoms (d = .30, p = .018). There were no significant effects of parent interventions on stress, caregiving burden, family adjustment, or physical health. When analyzed by intervention type, both parent implementation interventions (d = .20, p = .007) and parent support interventions (d = .29, p = .033) had significant effects on parental outcomes. Moderator analysis indicated that the efficacy of parent interventions was not significantly moderated by child age, parent age, intervention format (i.e. group/individual), or treatment duration.

Conclusions: The impact of existing parent interventions on the psychological and emotional outcomes of parents caring for individuals with ASD was modest and heterogeneous. Existing interventions had the greatest impact on caregiver confidence and mental health symptoms, yet had no consistent effect on stress, caregiving burden, family adjustment, or physical health. Both parent implementation and parent support interventions led to small but significant improvements in parental outcomes. While these results suggest promise in assisting parents, more work is needed to develop interventions that have a greater impact on parental outcomes.

192 **172.192** Job Burnout and Work Engagement in Registered Behavior Technicians

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Background:

Increases in the prevalence of ASD have resulted in a dramatic increase in the number of individuals receiving services (California Department of Developmental Services, 2007), leading to an increased demand for ASD service providers. One of the largest certified occupational groups providing intervention services to individuals with ASD are Registered Behavior Technicians (RBTs). RBTs are classified as human service professionals (Freudenberger, 1974). As such, RBTs face significant stressors that can be challenging and reduce occupational well-being (Maslach & Jackson, 1981). Although there is great need for training and retaining high-quality RBTs in the workforce, few studies have examined the unique factors that contribute to occupational well-being (i.e., job burnout, work engagement) in RBTs for individuals with ASD.

Objectives:

1) To determine which job demands and resources are significant concurrent predictors of job burnout category in RBTs. 2) To determine which job demands and resources are significant concurrent predictors work engagement in RBTs.

Methods:

The sample includes 311 RBTs (M_{age}= 27.71 years, SD=7.29) with diverse ethnic/racial backgrounds. Participants were primarily female and held a college degree or higher. Job demands examined included challenging behaviors and low client skill level. Job resources included social resources (i.e., supervision, role clarity), training satisfaction, and training methods. Burnout (i.e., negative emotional response to work-related stress) was measured using the Maslach Burnout Inventory, comprised of three subscales: emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA). Work engagement (i.e., positive, fulfilling work-related state of mind) was measured by the short version of the Utrecht Work Engagement Scale. Multiple ordinal regressions were conducted to examine the relation between job demands, resources, and burnout. Multiple linear regression analysis was conducted to examine the relation between job demands, resources, and work engagement.

Results:

Nearly 45% of RBTs reported levels of EE that identified them as employees with high burnout. Increases in stress from challenging behaviors resulted in greater odds of burnout (high vs. low/moderate EE: OR=1.04, p<.001; (high vs. low/moderate DP: OR=1.04, p<.001). RBTs employed full-time had greater odds of burnout (high vs. low/moderate EE: OR=2.90, p<.001) compared to RBTs employed part-time. Conversely, increases in social support resulted in lower odds of burnout (high vs. low/moderate EE: OR=.98, p=.001). RBTs with matched training styles had lower odds of burnout (high vs. low/moderate EE: OR=.525, p=.012; (high vs. low/moderate DP: OR=.50, p=.027) compared to those with mismatched training styles. Increases in social support (b=.18, p=.001) and training satisfaction (b=.20, p=.001) scores were associated with increases in work

engagement scores.

Conclusions:

Findings illustrate that social and training resources are central factors associated with both burnout and work engagement. Companies may reduce the impact of job demands by providing more of these resources, such as through supervision support. Taking these steps may improve occupational well-being not only by preventing and alleviating burnout, but also increasing work engagement in RBTs – ultimately helping to ensure that individuals with ASD consistently receive the services they need.

193 **172.193** Lessons Learned from Adapting a Peer-to-Peer Parenting Program for Urban Black Families Raising Children with Autism

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Background:

Very little intervention research has focused specifically on low-income Black families raising young children with autism, despite documented racial disparities in autism diagnosis and treatment. While early intervention significantly improves child and family outcomes across the lifespan (Koegel, Koegel, Ashbaugh, & Bradshaw, 2014; Warren et al., 2011), low-income children with autism are less likely to access such services (Carr & Lord, 2016; Nguyen, Krakowiak, Hansen, Hertz-Picciotto, & Angkustsiri, 2016). Although Black caregivers across socioeconomic strata experience racial discrimination and poor parent-provider relationships, low-income Black caregivers also report limited autism knowledge and suboptimal access to care for their children (Dababnah, Shaia, Campion & Nichols, 2018).

Objectives:

We will report on the process of designing and initiating a feasibility trial of an adapted version of a peer-led, in-home, 14-week manualized program, *Parents Taking Action*, among low-income urban Black families raising children with autism. The presentation will focus on the first two aims of the project: 1) Engage key stakeholders in the local implementation of *Parents Taking Action*; and 2) Adapt *Parents Taking Action* for low-income caregivers of Black children with autism.

Methods:

Using the World Health Organization's ExpandNet implementation science framework (Simmons, Fajans, & Ghiron, 2011), we used a mixed-methods approach to adapt, implement and evaluate *Parents Taking Action*. The intervention uses videos, activities, and discussion to cover topics on autism therapies, advocacy skills, behavior management strategies, and social support. Unlike group-based or clinical interventions, *Parents Taking Action* offers flexibility to participants, as meetings are set around caregivers' schedules, and in-home meetings reduce travel time and costs. To accomplish Aims 1-2, we formed an advisory group composed of individuals with autism, parents, service providers, and advocates of children with autism. The group developed recommendations on adapting the program, identifying Parent Leaders (parents of older children or adults with autism from the local community) and recruiting participants (parents of young children with or at-risk for autism). We recruited both the Parent Leaders and the intervention participants from low-income neighborhoods in a large mid-Atlantic US city.

Results:

The advisory group met quarterly in person and consulted with the research team regularly between meetings to recommend actions related to intervention adaptation and implementation. The advisors' primary recommendations included adding culturally relevant pictures and videos, addressing potential police interactions, modifying the language to be more strengths-focused, supplementing the manual with local resources, and reordering the weekly topics. After we summarized our advisors' perspectives, the research team discussed recommended changes and modified the manual. We then identified, hired, and extensively trained four Parent Leaders to deliver the in-home program to a pilot group of 15-20 local parents of young children ages eight and younger with or at-risk for autism. We will discuss various challenges we encountered during the hiring and training processes, as well as the ways in which we addressed these obstacles.

Conclusions:

The "lessons learned" from developing and implementing a peer-led intervention with significant input from community stakeholders can be used to inform future studies targeting communities experiencing the multiple effects of poverty.

194 **172.194** Listening to Parents to Inform Autism Research

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Background:

Most studies setting the priorities for autism research have focused on the early intervention years (Ghanadzade et al. 2018; Pitchet et al. 2011; Rodger, Braithwaite & Keen, 2004), or the daily priorities for adults on the spectrum (Gotham et al., 2015). Therefore, we do not have a good understanding of what the priorities should be for autism research in the school years. With an increase in prevalence of Autism Spectrum Disorders (ASD), now affecting 3% of school children aged between 7 and 17-years (Blumberg et al. 2013), establishing research needs and priorities is important to inform future autism research, that can best support the learning outcomes of school aged children with ASD.

Objectives:

Researchers are beginning to understand the benefits of involving members of the autism community in setting priorities for autism research. This study aimed to investigate parents' priorities for the future focus of autism research to support their school age child with ASD across the home, school and community environments.

Methods:

A sample of 116 parents of school age children with ASD responded to an online questionnaire which included general demographics and more specific questions to determine parent's research priorities. Parents were asked to nominate their top three priorities or research areas that they wanted to see as the focus of future autism research in the home, school and community settings, from most to least important.

Results:

The data was analysed using thematic analysis. Parent priorities for autism research in the home were explored first, where *family support, daily living skills* and *behavioural difficulties* emerged as the three most prevalent priority themes for future research in the home. Parents identified that *teacher knowledge and experience with disability,* research exploring *social relationships* and research into *academic and learning outcomes* as the areas of priority for future school-based research. Within the community setting, research to promote *awareness and understanding* within the community and greater *inclusion* were of the highest priority for many parents. In addition, many parents wanted to prioritise research exploring ways of adapting the community environment and community activities to better support the needs of individuals on the spectrum.

Conclusions:

Involving members of the autism community in priority setting for autism research increases community engagement and can improve the translation of autism research to maximise the impact of future autism research where it is needed most.

195 **172.195** Mechanisms of Parental Stress Associated with Emotional and Behavioral Problems in Children with Autism Spectrum Disorder

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Background: Emotional and behavioral problems (EBP) are common in autism spectrum disorder (ASD). There is ample research to show that EBP, particularly externalizing behaviors, are associated with negative impacts on the family system. Additional research is needed to clarify the underlying mechanisms of this relationship. Studies have shown that parental self-efficacy (PSE) is an important variable in terms of parental stress and has been hypothesized as a potential mediator between EBP and family distress. A limitation to extant research is the infrequent focus on underserved populations. Further investigation into how family resources affect PSE and family distress is needed.

Objectives: The purpose of the current study was to investigate the role of PSE as a mediator of the relationship between EBP and family distress in an underserved sample of children with ASD. We hypothesized that the mediation effect would be greater for externalizing (EBP-E) versus internalizing (EBP-I) behaviors. Additionally, we hypothesized that the amount of family resources would moderate the degree of mediation such that lower family resources would be associated with a stronger relationship between lower PSE and increased family distress. We predicted no significant differences after controlling for autism symptom severity and intellectual ability.

Methods: Participants included (98) families of children with ASD between the ages of 3 and 13 who were recruited as part of a larger study of improving dental care. Families exhibited racial (45% Non-Caucasian) and ethnic (41% Hispanic) diversity, and all were underserved as defined by Medicaid-eligibility. Children completed the Autism Diagnostic Observation Schedule–2nd Edition (ADOS-2) and Stanford-Binet–5th Edition, abbreviated battery (ABIQ). Parents completed questionnaire ratings of PSE, Family Resources, Family Distress, and Child EBP. We used the PROCESS macro (Hayes, 2018) to assess for the degree of moderated mediation of the hypothesized model for both EBP-E and EBP-I (see Fig. 1).

Results: All associations were in the hypothesized directions. Both EBP-E and EBP-I models were significant and accounted for 58% and 44% of the variance, respectively. There was a significant direct effect of EBP-E on parent stress (β=.48, p<.001) and PSE mediated this relationship. The index of moderated mediation was significant (β = -.07, CI = -.14 – -.008) indicating that fewer resources was associated with greater mediation by PSE. Results for EBP-I were similar, albeit not as pronounced, as hypothesized (see Fig. 1). Results were unchanged after controlling for autism symptom severity and intellectual ability.

Conclusions: Our data suggest that EBP increase parent stress through a mechanism of decreased PSE, particularly when resources are limited. Increasing parents' sense of self-efficacy, especially in underserved populations, may be a critical focus of interventions to decrease stress associated with emotional and behavioral problems in children with ASD. These results highlight the need to support families with limited resources including providing parents with tailored interventions and novel skills that can target specific areas of concern that they may not otherwise be able to address on their own.

196 **172.196** Monitoring Electronic Communication of Autism Support Teams through Hover Reporting

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Background: A few online tools to facilitate communication and resource sharing among treatment and education team members working with children with autism have been developed. To date, no studies have investigated how these interfaces affect collaboration among users. There are no standard ways of measuring team interaction on digital interfaces. Rigorous measurement of these interactions will provide new knowledge about the impact that digital interfaces have on care coordination and outcomes. We developed, using R programming, a method to map digital social networks as a promising approach for studying team dynamics on digital interfaces for individuals with autism.

Objectives: To demonstrate how networks of communication and resource sharing can be inferred from measurements of electronic activity of team members, and how reports about that communication can be built to support team interactions.

Methods: As part of the pilot of a larger, multi-site HRSA study, we asked autism support teams to use a social networking application designed to facilitate communication between teachers and parents. We asked teams to use the tool during the implementation of two interventions: 1) a school transition support intervention implemented before, during, and after the child's transition between schools and 2) diagnosis to treatment intervention, implemented post diagnosis for families without services. Data was collected from the application and then, using R, transformed to describe activity and communication on each of the teams. These variables were then built into reports delivered to study coordinators.

Results: By using the application, members of the support teams were able to create and share calendar events, links, documents, pictures, and resources that work for the child. We experienced some challenges getting the data out of the application but once we did, the data provided a clear picture of real time, actual communication of teams. Using R, data from these teams were used to build hover reports, describing communication and activity of those teams. These reports were then given to site administrators to help them understand what team members at

their sites were doing. For the pilot, we successfully extracted the data from the app and computed average counts of different types of interaction (e.g. posting a link to the team), as well as the average number of roles present on each team.

Conclusions: Online tools present an opportunity for teams providing support to children with autism spectrum disorder to communicate and share resources and knowledge. Researchers and other entities can hover over communication in these online tools to measure actual collaboration within these teams to both measure them and to provide feedback that can better focus or guide future intervention.

197 **172.197** Parent Coaching of Music Interventions for Children with ASD: A Limited-Efficacy Study

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Background: *Parent-mediated interventions* are specific interventions where parents collaborate in goal setting and implement evidence-based strategies with their children with disabilities (Steiner, Koegel, Koegle, & Ence, 2012; Zwaigenbaum et al, 2015). These models have responded to the need of early intervention services, especially in areas where professional services are scarce (Oono, Honey, & Mcconachie, 2013). Concurrently, *parent coaching* is the professional service provided to train parents in those strategies (Steiner et al, 2012). Parent coaching is currently researched as a very cost-effective and useful strategy in the ASD field (Oono et al, 2013). In music therapy, parent participation studies are emerging in the research literature, particularly in the last 5 years (2012-2017). However, parent-mediated interventions and their coaching are very limited (Blind Review, 2018a). For this study, a parent coaching model based on the Parent-Early Start Denver Model was developed (Rogers et al., 2012). The theoretical framework conceptualizes music as a mediator of parent coaching through optimization of psychophysiological arousal of both child and parent, and through synchronization of their social communication (Blind Review, 2018b). Such optimization would increase parental responsiveness, and child attention and motivation (Baker et al, 2015; Feldman et al., 2012; Trainor & Cirelli, 2015).
Objectives: The purpose of this exploratory study was to test the limited-efficacy of parent coaching of music interventions on parental responsiveness and child communicative behaviors.

Methods: An alternating treatments design for three parent-child dyads was implemented. Parents received ten 1-hour coaching sessions based on the Parent-ESDM manual (Rogers & Vismara, 2015). Music and non-music conditions were offered in each session, counterbalancing to avoid order effects. Two trained observers coded parental and child behaviors in three baseline and ten treatment sessions.

Results: Only one parent-child dyad completed the treatment and was analyzed. Behavioral video analysis of parental verbal and nonverbal responsiveness, child joint attention and verbal behaviors, and parent and therapist fidelity provided quantitative data. A semi-structured follow-up interview with the parent addressed concerns, preferences, and suggestions for improvement. Parental verbal responsiveness seemed lower during the music condition, but non-verbal responsiveness increased notably during the music condition. Importantly, parental responses changed from directive instructions to responsive comments to child communication, but this fact was not reflected in quantitative data. Parent fidelity was achieved in the 6th session. As theorized, parental fatigue due to personal circumstances impacted results in the last two sessions. Child receptive joint attention increased in the music condition only, and initiating joint attention was higher in most sessions during the music condition. Parental comfort with the music did not seem ideal with the brief time allotted to training despite familiarity with the music used.

Conclusions: Parent coaching of music interventions to enhance social communication of preschoolers with ASD seems feasible and potentially efficacious. Further research should investigate other approaches to teach the music, alternative schedules, and more precise measures of parental responsiveness, such as a ratio of directive vs. responsive parental communication.

The present manuscript is part of the author's dissertation presented in partial fulfillment of a PhD degree.

198 **172.198** Parent Education and Communal Experience (PEaCE): Results from Self-Report Questionnaires

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Background:

Parents of children with Autism Spectrum Disorder (ASD) report greater parenting stress, marital distress, and mental health symptomatology than parents of typically developing children, as well as parents of children with other types of disabilities. Social support, parenting self-efficacy, and coping styles moderate the association between autism and parenting stress. Parent support groups have been shown to raise awareness, decrease stress, and increase empowerment among participants. Little research exists on the mental health outcomes of support groups for parents of children with ASD.

Objectives:

The present study focused on determining the impact of a Parent Education and Communal Experience group on the mental health and life satisfaction of parents of children with ASD.

Methods:

Participants: 34 Parents, four consecutive groups

19 biological mothers, 13 biological fathers, one adoptive mother, and one step-father

19 Caucasian, 3 Asian/Pacific Islander, 6 Hispanic/Latinx, 5 Middle Eastern

Children ages 2-17 with an ASD diagnosis

Design:

Quasi-experimental, pre-post, descriptive study. To determine the acceptability and utility of a 7-week education and support group for parents of children with ASD. Parents completed self-report measures of parenting stress, anxiety, depression, life satisfaction, and empowerment.

Overview of PEaCE program:

Seven sessions, each lasting 1.5 hours, offered once per week

Week 1: Introductions

Week 2: ASD Psycho-Education

Week 3: Community Resources
Week 4: IEP/504, Parents' rights
Week 5: Self-Care, Coping Skills
Week 6: Date Night / Self-Care Night
(respite care provided, but no group meeting)
Week 7: Wrap-up
Results:
Preliminary results show paired samples T-Tests revealed a significant increase in the Service System subscale of the Family Empowerment Scale, and trends for increases on the Family and Community/ Political subscales. Analyses also revealed trends for decreased pessimism as measured by the Questionnaire on Resources and Stress, as well as a trend for increased Satisfaction with Life
after participation in the Parent Education and Support Group. Final results will be completed by early March.
Conclusions:
Despite the brief nature of this program and very small sample size, trends in the parenting stress, family empowerment, and life satisfaction measures were promising and support the utility of this parenting education and support program. The researchers intend to conduct a randomized control trial, and may consider extending the length of the program. Additionally, parents who have participated in these groups frequently request ongoing support group meetings. Therefore we would like to offer ongoing support to parents who have completed this initial program. It may also be of interest to collect qualitative data from future participants to better understand the impact of participation in this group.

199 **172.199** Parent Understanding of EEG Study Procedures for Culturally and Linguistically Diverse Children with ASD: Impact of a Social Story

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Background: The successful inclusion of children with autism spectrum disorder (ASD) in neuroimaging research poses unique challenges due to associated behavioral and communication deficits [1-3]. Children from linguistically and culturally diverse backgrounds face additional barriers to participation, one of which may be parent understanding of research procedures, a critical aspect of informed consent and assent processes [4-10]. Although limited, some research supports multimedia approaches to improving parent and child understanding of study participation [11]. Here, we assessed the effectiveness of social stories, visual aids frequently employed to support learning and understanding for children with ASD [12-14], for improving parent understanding of EEG procedures for culturally and linguistically inclusive research targeting children with ASD.
Objectives: The research questions are as follows:

1. Do parents have a better understanding of EEG study procedures after viewing a social story than after reading a traditional explanation in text format?
2. Does the social story impact parent understanding differently for English and Spanish speakers?

Methods: Participants were 83 English- or Spanish-speaking parents of children with ASD (see Table 1) who completed an anonymous online survey. Participants were randomly assigned to either (a) social story condition (photographs of a child volunteer completing the EEG study procedures accompanied by short text explanations) or (b) written condition (written explanation of study procedures intended to mirror what would typically be provided verbally and/or in writing during consent). Parents' measured understanding (two multiple choice questions about study procedures) and *perceived* understanding ("After what you just read/saw, did it increase or decrease your understanding of brain research?") were then assessed.

Results: Independent samples T-Tests revealed significant differences between groups in both measured understanding ($p < .001$) and perceived understanding ($p = .024$). A 2 (condition) x 2 (language) ANOVA revealed a significant interaction between condition and language ($p < .001$) for *perceived* understanding, but no significant interaction ($p = .220$) between condition and language for measured understanding (see Table 2). Findings suggest that only Spanish speakers perceived their understanding to be better in the social story condition versus the control condition. However, both language groups' *measured* understanding was better in the social story condition.

Conclusions: Both English- and Spanish-speaking parents of children with ASD who saw a social story demonstrated better understanding of the EEG study procedures than parents who read a written explanation. Further, Spanish-speaking parents' perception of their understanding was significantly higher in the social story condition. These results have implications for the informed consent process and recruitment, suggesting that social stories may be a feasible, cost-effective method for promoting parent understanding of child EEG research study procedures across culturally and linguistically diverse populations. If parents have a better understanding of children's neuroimaging studies, they may feel more comfortable participating, asking questions, and answering their child's questions, which could result in both parents and children having a more positive, successful experience with neuroimaging research studies.

200 **172.200** Parent-Child Interaction in Families of Children with Autism: Analysis across Mealtime and Play Contexts

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Background: Children with autism spectrum disorder (ASD) often display behaviors such as food selectivity, mealtime rigidity, food refusal, and disruptive mealtime behaviors that can significantly disrupt family mealtime. These behaviors and the ways in which caregivers respond to them have been shown to greatly influence the quality of the parent-child interaction and the overall mealtime experience for families. The playtime experience is also influenced by symptoms of ASD. Specifically, children with ASD are less likely to participate in pretend play and demonstrate decreased social engagement during play. As dyadic interaction is a central component to playtime and mealtime experiences for young children, it is important to examine the impact of these contexts on the dyad and on each individual.
Objectives: The purpose of this study was to compare the differences of parent-child interaction during the mealtime and playtime contexts.

Methods: A repeated measures design was used to identify and compare the characteristics of the parent-child interaction in parent-child dyads across two contexts: playtime and mealtime. Seventeen children with ASD ages 2-7 years participated in a playtime and mealtime observation using preferred food with their primary caregiver. The interactions were video recorded and coded using the Parent-Child Early Relational Assessment. The Parent-Child Early Relational Assessment is designed to measure quality of affect and behavior during a five-minute face-to-face parent-child interaction. The parent, child, dyad, and total scores were compared across playtime and mealtime contexts using related samples t-tests.

Results: Parent and dyad scores were significantly higher ($p<.05$) in the playtime context compared to mealtime with a large effect size, indicating more positive interactions during playtime and more negative interactions during mealtime. Child scores were not significantly different across contexts.

Conclusions: Children with ASD display consistent behaviors across the playtime and mealtime contexts. However, parents displayed significantly more positive affect and behavior during playtime as compared to more negative affect and behavior during the mealtime context. This difference in parent scores suggests that context influences parent affect and behavior, thereby impacting their overall interaction with their child. The majority of previous research and interventions has focused on the behavior of children with ASD during mealtime, however our results suggest that the parents' behavior and affect also contributes to the difficult mealtime experience. Interventions focused on mealtime for children with ASD should include the parent as well as the child, as context influences this dyadic interaction and mealtime context. When designing interventions focusing on improving the mealtime experience for children with ASD, providing parent support and strategies are important methods to improve the overall family experience and potentially child eating behaviors.

201 **172.201** Parent-Child Interactions in Families of Preadolescent Children with Autism Spectrum Disorder

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Background: Relationships between children with autism spectrum disorder (ASD) and their parents constitute fundamental sources of support for children as they transition into adolescence, yet little attention has been devoted to characterizing these relationships or their associations with child outcomes.

Objectives: The aims of the current study are to 1) characterize parent-child interactions in families of children with ASD using two well-validated, observer-based, family research measures to establish whether the relationships of parents and children with ASD differ from those found in families of typically developing (TD) children, 2) test within-dyad associations of family interaction characteristics, and 3) examine the associations between family interaction characteristics (child and parent positivity; parent control) with child characteristics, including temperament, mental health problems, and autism symptoms.

Methods: Families of children with ASD (n = 21) and families of typically developing children (n = 21), matched on age and intellectual abilities were recruited into the current study. Children received diagnostic and intellectual assessments. Parents were administered the Five Minute Speech Sample (Magaña et al., 1986) to measure aspects of the family environment and reported on their child's mental health problems via the Child Behavior Checklist (Achenbach & Rescorla, 2001) and regulation via the Temperament in Middle Childhood Questionnaire (Simonds & Rothbart, 2005). The child and one parent were observed engaging in a standardized discussion task. These interactions were coded for the levels of parent and child positivity (e.g., behaviors that served to show support, warmth, and responsiveness) and control (e.g., behaviors that served to control, influence, or dominate the opinions, actions, or points of view of others during the interactions) with the Iowa Family Rating Scales (Melby et al., 1998). Group differences were tested using multilevel modeling, and Spearman's correlations were used to test associations between family interaction characteristics and child functioning.

Results: Results showed no diagnostic group differences in the observed levels of positivity exhibited by parents, but significantly less positivity in children with ASD compared to TD children (See Table 1). In addition, parents of children with ASD had higher levels of observed control compared to parents of TD children. Child ADHD symptoms were negatively associated with levels of positivity in parents $rs(18) = -.45$, $p = .04$) and children ($rs(18) = -.47$, $p = .04$) in the ASD group. Also in the ASD group, child positivity was positively associated with child effortful control ($rs(18) = .52$, $p = .02$). Finally, levels of control in parents were positively associated with child anxiety in the ASD group ($rs(18) = .49$, $p = .03$).

Conclusions: Findings highlight both the positive characteristics of parents of children with ASD, and the potential impact of family processes in the development of comorbid mental health problems for youth with ASD. Parent-child relationships may be an important cornerstone of positive development during the transition to adolescence, especially in consideration that peer relationships become increasingly complex and difficult to navigate for individuals with ASD in middle-school and high-school.

202 **172.202** Parenting Needs of Chinese Parents of Children with Autism in America, Macau, and Taiwan

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Background: Many studies have focused on parenting stress in parents of children with autism spectrum disorder (ASD) and high parenting stress is commonly reported. However, limited studies have focused on parenting needs of parents of children with ASD and few studies have focused on Chinese parents of children with ASD.

Objectives: This study was conducted to understand (a) the needs of Chinese parents of children with ASD in the United States, Macau, and Taiwan in the support services to help them decrease their parenting stress and (b) the differences in parenting needs between Chinese-American parents and non-American Chines parents.

Methods: A parenting needs survey was developed for the purpose of this study. This survey included questions about parents' characteristics, children's characteristics, and parenting needs. A total of 94 parents of children with ASD participated in this study, including 57 Chinese-American parents and 37 Non-American Chinese parents (35 Macanese and 2 Taiwanese). The mean age of their children with ASD is 9 years.

Results: 85 % of the parents indicated that they needed support services to help them decrease their parenting stress and these parents preferred attending a parent support group (42%) to receive the services over visiting a clinical professional (32%) or asking help from family and friends (27%). The non-American Chinese parents were more likely than the Chinese-American parents in getting the support services they need

through attending a parent support group (X^2 (1, N = 94) = 6.86, p < .01). The parents who needed support services showed significantly lower quality of life than those who did not (t(93) = 2.05, p < .05). 89% of the parents reported needing support services to help them improve their parenting skills. The top one support service they need is training to teach them how to teach their child/children with ASD. The top one skill that these parents wanted to learn is to manage their child's/children's behaviors. Chinese-American parents were more likely to need support services to improve their parenting skills (X^2 (1, N = 94) = 4.34, p < .05) and training for teaching their child/children with ASD than non-American Chinese parents (X^2 (1, N = 94) = 5.84, p < .05). 62 % of the parents needed financial support to help them raise their child/children with ASD. But, the relation between financial support and country (America vs. Non-America) was not significant. Not every parent reported that their child/children with ASD has/have ever received the supports and benefits from the government where they reside. Only 72% of the parents reported their child/children with ASD did. 79% of the parents reported that their child/children with ASD have afterschool program needs. The top one skill that these parents wanted their child/children to learn is social and communication skills. The relation between afterschool program needs and country was not significant.

Conclusions: Parents of children with ASD need support services to help them decrease their parenting stress. The needs of Chinese-American parents may be different from those of non-American Chinese parents.

203 **172.203** Parents' Attitudes Toward the Process of Attaining a Diagnosis of Autism Spectrum Disorder for Their Children

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Background: Research does not have enough data about the parent's attitudes and responses to having a child diagnosed with ASD. This knowledge is crucial in the design and development of public policies for screening, diagnosis and general access to services.
Objectives: Explore parents' attitudes toward the process of attaining a diagnosis of autism spectrum disorder for their children in a sample of Venezuelan caregivers.

Methods: Parents were recruited via key informants at special schools, child development centers, and health clinics. 20 Venezuelan parents of children between 5 and 10 years of age with a diagnosis of ASD were interviewed. The instrument was a semi-structured qualitative interview which was validated by experts. Sessions were audio recorded and transcribed. Two researchers coded transcripts, and data were analyzed using thematic analysis.

Results: Three central themes were constructed following data analysis: 1.) parents' thoughts about diagnostic and the professionals involved in the diagnosis, 2.) parents' behaviors related to diagnostic, family and self, and 3.) parents' emotions about diagnostic and self. Parents expressed ambivalent attitudes with both positive and negative thoughts, emotions and behaviors related to acceptance, decision making, searching professional help for the mental health of their children. Concerns about the costs of services, availability of services, the organization of time, and the future of their child were common expressions from parents. Reports about acceptance and support from extended family were also frequent in this sample

Conclusions: Results contribute to understanding how parents' attitudes toward the process of attaining a diagnosis of ASD for their children are related to the availability of services, financial burden, and support from family. Their lived experiences about knowing of their child's autism, identify it as a defeat, uncertain and something unfortunate. These results have important implications for future work with Hispanic families and supporting them in the process of identification and diagnosis of ASD of one of their members.

204 **172.204** Participant Characteristics Predicting Response to New Research Opportunities Offered By SPARK Research Match

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Background: Simons Foundation Powering Autism Research for Knowledge (SPARK) is a collaborative, online study that enrolls individuals with a professional diagnosis of autism spectrum disorder (ASD) and their family members into an autism research cohort. One of SPARK's central features is "research match" (RM), a research platform that enables researchers to recruit, cost-free, potential study participants from the SPARK cohort. Participants are notified about studies by email and can indicate interest in the study by clicking a weblink. To date, 20+ studies have used RM and 20,000+ SPARK participants have responded to at least one study invitation. It is unknown how individual participant characteristics, such as demographics and prior engagement in SPARK, impact these response rates.
Objectives: Evaluate response rates by demographic and enrollment factors

Methods: Eleven studies (5 online and 6 in-clinic) that used RM during 06/2017-11/2018 were selected for analysis. All studies recruited children and/or dependent-adults with ASD. Participants who received at least one invitation for the studies were included in the sample. For families invited to more than one study, each study was considered as a separate opportunity to respond. Participants who clicked on either the "interested" or "not interested" weblink were classified as responders, while participants who selected neither were non-responders. Demographic characteristics and other SPARK-related factors were indexed to the dependent with ASD.

Results:

- There were 34,823 recruitment opportunities for the eleven selected studies
- Online studies: 33,477 recruitment opportunities; 16,102 (48.1%) response rate
- In-clinic studies: 1,346 recruitment opportunities; 423 (31.4%) response rate
- Saliva kit return and previous SPARK study protocol survey completion predicted response for both study types
- Participants were more likely to respond to either type of study if their time since enrollment was <9 months
- Clinical site affiliation was associated with higher response to in-clinic studies; however, non-affiliated participants were more likely to respond to online studies
- Age of the child with ASD was not associated with response for in-clinic studies, but parents of children <10 years were more likely to respond to online research opportunities
- No difference in response rate for child/dependent-adult gender

- See Table 1 for participant characteristics and response rates, and Table 2 for results of multiple logistic regressions

Conclusions: SPARK research match has been successful in engaging a range of SPARK participants in new research studies. Certain participant characteristics predict response to invitations about new research in general, such as previous engagement with SPARK (e.g. saliva kit return). These participants have already demonstrated willingness to engage with SPARK after registration. We also identified differences between online and in-clinic studies. Clinical site-affiliated-participants may be more likely to respond to in-clinic studies due to the pre-existing relationship with the local site. Non-affiliated participants' sole method of interaction with SPARK is online, and may indicate a general preference for how to participate in research. Participants with ASD of all ages may be seeking direct benefit from in-clinic studies, while parents of younger children may be more willing to participate in a broader range of autism research due to recency of diagnosis.

205 **172.205** Participation in Mainstream Versus Disability-Specific Community Programs for Children and Youth with Autism Spectrum Disorder

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Background: The World Health Organization has identified social inclusion and participation as a vital part of health, development and quality of life. In line with a philosophy of social inclusion and participation, the ratification of the United Nations Convention on the Rights of Persons with Disabilities obligates countries to take action to ensure that "community services and facilities [...] are available on an equal basis to persons with disabilities" (Article 19). However, research shows that children with autism spectrum disorder (ASD) participate in significantly fewer mainstream (inclusive) community-based programs than their neuro-typical peers.

Objectives: This study aims to (1) identify factors associated with a child's participation in community-based programs, and (2) explore parents' reasons for choosing mainstream versus disability-specific community programs.

Methods: Parents of children with ASD from Canada and the United States completed an online survey hosted through REDCap. The survey included child and family demographics (e.g., child age, communication ability, presence of disruptive behaviours, size of community, identified culture, etc.), the number and types of mainstream community programs in which the child with ASD participated (past and present), what information was provided about a child's ASD diagnosis and by whom, and open-ended questions, including, "What led you to put your child in a mainstream community program(s) versus a disability-specific program(s)?". Multivariable regression analyses will be conducted to identify child, family and/or program factors associated with the number and types of mainstream community programs in which a child participates. Qualitative responses to the open-ended question will be thematically analyzed.

Results: To date, n=82 parents, with n=92 children with ASD (mean = 8.97 years, range 2-20 years) have completed the survey (survey closes December 31, 2018). Children participated in an average of 1.22 mainstream community programs. Twenty-eight (31%) of children with ASD had never participated in mainstream community programs, whereas 22 (24%) participated in five or more.

Conclusions: Research on inclusion and participation in community programs for children with ASD is limited. Findings from this study can start to fill this gap by increasing our understanding of the types of community programs in which children with ASD participate, and factors associated with, and parents' reasons for choosing, mainstream versus specialized community programs for children with ASD.

206 **172.206** Participatory Action Research Project on Family Needs: Experiences of Professionals in Providing Support Services to Zambian Parents of Children with Autism.

J. Nyoni*, Education, Lusaka, Zambia*

Background: The role of professionals in the attainment of sustainable development of quality health for families of children with Autism Spectrum Disorders (ASD) is critical mainly in the Lower - and Middle-income nations where ASD is hardly known. Parents of children with ASD experience higher stress levels to care for these children. The stress levels are further compounded when there is inadequate support services provision from professionals. There is limited publication in Zambia on the barriers and challenges that professionals face in providing support services to these families.

Objectives: The aim of the study was to determine professional experiences in providing formal support services currently available to families of children (ASD) in Zambia and explore how the use of advocacy, professional-parent collaboration could be used to empower families, meet their support needs through Participatory Action Research (PAR) approach.

Methods:

A qualitative, Participatory Action Research (PAR) design was employed to generate data. Purposeful sampling was used to recruit 21 professionals from the Lusaka Province of Zambia under the Ministries of Health, General Education, Community Development and Social Welfare, Zambia Agency for Persons with Disabilities and Teaching Council of Zambia. Participants had more than three years working experience with ASD families. They were drawn from both the private and public sectors and rural and urban settings. Semi-structured interviews, document analysis conference proceedings, participant observations and field notes were employed to collect data. Data was analysed using thematic analysis and Dedoose (ongoing).

Results: Preliminary results indicate that professionals face barriers to provide services which included; lack of standardised and cultural friendly instruments for diagnosis. Lack of a National Policy Framework that support autism services. Some professionals faced discrimination fellow workers at working places. There was pressure from parents for immediate results about child's condition. The existing professional groups in line Ministries are uncoordinated, fragmented and operate through social media as opposed to Continuous Professional Development meetings. This has led to internal and external conflicts amongst the professionals on the type of treatment and intervention to provide to families

Conclusions:

There is a need to establish a national policy on ASD. Further training is needed amongst professionals to avoid wrong diagnosis and wrong labelling of the child. Currently, Zambia has less than 10 occupation therapists and less than 50 speech therapists against 17million people. Professionals that have set up private institutions such as hospitals, schools and assessment centres need government financial support to

reduce the costs of services provision to families. Public employees needs an extra duty stipend as a motivation.

207 **172.207** Pathologizing Among Romantic Partners of Autistics Who Use Online Support Groups: An Emergent Theory

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Background:

As many as 25% of autistic adults report they have been in intimate relationships, and few studies have explored these relationships from the perspectives of neurotypical (NT) partners. Studies that exist have indicated patterns of miscommunication, unmet need, and abusive behaviors, and NT partners are increasingly using peer-mediated online support groups to manage these challenges. Anecdotal evidence and informal review of public online forums suggest that NT partners using online support groups have symptoms of depression, anxiety, and dissatisfaction in their relationships, warranting further investigation.

Objectives:

The purpose of this study was to capture a theory that reflects the basic social experience of partners of autistics who use online support groups and the basic social process they use to navigate that experience.

Methods:

A classic Glasieran grounded theory was used to allow a theory to emerge from data. Participants were recruited via online support groups and participated in asynchronous online interviews and telephone interviews. Theoretical sampling was used and interview questions evolved throughout the study based on emergent findings. Data were concurrently collected and analyzed using constant comparative analysis. The sample included 162 NT individuals who used online support groups and believed their partners had autism.

Results:

A basic social problem was identified as an imbalance in the need for emotional intimacy between NT and autistic partners. NTs attempted to resolve this problem through pathologizing, or attributing negative aspects of their relationships to autism rather than to their partners as individuals. The degree of pathologizing resulted in five behavioral profiles of the NT partner that created relationship contexts. In order of increasing pathologizing, contexts included: mutual partnership, in which partners were viewed as equals and NTs showed respect and gratitude for autistic partners' contributions; companionship, where NTs viewed autistic partners positively but believed symptoms of autism prevented them from forming a deep connection; caregiving, in which NTs viewed autistic partners as dependent and compared their relationships to parent-child dyads; detachment, in which NTs believed their relationships were broken beyond repair due to the effects of autism and viewed giving up as a means of self-protection; and abusive context, where NT partners made negative generalizations about autism beyond their relationships and felt compelled to warn others about the perceived dangers of neuromixed relationships.

Conclusions:

While some partners used pathologizing as a coping mechanism to maintain a positive view of their partners, others used it to relieve themselves of internal pressure to invest in their relationships or to justify detachment or abuse towards autistic partners. This study highlights the need to explore risks versus benefits of unmoderated online support groups, as pathologizing is common in these groups and may perpetuate negative views of autism that create toxicity within relationships. Professionals must monitor for patterns of abuse of the autistic partner and assist both partners in creating balance in their needs for emotional intimacy while minimizing pathologizing. Future studies should explore the presence of pathologizing in neuromixed relationships outside of support group users and in couples affected by conditions other than autism.

208 **172.208** Performance of the Olson Circumplex Family Model in Families with a Child with ASD

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Background:

For families of typically developing children, extremes of family cohesion (enmeshed and disengaged) and flexibility (rigid and chaotic) are associated with negative outcomes (Olson 2011). Although, some work has suggested that this may not be the case for families of children with autism (Altiere & von Kluge 2008). Specifically, regimented daily routines (increased rigidity) and highly involved caregivers (increased enmeshment) may be associated with positive outcomes (Altiere & von Kluge 2008).

Objectives:

1. Examine if families with children with autism reported more enmeshed and rigid family dynamics relative to families with typically developing children.
2. Examine if the relationship between reported enmeshment and rigidity was equally predictive of family outcomes for families with typically developing children and families with children with autism

Methods:

This data comes from a larger research effort examining leisure satisfaction and participation in families with and without a child with autism. As a part of the present analysis, 233 parents (111 with a child with autism, 122 with a typically developing child) responded to an online Qualtrics survey providing data on the following variables: Family Adaptability and Cohesion Scales (FACES-IV)(Olson, Gorall, &Tiesel 2004), The Depression-Short Form from the Neuro-QOL Item Bank v1.0 (Cella et al. 2012), and Neuro-QOL Item Bank v1.0 – Positive Affect and Well-Being – Short Form (Cella et al. 2012). Regression-based moderation analyses were used to examine if group (parent with or without a child with ASD) moderated the relationships between reported enmeshment and rigidity, and outcomes (reported happiness and depression).

Results:

Parents of children with ASD reported more enmeshment (t[233]=4.2, p<.01), and comparable rigidity (t[233]=1.0, p=.30) relative to families with typically developing children. Results from a moderation analysis found that parent reported family rigidity did not perform differently for families with typically developing children versus children with ASD for either parent reported symptoms of depression or positive affect and

well-being. However, family enmeshment performed differently in families with and without a child with ASD ($F[1,231]=7.1$, $p<.01$). Increased enmeshment was associated with decreased parental happiness in families with typically developing children ($\beta=-.31$, $p<.01$). For these families, for every one SD increase in reported enmeshment, there was a corresponding .31 SD reduction in reported positive affect and well-being. Contrastingly, increased enmeshment did not affect parent reported happiness ($\beta=.04$, $p=.63$) in families with a child with ASD.

Conclusions:

It may be that high levels of enmeshment are necessary for supporting a child with ASD (e.g., increased time spent in attendance and coordination of therapeutic appointments, learning child's specific likes and dislikes, time spent supporting child during daily life) and are not signs of dysfunction in this population. This finding dovetails with previous work, and suggests that ideal family dynamics may be different for typically developing children versus families with a child with ASD.

209 **172.209** Protecting Myself and My Child: A Grounded Theory of Parents' Journey through Diagnostic Feedback for Autism

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Background: The diagnostic feedback meeting represents the first time that parents hear the news that their child has autism. Given the essentially unanimous agreement around the significance of this event, surprisingly little of substance has been said about it in the clinical and empirical literature.

Objectives: In this project, we developed a social-psychological conceptualization of parents' journey through this pivotal period. This conceptualization addressed three interrelated questions: How are parents responding? Why are they responding this way? When do they respond differently?

Methods: Our work was guided by the methodology of grounded theory and the onto-epistemological lens of critical realism. We generated data from in-depth interviews with 27 parents of children (ages 1-10) who were recently diagnosed with autism at a clinic in Ontario, Canada.

Results: The central process, labelled *protecting myself and my child,* indicated that parents rapidly make meaning of, feel, think, and respond to the delivery of the diagnosis as signalling a hazard from which they must protect their family. Primary categories of action-interaction consisted of an *undercurrent of anticipating* in the lead-up to the feedback meeting, *sounding the alarm* when hearing the official pronouncement, followed by *swelling distress and uncertainty*. Depending on a complex interplay of conditions, parents dealt with their situation in three ways: *protective maneuvering, instrumental responding,* and/or *processing-oriented advancing,* which, in turn, affected their swell of distress and uncertainty.

Conclusions: These findings can help clinicians and service providers to think deeply about their role and how they can best use their expertise to facilitate parents' journey through what is, primarily, an emotional process.

210 **172.210** Public Health, School, and Recreational Barriers That Parents Have to Face in Rosario, Argentina

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Background: Research in the field of Autism Spectrum Disorder (ASD) is not vast in Argentina, and among the available investigations, very few consider parents perspectives. However, during consultations it is very common to hear about the issues that caregivers have to struggle with. Some of the most common complaints are related to complications accessing public health services, difficulties with schools, and the pediatricians' responses when they first consulted about diagnostic concerns.

Objectives: To gather information about the barriers that parents of people with ASD have to face concerning public health, educational and recreational services. In addition, to identify the knowledge that pediatricians have regarding autism, and diagnostic tools.

Methods: Two exploratory studies were conducted in Rosario, Argentina. In the first one, 97 parents of people with ASD (ages between 22 and 56; 70.1% female, and 29.9% male) were consulted about the barriers they had to face regarding public health, schools, and leisure and recreational spaces. In the second one, 20 pediatricians (ages between 28 and 62; 85% male, and 15% female) were asked about the screening and diagnostic tools they know and/or they use in their practices, diagnostic criteria, causes, and characteristic symptoms of ASD.

Results: More than half of the parents had to go through some difficulties. Almost 60% stated that they had issues at some point: the main problem (over 50% of the cases) seems to be related to schools; the most significant findings after that were problems with hospitals and public health care centers (41.5%), issues with the public disability evaluation boards (22%), and conflicts at municipal recreational spaces (9.8%). Additionally, a low level of ASD-related-knowledge was found among pediatricians. Most of the consulted doctors (80%) were not familiar with the diagnostic criteria, and/or the screening and diagnostic assessments, and only 5% think an interconsultation is necessary in case of diagnostic suspicion.

Conclusions: As a first approach to the subject, it is possible to state that aside from the difficulties of raising a child with ASD, parents also have to overcome other barriers, including the lack of knowledge pediatricians have (that leads to wasting valuable time), and struggling with public health services and schools. Although the reaches of these studies are limited, and they should be replicated with more meaningful samples, the results allow us to consider the situation, and the need of public policies regarding autism.

211 **172.211** Qualitative Parent Outcomes of an Introductory Pivotal Response Treatment Parent Education Program for ASD

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Background: Families whose child has recently received a diagnosis of autism spectrum disorder (ASD) are a unique population in need of specialized support and guidance. These parents frequently experience feelings of stress, fear, and uncertainty, which are often related to concerns about how to address their child's social communication and behavioral needs. Further, parent goals and values are not often solicited and incorporated into early intervention programs. Pivotal Response Treatment (PRT) is a widely used evidence-based practice for ASD that parents are often taught to implement with their child. However, PRT education alone may not be enough to address the complex needs and multiple areas of concern these parents tend to report. Positive Behavior Support (PBS) is another gold standard for how to support families of children with ASD. What is not evident in the literature, however, is a clearly delineated process for how PRT parent education could be

implemented within the context of a PBS plan to address social communication and behavioral goals in a comprehensive way. Further, there is limited information on the outcomes and experiences of parents receiving these types of early intervention services.
Objectives: The aim of the current study was to provide an in-depth understanding of parent experiences participating in a brief PRT education program delivered within the context of an individualized PBS plan. The objective was to collect qualitative interview data to supplement, triangulate, and elaborate upon quantitative measures.

Methods: Four parents whose young child had recently received a diagnosis of ASD received 20 hours across five days of PRT education within the context of an individualized PBS program. Parents received instruction in PRT and specific evidence-based strategies for addressing their reported goals for themselves and their child. Parents completed semi-structured interviews following the completion of the program. Using open-coding thematic analysis, interview transcripts were coded to identify commons themes and patterns in responses.

Results: Five main themes emerged from the interviews: 1) increase in parent self-efficacy, 2) effectiveness of approaches, 3) ease of implementation, 4) reduction (but not amelioration) of stress, and 5) minimal changes to the program. Following the parent education program, all parents reported an increase in confidence and competence with interacting with their child, which was conceptualized as 'self-efficacy'. All parents reported that intervention strategies were effective and easy to implement. Parents reported reduced stress following the program but also reported concerns about future stressors, such as transitions in schooling. Further, parents reported minimal and superficial changes to the program.

Conclusions: The current study addresses an important issue in early intervention by providing a thorough examination of treatment outcomes for parents whose child has a recent ASD diagnosis. It appears that a short-term parent education program in PRT individualized to reflect parent goals and values can promote well-being for families. This study also provides detailed evidence that parents find this type of program to be helpful for improving their self-efficacy and empowering them to support their child.

212 **172.212** Developing a Participatory Mentorship Program for and with Autistic College Students: Project Reach@CSI

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Background: Autistic students are increasingly entering college, where they face difficulties self-advocating, self-regulating, developing social relationships, and managing time (Gelbar et al., 2014; Elias & White, 2017). Autistic students often have strengths they can use to overcome challenges, including systemizing skills, detail orientation, sincerity, and focus (Gobbo & Shmulsky, 2015). While autistic students are *less* likely to enroll in college than students with most other disabilities (Shattuck et al., 2017), they may be *more* likely to *persist* in college (Wei et al., 2013). However, very little remains known about factors that support their *success* in college. Supports for autistic college students are often neither evidence-based nor informed by their perspectives (Barnhill, 2016). Although promising reports about programs for autistic students have emerged (Kudder & Accardo, 2018), prior research, including our work examining earlier iterations of our program (Gillespie-Lynch et al., 2017), has *not* examined academic improvements associated with programming or provided sufficient opportunities for autistic students to develop self-advocacy skills by guiding program development.
Objectives: Evaluate a *participatory* mentorship program in which neurodivergent students play leadership roles in developing, delivering, and evaluating programming.

Methods: Our program is designed for autistic students but open to other neurodiverse students. Programming is free for students who can consent to complete assessments (e.g., interviews, standardized assessments and writing activities) for gift cards, but are under no obligation to provide data to participate. Students choose to attend an hour per week of one-on-one mentorship, structured group meetings, or both (recommended). Although our goal since program inception in 2013 was for it to be participatory, becoming truly participatory took time. The current study focuses on data collected *after* our most recent program evaluation in Summer 2015 (Hotez et al., 2018). Thirteen students with disabilities (11 autistic) have become mentors thus far. In Fall 2016, we formed a participatory research group to guide assessment/curriculum development.

Results: Of the 46 students who signed consents since Fall 2015, 38 were autistic (the focus of analyses; 92% Male; 61% White; *M* NVIQ = 96; *M* SRS-A = 69.87). Two autistic students did not continue past pre-tests. Students averaged 20.4 years when joining REACH; 93% continued for a year or more. Group curriculum is selected/developed based on individual computerized needs assessments and group discussions at the beginning of each term (see Table 1 for student-identified needs). Analysis of GPA changes associated with joining REACH revealed that the GPA of students who had been in college before joining REACH improved from the semester before (*M*=2.80) to the semester they joined (*M* = 3.10; *p* = .02); students enrolled in REACH attained higher GPAs than college norms their first semester in REACH (*p* = .04). Qualitative analysis of interviews and weekly mentor logs highlight empowering aspects of our participatory model.

Conclusions: By collaborating with autistic students, we have developed increasingly socially valid and engaging programming; students have gained valuable skills as mentors, researchers, and speakers on campus and at local and international conferences. Programming for autistic college students should build from their strengths.

213 **172.213** Determining Impact of Fellowship Grants in Autism Research

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Background:
Autism advocacy organizations have funded millions of dollars in pre- and post-doctoral fellowship programs that train emerging talents in autism science. Yet, there is little data on the short and long-term impact of these investments. Utilizing a logic-model framework two non-profit organizations separately examined the impact of their funding on a range of indicators relevant to scientific output, innovation, and career trajectory.

Objectives:

We conducted the first multi-year follow-up analysis of pre-doctoral and post-doctoral fellowship funding two autism research funding advocacy organizations to identify scientific and career impact of specific autism funding.

Methods:

Guided by a logic model approach to understanding impact of grant funding, the organizations implemented slightly different evaluation methodologies. Organization A tracked pre- and post-doctoral fellows and unfunded applicants outputs for a 4-year period and impact was measured through qualitative and quantitative metrics, and bibliometric analyses. Organization B assessed outcome of pre-doctoral fellowships for up to 9 years following funding. Both organizations utilized HRA reporter, powered by UberResearch's flagship offering 'Dimensions', to track bibliometric impact and altimetric data. Other resources like PubMed data base, as well as professional networking data such as LinkedIn, ResearchGate, telephone interviews and other queries were used to document career trajectories of the funded fellows. Multiple outcomes were assessed related to scientific productivity, impact, and career trajectory, including reporting of retention in autism research, collaborations, careers in science, as well as quantitative measures of productivity including number of publications, citation index, collaborators, altimetric scores and attainment of additional funding.

Results:

Both organizations showed a similar 80% retention in autism research from funded fellows. Organization A estimated the impact of its fellowship by comparing data for funded fellows to those of fellows that were rejected. The retention rate in autism research for fellows funded was 80% whereas only 30% of non-funded fellows. Most funded pre-doctoral fellows were pursuing post-doctoral studies. Post-doctoral fellows had higher number of publications compared to pre-doctoral fellows. Both funded and unfunded fellows showed similar numbers of publications and impact factors for those publications, indicating that success in autism research, not scientific endeavors in general, were improved by autism-specific funding. For Organization B, the funded fellows brought $4 in form of funding from federal, state, and non-profit funding for every $1 invested towards fellowship support. Further the publications from fellows had an average citation rate of 27 per paper with a relative citation ratio of 2.6.

Conclusions:

Advocacy organizations should continue to support early career investigators, as the return on investment is high and most fellows remain engaged in autism research with a high volume of quality output. This combined analysis provides objective evidence of the value of fellowships on retention in autism research, and further demonstrates the utility of different outputs in determining the effectiveness of fellowship mechanisms.

214 **172.214** "Our Relationship Has Matured": Improving Parental Relationships through Specialist Peer Mentoring for Autistic University Students

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Background:

The lifelong nature of autism spectrum disorders has implications for autistic people and their families, with many parents continuing to support to their children well into adulthood. Transitioning to adult roles, such as that of a university student, can be challenging for both autistic young adults and their parents. Specialist peer mentoring (SPM) has been proposed as one approach, which may be effective in mitigating the challenges of transitioning to university for autistic young adults.

Objectives:

This study aimed to explore the experiences and perceptions of parents of autistic young adults who participated in a SPM designed to support the transition to university.

Methods:

A total of 13 semi-structured interviews (11 mothers and two fathers) were completed. Parents were discussing the experiences of 12 specialist peer mentored autistic university students (average age=21.2; SD=1.94; 2 female). The interviews were transcribed verbatim and analysed in three stages commencing with identification of meaning units, followed by thematic analysis and directed content analysis, which linked data to the International Classification of Functioning, Disability and Health comprehensive core set for autism spectrum disorder (ICF core set for ASD).

Results:

A total of 284 meaning units were identified from the data. Five inter-related themes emerged; *the mentoring relationship is a facilitator*, *developing skills for university*, *mentoring changes lives*, *mentoring is not a substitute for other supports* and *'university' is an emotional rollercoaster*. *The mentoring relationship is a facilitator* articulated the interaction within the mentor-mentee dyad, which served as the key mechanism supporting outcomes. *Developing skills for university* captured the emergence of autistic students study skills including improvements in planning and completing tasks. *Mentoring changes lives* described parents' experience of the SPM as a transformative intervention, which resulted in improvements in the parent-child relationship. While parents valued the SPM the theme, *Mentoring is not a substitute for other supports* captured parents view that mentoring did not solve everything. *University is an emotional rollercoaster* highlighted that for parents supporting their autistic young adults was a challenging and emotional journey.

The 284 meaning units were linked with Body Function (18%), Activity and Participation (43%), Environment (31%) and Personal Factors (6%) domains within the ICF core set for ASD (2% not coded).

Conclusions:

SPM was valued by parents who attributed their improving relationship with their autistic young adult to the intervention. Linking to the ICF core set for ASD revealed that from the parents' perspective the SPM program worked to target 'the fit' between participation in university and the environment for autistic young adults. This study highlights the importance of considering and developing intervention, which target aspects of the environment in improving the life outcome of autistic young adults.

215 **172.215** Reliability and Factor Structure of the Parent Effort Scale Home Version (PES-H)

B. Pfeiffer *and K. Bevans, Rehabilitation Sciences, Temple University, Philadelphia, PA*

Background: The ability to participate in common daily activities can have a profound impact on the development of young children. Participation occurs most extensively within the context of the family. Both the child and family respond to participation restrictions through an interactional relationship in which parents provide supports to facilitate participation resulting in various amounts of parental effort. Although all parents describe effort required to support participation, research with families of children with Autism Spectrum Disorders (ASD) have described high levels of parental effort to accommodate their child's special needs[1-2]. There are few if any instruments that consider the impact of parent effort on child participation and none specifically for parents of children with ASD. The Parent Effort Scale – Home Version (PES-H) was developed to fill this need, although requires further psychometric examination.

Objectives: The purpose of this study was to examine internal consistency, factor structure, test-retest reliability, and scale distribution of the PES-H in children between the ages of 3 and 5. Additionally, this study examined differences in parental effort between children with and without Autism Spectrum Disorders.

Methods: A cross sectional design was used to collect data for psychometric analyses. Participants were 304 parents of children with and without ASD between the ages of 3 and 5 years old. Recruitment occurred nationally through social media, ASD community groups, private preschools, and school districts. Participants completed the PES-H, the Gilliam Autism Rating Scale to confirm ASD diagnosis, and a demographic questionnaire either through Qualtrics Survey software. All data was downloaded or inputted into excel and converted for STATA prior to analysis. One hundred and twenty-eight of the participants completed the PES-H two weeks later to evaluate test re-test reliability. Cronbach's alpha was used to calculate internal consistency and intraclass correlation coefficients to calculate test re-test reliability (n=304)[3]. A confirmatory factor analysis to evaluate the model fit was completed using Stata software. The frequency of response options was calculated to examine scale distribution. A Cohen's d effect size estimate was used to examine known group comparisons between scores of parent's rating of children with (n=176) and without ASD (n=137)[3].

Results: Confirmatory factor analysis identified the best fit as a four-factor model (CFI = 0.99, TLI = 0.99, RMSEA = 0.09). The four factors represented dressing, hygiene, sleep and social scales based on item content. Internal consistency was high for all four scales with Cronbach's alpha ranging between .61 to .73 and very high for the total scale at .78. Total test-retest reliability was moderate for all items and scales (*ICC* = .51-.71). The PES-H had reasonable distributions for the whole sample. Negative effect sizes on Cohen's d also indicated that parents of children with ASD when compared to children without ASD had higher effort scores on all subscales and the total scale.

Conclusions: The results of this study identify the underlying factor structure and provide initial reliability for a unique measure to assess parent effort to support participation in the community for young children with and without ASD.

Poster Session
173 - Molecular Neuroscience
11:30 AM - 1:30 PM - Room: 710

216 **173.216** Alteration of Mitochondrial Morphology and Function in Juvenile Rats Exposed to Maternal Immune Activation

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Background: Maternal infection is a profound risk factor for neuropsychiatric disorders, including autism, schizophrenia and bipolar disorder. Studies on animal models indicate that maternal immune activation (MIA) may lead to neurochemical and behavioral abnormalities in the offspring. Additionally, mitochondrial dysfunction has been proposed as a major consequence of MIA, and may represent a critical link between neuronal dysfunction and behavioral phenotypes observed in the adult offspring.

Objectives: Here, we analyze the effect of MIA on the morphological abnormalities and alteration of mitochondrial function in rat offspring.

Methods: MIA was evoked by single intraperitoneal (i.p.) injection of lipopolysaccharide (LPS) (100 µg/kg) to pregnant rats at embryonic day 9.5. Hippocampus and brain cortex of juvenile (on 52-53 post-natal day) male rat offspring were analyzed. Molecular biology, biochemistry and transmission electron microscopy were used in the research

Results: We demonstrated that MIA evoked changes in brain morphology, especially in ultrastructure of mitochondria: we observed fragmented cristae with evidence of an expanded matrix compartment or disrupted membrane in both cerebral cortex and hippocampus of juvenile rat offspring. These alterations were accompanied by reduced mitochondrial membrane potentials and enhanced oxidative stress, measured by glutathione levels. The data presented changes in expression of electron transport chain (ETC) complexes. In the cerebral cortex of MIA rats the expression of complex I subunit (*mt-Nd1*), complex III subunit (*mt-Cyb*) and complex IV subunit (*mt-Co1*) was decreased, however in hippocampus only *mt-Co1* was reduced. We also demonstrated that MIA altered transcription of proteins regulating mitochondrial fusion-fission. The reduced level of mitofusin 1 (*Mfn1*) and mitofusin 2 (*Mfn2*), with concomitant elevation of dynamin related protein 1 (*Drp1*) was observed in the cortex, whereas the mitochondrial fission 1 (*Fis1*) expression was altered only in hippocampus of MIA rats. Moreover, we showed down-regulation of transcription factors responsible for mitochondrial biogenesis: Pgc1α (*Ppargc*) in cerebral cortex and *Tfam* in both cerebral cortex and hippocampus of juvenile MIA offspring were reduced.

Conclusions: The observed changes in mitochondrial ultrastructure, function and gene expression of main proteins regulating mitochondrial dynamics/biogenesis and ETC subunits may help in understanding their role in synaptic stress. These findings may contribute to a potential point for novel therapeutic strategies for inflammation-related pathology in neurodevelopmental and neuropsychiatric disorders through the protection of synaptic transmission by targeting mitochondrial deficits. Future work will need to explore associations with behaviors, the impact of interventions, and the correlates in clinical populations.

Supported by the NCN Grant (2016/23/D/NZ4/03572)

217 **173.217** Altered Expression of Cadherins Suggests Their Potential Roles in Brain Development and Autism

***J. A. Frei**, R. F. Niescier, J. E. Nestor, M. W. Nestor, G. J. Blatt and Y. C. Lin, Hussman Institute for Autism, Baltimore, MD*

Background:
Multiple members of the cadherin superfamily have been strongly implicated in autism. The cadherin superfamily contains more than one hundred cell adhesion molecules. A genome wide association study identified the classical type II cadherin CDH8 and CDH11, the protocadherin PCDH9, and the atypical cadherin FAT1 as candidate risk genes. This suggests that cadherin signaling pathways could be disrupted and may display increased vulnerability in autism.

Objectives:

We first determined the expression of autism risk cadherins CDH8, CDH11, PCDH9 and FAT1 in iPSC-derived cortical neurons from control and autism individuals to evaluate whether cadherin levels are commonly altered in autism. We then investigated the expression patterns of cadherins in developing mouse brains and in primary neurons at the subcellular level. Functional effects of cadherins on dendrite arborization were further examined. This study provides novel insights into common and distinct functions of different cadherins in neural circuit formation and the implication in autism.

Methods:

Western blot analyses were performed to evaluate the protein expression of CDH8, CDH11, PCDH9 and FAT1 in iPSC-derived cortical neurons, the developing mouse tissues from different brain areas as well as primary neurons. Subcellular localization as well as enrichment of cadherins in synaptic plasma membrane and postsynaptic densities were further analyzed using a synaptic fractionation assay and immunocytochemical labeling with neuronal marker MAP2 or synaptic markers PSD95, Synapsin 1 and GAT1. Sholl analysis was performed to measure the effect of cadherin knockdown on the complexity of dendritic arbors.

Results:

We found altered cadherin expression levels in iPSC-derived cortical neurons with an increase of CDH8 and a decrease of CDH11. Similar findings were observed in brains of CDH11 knockout mice. Temporal expression analysis in the developing mouse brains revealed increased expression of all cadherins examined at P7 and P14. Analysis of specific brain areas showed that CDH8, CDH11 and PCDH9 were prominently expressed in the cortex, hippocampus and thalamus/striatum whereas FAT1 expression was restricted to the cerebellum. CDH8, CDH11 and FAT1 localized to MAP2-positive dendrites and were enriched in synaptic plasma membrane and post-synaptic density. Moreover, CDH8 and CDH11 were associated with excitatory and inhibitory synaptic markers. Sholl analysis of hippocampal neurons revealed opposing effects on dendrite arborization after loss of CDH8 and CDH11 compared to PCDH9.

Conclusions:

The present study suggests altered expression profiles of cadherins in autism brains, thus strengthening the hypothesis of a central role of cadherins in autism. The findings presented here highlight that cadherins of different subfamilies are expressed in a developmental time window and in vulnerable brain areas implicated in autism. Taken together, by focusing on cadherins across different subfamilies, this study elucidates the role of different cadherin classes in the neurodevelopment of autism, both in animal models and in individuals with the condition.

218 **173.218** Autism-Associated CHD8 Deficiency Impairs Axon Development and Migration of Cortical Neurons

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Background: Mutations in *CHD8*, chromodomain helicase DNA-binding protein 8, are among the most replicated and common findings in genetic studies of autism spectrum disorder (ASD). The CHD8 protein is believed to act as a transcriptional regulator by remodeling chromatin structure and recruiting histone H1 to target genes. The mechanism by which deficiency of CHD8 causes ASD has not been fully elucidated.
Objectives: To reveal the expression pattern and important roles of Chd8 in mouse developing brain.

Methods: We examined the expression of *CHD8* in human and mouse brains using both immunohistochemistry and RNA in situ hybridization. We performed in utero electroporation, neuronal culture, and biochemical analysis using RNAi to examine the functional consequences of *CHD8* deficiency.

Results: We discovered that CHD8 is expressed highly in neurons and at low levels in glia cells in both humans and mice. Specifically, CHD8 is localized predominately in the nucleus of both MAP2 and parvalbumin positive neurons. In the developing mouse brain, expression of *Chd8* peaks from E16 to E18 and then decreases significantly at P14 to adulthood. Knockdown of *Chd8* results in the reduction of axon and dendritic growth, disruption of axon projections to the contralateral cortex, and delayed neuronal migration at E18.5 which is recovered by P3 and P7.

Conclusions: Our findings indicate an important role for CHD8 in dendritic and axon development and neuronal migration, and thus offer novel insights to further dissect the underlying molecular and circuit mechanisms of ASD caused by CHD8 deficiency.

219 **173.219** Convergence of Causal Paths across Epigenetic Regulators in ASD

***C. P. Dotter** and G. Novarino, IST Austria, Klosterneuburg, Austria*

Background: Autism spectrum disorders (ASD) are a range of neurodevelopmental disorders affecting 1 in 59 children in the US. A large number of risk genes have been identified by whole exome sequencing studies of patients. Previous studies provided evidence for both common themes in idiopathic ASD as well as common pathways affected by ASD risk genes, giving rise to the concept of convergence across different genetic etiologies. This concept states that different causes, such as mutations at the DNA level converge onto similar changes along the causal path from mutation to phenotype, for example at the level of transcriptional regulation.
Objectives: The aim of this study is to provide evidence for convergence across multiple ASD risk genes associated with chromatin regulation, as this process has been implicated to play an important role in the pathogenesis of ASD. For this reason we study the molecular consequences for neurodevelopment of heterozygous mutations in these genes using cortical spheroids derived from genetically modified human embryonic stem

cells (hESCs) as an *in vitro* human model system.

Methods: Heterozygous mutant hESC lines were established by insertion of a GFP cassette on one allele using CRISPR/Cas9 and the use of a FACS based selection strategy. Multiple independent clones were generated per gene and verified by PCR and Southern Blot including off-target effects. We then used both wild type and mutant hESC to generate cortical spheroids and study the transcriptomic and epigenomic consequences through RNA- and ATAC-seq at different stages of development, starting with the stem cell state.

Results: We successfully generated and verified clones for five genes (KDM5B, SETD5, CHD8, KMT5B and ASH1L). Sequencing showed correct insertion and an intact wild type allele, Southern blot and PCR confirmed the absence of random integrations and off-target effects. Cortical spheroids were generated and showed the expected cell-types across differentiation. RNA-sequencing and ATAC-seq of hESC and cortical spheroids are ongoing at the time of abstract submission.

Conclusions: The genetic heterogeneity present in ASD hinders the progress in understanding the underlying pathogenic mechanisms. Convergence across causal paths in the pathogenesis of the disorder is a useful paradigm to narrow down the list of possible causative mechanisms. The focus on common downstream effects of mutations in different risk genes allows the delineation of the processes important for ASD pathogenesis from confounding coincidental effects. This might ultimately lead to a way to develop common treatments for patients with mutations in different genes.

220 **173.220** Exploring the Neurodevelopmental Bases of DDX3X Syndrome

D. Ung[1,2,3], *A. Boitnott*[1,2,3], *D. Mendonca*[1,2,3], *K. Niblo*[1,2] *and S. De Rubeis*[1,2,3], *(1)Seaver Autism Center for Research and Treatment, Icahn School of Medicine at Mount Sinai, New York, NY, (2)Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (3)Mindich Child Health and Development Institute, Icahn School of Medicine at Mount Sinai, New York, NY*

Background:
DDX3X syndrome is a recently identified rare genetic disorder associated with autism spectrum disorder (ASD) and intellectual disability (ID). Affected individuals present with ID, behavioral problems including ASD, low body weight, movement disorder, hypotonia and brain anomalies such as cortical malformations. DDX3X syndrome is caused by mutations in the X-linked gene *DDX3X* and most patients are females with *de novo* mutations. DDX3X is a RNA helicase and it has been studied in non-neuronal cells, where it has been found to regulate mRNA translation. Local mRNA translation at synapses is essential for learning and memory and is altered in mouse models for ASD and/ID. To date, the exact functions of DDX3X in neurons and at synapses are poorly known.

Objectives: The objective of the study is to understanding the molecular and cellular functions of DDX3X during neurodevelopment, particularly corticogenesis and synaptogenesis.

Methods:

We have generated a novel conditional knockout mouse recapitulating DDX3X deficiency. To study the effect of DDX3X deficiency on corticogenesis, we study cortical lamination with layer-specific markers. To dissect the molecular complexes and mechanisms mediating DDX3X-dependent translation, we apply biochemical methods to purified synapses (synaptosomes) from mouse cortices.To study synaptogenesis, we use the novel mouse model we have generated to assess synapse morphology and density in single-embryo mouse neuronal cultures modeling the genetics of DDX3X syndrome.

Results: We found that *Ddx3x*null male mice (Ddx3x$^{-/y}$) die *in utero*, compatible with the dearth of boys affected by DDX3X syndrome. *Ddx3x*-deficient females (*Ddx3x*$^{+/-}$) are viable and have reduced DDX3X protein expression in the cortex compared to control littermate. DDX3X is expressed at synapses from cortex at a critical window for synaptogenesis and expression is sex-specific. DDX3X is also expressed in glutamatergic projection neurons in the developing cortex and we are beginning to characterize cortical connections in *Ddx3x*-deficient mice.

Conclusions:

We have generated a mouse model with construct validity for DDX3X syndrome that shows initial evidence for face validity. We are using this model to understand the molecular and cellular neurobiology underlying DDX3X syndrome.

221 **173.221** Gabaergic Interneuron Cell Loss in Mice Lacking Autism-Associated Gene Slit3

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Background: Altered neuronal connectivity reported in Autism Spectrum Disorder (ASD) leads to alterations in brain function and multisensory integration. Human studies reported that SLIT3, an axon guidance molecule, may be associated with neurological conditions, such as major depressive disorder, schizophrenia and ASD. SLIT proteins bind to the receptor Roundabout (ROBO) and have a role in axon guidance, cell migration, cell proliferation and differentiation of various cell types during embryogenesis. Taken together, these findings suggest that Slit3 may be an attractive candidate to analyze altered neuronal connectivity in ASD.
Objectives: The purpose of the current study is to investigate how Slit3 mutation affects neuronal connectivity in ASD. Since SLIT3 is involved in cell migration, we hypothesized that during brain development the migration of GABAergic interneurons is affected by the loss of SLIT3 gene, leading to alterations in the Excitation/Inhibition (E/I) balance, as seen in ASD.

Methods: Slit3 mutant mice were crossed with either GAD (Glutamate decarboxylase) 65 or GAD67-GFP (Green Fibrillary Protein) mouse lines to study GABAergic interneurons in different key areas of the brain affected in ASD. Inserting these GAD knock-in mouse lines within the Slit3 knock-out mouse line allows for reliable tracking of specific cell populations to investigate the contribution of Slit3 toward GABAergic interneuron migration.

Results: Analysis of the Slit3 mutant mice crossed with either GAD65-GFP or GAD67-GFP mouse lines revealed a reduced number of GABAergic interneurons in the cortex, hippocampus, reticular thalamic nucleus and cerebellum in Slit3 knockout (KO) adult mice compared to SLIT3 wild type (WT) mice. This cell reduction in GABAergic interneurons was seen early during brain development suggesting that the loss of SLIT3 gene affects either the production, proliferation or migration of GABAergic interneurons. When we analyzed the different populations of GABAergic interneurons our results showed that Parvalbumin interneuron number was reduced in Slit3 KO mice cortex, hippocampus, reticular thalamic

nucleus and cerebellum (KO, n= 14, WT, n=15), whereas Calretinin and Calbindin interneurons were not affected, suggesting that SLIT3 gene loss affects only the fast spiking-PV population.

Conclusions: Interneurons are known to synchronize neuronal activity and this synchronization is essential for cortical network function. Our results show a loss of GABAergic interneurons, especially the fast spiking-PV population, in mice lacking autism-associated gene Slit3. These findings reveal the importance of Slit3, an axon guidance molecule, in the formation of GABAergic neuronal networks and provide insight into the molecular pathways that may lead to altered neuronal connectivity in ASD.

222 **173.222** Implication of the Oxytocin System in Shank3-Deficiency

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Background:

Social deficits are a core symptom of autism spectrum disorder (ASD). To date, behavioral therapies are the first line of intervention for treating impaired social behaviors, whereas pharmacological treatments have been ineffective at addressing this symptom domain. To inform treatment targets, there is an urgent need to understand the pathophysiology underlying social deficits. The hypothalamic oxytocin system is a key modulator of social behavior that is well conserved across species. Despite the wealth of behavioral and pharmacological studies implicating oxytocin in social behavior, and the increased interest in oxytocin as a therapeutic in ASD, little is known about the effect of ASD-associated mutations, such as *SHANK3*, on the oxytocin system. Moreover, it is unclear whether impairments in the oxytocin system underlie social deficits in some forms of ASD. We have recently demonstrated attentional, social recognition memory, and synaptic plasticity deficits in a rat model carrying a S*hank3* mutation: the *Shank3*-deficient rat. We showed that both behavioral and synaptic plasticity deficits in this model are reversed by oxytocin. In this project, we study the effect of a *Shank3* mutation on the neural oxytocin system.

Objectives:

The objectives of our study are to understand if a *Shank3* mutation imposes a deleterious effect on (1) the hypothalamic oxytocin system in the paraventricular nucleus where oxytocin is produced and released and (2) the social recognition memory circuit that comprises brain regions targeted by the paraventricular nucleus. Further, we aim to examine the causality between alterations in the oxytocin system and the social recognition memory deficits that we have reported in the *Shank3*-deficient rat model.

Methods:

We are leveraging the *Shank3*-deficient rat model to explore the effect of the *Shank3* mutation on the neural oxytocin circuitry. Techniques include: immunohistochemistry to study the effect of the *Shank3* mutation on the morphology of oxytocin neurons, brain microdialysis to assess oxytocin levels during social behavior, fiber photometry to record neural activity of oxytocin neurons during social interaction, and chemogenetic tools to manipulate the oxytocin neural population in vivo and test the causality between social behavior deficits and alterations in the oxytocin system in *Shank3*-deficient rats.

Results:

Our preliminary findings show increased oxytocin immunoreactivity in oxytocin neurons within the paraventricular nucleus of *Shank3*-deficient rats, suggesting an accumulation of the oxytocin peptide due to impaired secretion. Furthermore, we observe diminished photometry signals in the PVN during social interaction, suggesting impaired neural activity of PVN neurons.

Conclusions:

Our findings suggest that *Shank3* mutations impact the oxytocin system by altering neural activity of oxytocin neurons and the release and oxytocin. These variations may underlie the social recognition memory deficits that we have previously reported in the *Shank3*-deficient rat model.

223 **173.223** Investigating the Role of NRXN1 in Autism Using iPSC-Derived Neurons

A. T. Massrali[1], *A. Paul*[2], *L. Dutan Polit*[3], *S. Baron-Cohen*[4], *M. R. Kotter*[5] *and N. J. Gatford*[6], *(1)Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (2)Department of Psychiatry, Autism Research Centre, Cambridge, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (5)Department of Clinical Neurosciences, Wellcome Trust-MRC Stem Cell Institute, University of Cambridge, Cambridge, United Kingdom, (6)Department of Basic and Clinical Neuroscience, Institute of Psychiatry, Psychology, and Neuroscience, King's College London, London, United Kingdom*

Background: Hundreds of genes contribute to autism likelihood. Of particular interest are mutations in genes encoding trans-synaptic signalling molecules, such as neurexins and their binding partners which have been implicated in autism. The Neurexin-1 gene (NRXN1) encodes for the presynaptic adhesion molecule neurexin-1, which binds to postsynaptic cell-adhesion molecules. While the role of NRXN1 has been established in regulating typical synaptic function and physiology, the role of its different isoforms and their contribution to the aetiology of autism is only now emerging and our knowledge remains patchy.

Objectives: Introduce the optimised inducible transgene (NGN2) over-expression for forward programming patient derived-iPSC lines and isogenic NRXN1-KO lines to investigate neuronal phenotypes, synaptic and functional changes caused by NRXN1 mutations

Methods: We generated iPSC-lines derived from individuals with autism carrying mutations in *NRXN1*-α (n= 2, 1 male, 1 female) and healthy controls (n=2, 1 male, 1 female (carrier))and 2 isogenic pair of iPSCs using eSpCAS9 to create NRXN1 knock-out via non-homologous end-joining. We aimed to target exon 4-5 (for NRXN1-α / KO) and exon 19 (shared by both isoforms). We systematically optimised inducible transgene over-expression (OPTi-OX) in the generated lines using a dual genomic safe harbour gene-targeting strategy to overcome silencing of transgenes and allow forward programming of iPSCs into mature functional neurons. We then examined the effect of those mutations on gene expression levels and protein using synaptic genes-specific primers and western blot antibodies. We also investigated neuron morphology using a combination of

live cell imagine and immunocytochemistry for synaptic protein markers. Neuronal synaptic activity was recorded using multi-electrode array (MEA) as well as calcium imaging.

Results: The neurons reprogrammed from the generated patient-derived lines as well as the isogenic pair showed high expression of MAP2, SYN1, VGLUT1 and other neuronal markers. Q-PCR show varied expression levels of NRXN and NRXN associated genes in the autism and control lines:while the mutation lies in the NRXN1-α it not only affected this isoform, but also affected NRXN1-bas well as CASK. The neurons were then tested for electrophysiological properties using multi-electrode array.

Conclusions: We have successfully developed a highly consistent and efficient human cell model to study NRXN1 defects in the induced neurons. This model shows accelerated generation of excitatory neurons that express pan-neuronal and glutamatergic markers. The multielectrode array recordings show that those neurons are electrophysiologically functional with synchronised firing starting at Day 21 as compared to Day 100 using traditional differentiation methods.

Poster Session
174 - Neuroimaging
11:30 AM - 1:30 PM - Room: 710

224 **174.224** Early (3–4 years) Brain Markers of Autism and Application of Machine Learning to Predict Future Diagnosis: A Feasibility Study Using Clinical Data

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Background: Most previous brain imaging studies in autism spectrum disorder (ASD) are based on children older than 6 years, well after the median age of ASD diagnosis (~52 months)[1]. The few studies that have used subjects less than age four years have investigated only a small subset of brain features[2]-[5]. As such, there is a significant knowledge gap of early ASD brain alterations. A comprehensive investigation of early brain markers is critical to identify the neuroanatomical underpinnings of ASD and may ultimately aid earlier diagnosis. Carrying out a prospective study to characterize early brain markers of ASD would be inordinately expensive. However, clinical brain images of patients who are later diagnosed with ASD are available in hospitals.
Objectives: We aim to identify pre-diagnosis brain alterations of ASD from images acquired as part of clinical care. We apply machine learning on brain morphometric features to predict future ASD diagnosis.

Methods: Brain MRI of 15 ASD male subjects of age three to four years and 18 age- and sex-matched non-ASD subjects were obtained from Geisinger Health System. ASD diagnosis status was based on ICD codes found on electronic health records. A comprehensive set of 687 brain morphometric features were extracted using Freesurfer[6]. ASD versus non-ASD prediction was performed using Random Forest[7]. Prediction accuracy and feature importance were evaluated using 5-fold cross-validation.

Results: Significant ($p<0.05$, uncorrected) ASD versus non-ASD brain differences are presented in Figure 1. We find that although total intracranial volume (TIV) in ASD was 5.5% larger, volumes of many brain areas (as a percentage of TIV) were smaller in ASD and can be partly attributed to larger (>10%) ventricles in ASD. TIV in ASD was correlated to surface area and cortical folding but not to cortical thickness. The correlation between total ventricular CSF and average cortical folding was 0.56 ($p=0.02$) for ASD, but was -0.13 ($p=0.6$) for non-ASD. Folding indices of 58 out of 68 cortices were higher in ASD in the frontal, temporal, cingulate, postcentral, and precuneus regions. White matter regions in ASD had less image intensity (predominantly in the frontal and temporal regions) suggesting myelination deficit.

We achieved 95% AUC for ASD vs. non-ASD prediction using all brain features. When prediction was performed separately for each brain feature type, image intensity yielded the highest predictive power (95% AUC), followed by cortical folding index (69%). The important prediction features for each feature types that yielded high AUCs are presented in Figure 2. The most important feature for prediction was white matter intensity surrounding the rostral middle frontal gyrus and was lower in ASD.

Conclusions: In addition to replicating previous findings, we report several novel brain morphometry differences in early ASD. The high degree of prediction success indicates that the application of machine learning methods on brain features holds promise for earlier identification of ASD, but this pilot study result needs to be replicated with a larger sample. To our knowledge this is the first study to leverage a clinical imaging archive to investigate early brain markers in ASD.

225 **174.225** Early Social Perception in Infants at Risk for ASD Using Functional Near-Infrared Spectroscopy (fNIRS)

***F. Zhang** and H. Roeyers, Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium*

Background: Converging evidence is implying that individuals with autism spectrum disorder (ASD) show atypical brain response to social stimuli at an early stage. However, the neural processing during early infancy in ASD has not been fully characterized. Studies of infants who are at substantially higher risk to develop ASD than the general population (HR), have the potential to clarify early functional manifestations of the brain for individuals with ASD.
Objectives: In this study, our aim was to find out whether cortical response to socially stimuli in HR infants differs from low risk (LR) controls by using fNIRS.

Methods: Until now, twenty 5-months-old infants participated in the fNIRS study; 4 of them were excluded because they failed to complete the whole study or made too much head movements.Finally, sixteen 5-months-old infants (n=8 for HR, n=8 for LR) were included for further analysis. Infants in the HR group had an older sibling with an ASD diagnosis or feeding problem or were premature babies. All subjects passively listened to a set of human vocal sounds (e.g., coughing and laughing) and familiar environmental sounds (e.g., rattles and car moving). fNIRS measurements were made using the NIRScout (NIRX, Germany/USA) device.

Results: The cortical activation by human sounds (i.e., the social task) relative to environmental sounds (i.e., the non-social task) was first

measured by paired-sample t-tests within each group, primarily using the changes of oxy-hemoglobin (HbO). For the LR group, we found a greater hemodynamic response to the social task (compared to the non-social task) in the bilateral temporal cortex, mainly located in the left posterior temporal region (channel 32: t (7) = - 3.26, p < 0.05, d = 1.36; channel 34: t (7) = - 2.67, p < 0.05,d = 1.06), and the right temporal region (channel 53: t (7) = - 3.32, p < 0.05, d = 1.37). By contrast, no channels showed significant activation for the social task compared to the non-social task in the high-risk group (p > 0.05 for all tests) after Bonferroni correction. To further investigate whether patterns of activation were different in the two groups, we carried out a 2*2 (groups: HR, LR; tasks: social, non-social) mixed ANOVA analysis in the left regions (Ch.32 and Ch.34)and right regions (Ch.53) separately. We observed a significant interaction effect between groups and tasks in the right hemisphere (F (1,15) = 5.04, p = 0.04, ηp^2 = 0.14) but not in the left hemisphere. For the social task, HR infants showed lower activation (t (7) = - 2.58, p = 0.02, d = 0.98) in the right hemisphere than LR infants. For the non-social task, no group differences were found.

Conclusions: Our initial results demonstrate that HR infants show different neural activation to social stimuli in the temporal regions compared to LR infants. This suggests that social development may already be impaired in the first year of life for (some of the) infants in the HR group. Data collection is still ongoing. At the meeting we expect to present results of at least 50 infants.

226 **174.226** Endogenous Bold Signal Complexity of Ventromedial Prefrontal Cortex Is Different in Autistic Men Versus Women and Differentially Associated with Compensatory Behavioral Camouflaging

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Background: Longstanding theories suggest that there may be an imbalance of excitation versus inhibition (E/I) in the autistic brain. E/I imbalance can result in increased neural noise with long-range dependence and this may be represented in the 1/f signal of non-invasive in-vivo measurements of brain function such as resting state fMRI (rsfMRI). The 1/f signal has been characterised with the Hurst exponent (H), indicating the temporally persistent behaviour (long memory) and stationarity of the signal when 0.5<H<1. However, rsfMRI BOLD signal exhibits non-stationary behaviour that also needs to be quantified. Thus we have utilised a novel approach for estimating H based on the fractionally integrated process (FIP) model to allow H>1, as a non-stationarity index. Using H as a metric of endogenous BOLD signal complexity, we examined how H may differ between males versus females with autism, by expanding on previous work on adult males (Lai et al., 2010). Here, we assess if H exhibits sex-by-diagnosis interaction effects when examined in a 2x2 design.
Objectives: To assess sex-by-diagnosis interactions in H and assess any sex-differential associations with clinical measures of behavioural camouflaging.

Methods: Age-matched male and female adults with ASD (males n=23; females n=25) and a typically developing (TD) group (males n=29; females n=33) were scanned with rsfMRI (3T, TR=1302 ms, 620 volumes) while awake with eyes closed. Data were preprocessed using a standard pipeline in AFNI, along with motion regression, CSF regression and wavelet despiking. Mean time-series from 180 parcels from the HCP parcellation (Glasser et al., 2016) were used to estimate H based on the FIP model. For each region, a linear model was constructed to examine main effects of sex and diagnosis along with the sex-by-diagnosis interaction, after covarying for mean framewise displacement and full-scale IQ. Multiple comparison correction was implemented with FDR q<0.05. A behavioural camouflaging index was computed identical to past work (Lai et al., 2017) and was utilised in correlation analyses with H, stratified by sex within autistic individuals.

Results: A region in ventromedial prefrontal cortex (vMPFC) showed evidence of a sex-by-diagnosis interaction (F=15.134, p=1.76e-4, partial η^2=0.12) with a TD>Autism effect in males (d=1.30) but no strong effect in females (d=-0.27). Increasing vMPFC H was significantly associated with increasing behavioural camouflaging in females (r=0.60, p=0.0015), whereas no association was present in males (r=-0.10, p=0.63). The strength of these vMPFC H-camouflaging correlations was different between males versus females with autism (z=2.58, p=0.0098).

Conclusions: These results suggest that an important node of the 'social brain', vMPFC, shows lower H in men but not women with autism, compared to same-sex TD controls. Lower H could indicate enhanced neural noise and may impact several key functions of vMPFC involved in social and self-referential cognition, particularly in males with autism. This marker also explains variance in clinically relevant phenomena such as camouflaging, in a sex-differential manner, suggesting that the less neural noise present in vMPFC of females with autism may be related to enhanced ability to camouflage impairments in the social-communicative domain.

227 **174.227** Factors Contributing to Success and Failure in MRI Assessment in Individuals with Low-Functioning Autism

H. Y. Lin[1], *Y. C. Liu*[2], *M. Y. Hsu*[3], *H. C. Ni*[4], *J. C. Chang*[5], *E. N. Tu*[6], *Y. Y. Wu*[3] *and S. S. F. Gau*[1], *(1)Department of Psychiatry, National Taiwan University Hospital & College of Medicine, Taipei, Taiwan, (2)Department of Psychiatry, National Taiwan University Hospital, Taipei, Taiwan, (3)YuNing Psychiatry Clinic, Taipei, Taiwan, (4)Chang Gung Memorial Hospital- Linkou Medical Center, Taipei, Taiwan, (5)Department of Psychiatry, National Taiwan University Hospital. Yun-Lin Branch, Yunlin, Taiwan, (6)Department of Psychiatry, Keelung Chang Gung Memorial Hospital,, Keelung, Taiwan*

Background: Although accumulating evidence indicates altered brain phenotypes in autism spectrum disorder (ASD), the majority of neuroimaging research has focused on individuals with relatively intact cognitive and language function (i.e., 'high-functioning'). Those having more severe phenotypes (i.e., 'low-functioning', including minimally verbal and intellectually disabled individuals, are generally understudied and overlooked. This dearth of the knowledge hinders unraveling the etiologies underlying the heterogeneity in phenotypic expressions.
Objectives: We aimed to identify the factors and individual features which contribute to the success and failure in MRI assessment.

Methods: To answer this specific question and further investigate the expression of brain phenotypes in this understudied population, minimally verbal individuals and those with intellectual disabilities were recruited. These individuals were intentionally grouped in the 'low-functioning' group considering the sample size and dimensional features of verbal language expression levels, and were contrasted with the 'high-functioning' individuals with ASD (full-IQ>70), and neurotypical group. All participants received comprehensive assessment of clinical presentations (including the ADI-R, ADOS, and a myriad of parent-rated questionnaires measuring autistic features, adaptive functioning, and co-occurring

behavioral/emotional problems), cognitive abilities (Wechsler and Leiter scales), and MRI (T1w, resting-state and task MRI, and diffusion imaging). Failure to complete MRI assessment was defined as inadequate quality (notable motion artifacts after several runs) of 6-minute T1w image, participants' active cancellation of scans, or inability to be compliant.

Results: The sample (age 7-30 years) consisted of 33 high-functioning, 27 low-functioning participants with ASD (17 fulfilled the stringent criteria of minimally verbal status), and 27 neurotypical controls. Among them, 32 (97%) high-functioning, 20 (74%) low-functioning individuals (12 minimally verbal), and all neurotypical controls successfully completed MRI assessments. All low-functioning individuals had practiced to lie still before scans, and were accompanied by the parents or therapists during scans. 20 (all low-functioning, including all unsuccessful cases) had received the mock scan before the official assessment; 3 of them failed to comply with mock scans. All participants who failed to complete scans, alongside 3 individuals in the low-functioning group having tolerable quality of image data, had several runs of T1w scans. Overall, low-functioning, relative to high-functioning individuals, had higher autistic severity based on the ADI-R and ADOS. These two patient groups did not differ in ratio of sex, or psychiatrist-diagnosed comorbidity, or most of parents-rated questionnaires, except higher internalizing and externalizing problems in high-functioning individuals. Benchmarking against the low-functioning individuals successfully completing MRI assessment (N=20), those who failed (N=7) had younger age (10±1.5 vs. 19±4.9 years). These two subgroups on the low-functioning spectrum did not differ in the severity of autistic or ADHD symptoms (regardless of the raters), or intellectual function.

Conclusions: Our preliminary findings suggest that younger age lead to higher failures in completing MRI assessment. Company by the family members or therapists, and several scan attempts may facilitate higher successful rates for scans. The mock practice could help the low-functioning individuals better accustom to the scan environment, and also helps the researchers to decide which participants might have higher chances to finish MRI scans.

228 **174.228** Hyperconnectivity of Social Perception, Language Processing, and Face Recognition Areas Associated with Greater Deficits in Social Cognition in Autism Spectrum Disorder

***D. Cochran**, S. M. Hodge, J. Frazier and D. Kennedy, Psychiatry, UMass Medical School, Worcester, MA*

Background: The right posterior superior temporal gyrus (rpSTG) is involved in language processing and social perception, particularly the perception of biological motion, and has been found repeatedly to be one of the core neuroanatomical areas with observed differences between individuals with autism spectrum disorders (ASD) and typically developing controls (TD). Functional connectivity studies have found both hyper- and hypoconnectivity of rpSTG in ASD with various brain regions associated with social cognition.
Objectives: We sought to determine whether the functional connectivity of rpSTG with other brain regions was associated with quantitative measures of social cognition in adolescent males with and without ASD.

Methods: We used resting-state functional connectivity (rsFC) data from males age 13-17 with verbal IQ in range of 85 to 115 included in the Autism Brain Imaging Data Exchange repository. We focused on male gender and narrow age and IQ range to limit the confounding effects of these variables on the resting state results. We limited our analysis to those subjects with documented total scores on the Social Responsiveness Scale. The final dataset included 29 subjects with ASD [Mean Age(SD) = 15.4 (1.5); Mean VIQ(SD)=100.7(9.5)] and 27 TD subjects [Mean Age(SD)=15.6(1.3); Mean VIQ(SD)=102.5(8.6)]. Seed-to-voxel rsFC analyses were performed using the CONN-fMRI toolbox v18a and SPM12 with the rpSTG as defined by the FSL Harvard-Oxford atlas used as the seed. SRS scores were used as regressors in the analysis, controlling for age. A peak voxel threshold of $p<0.001$ and a cluster extent threshold of $p<0.05$ were set for positive and negative associations of connectivity, with significance defined as surviving Family-Wise Error correction at $p<0.05$.

Results: Greater impairment in social cognition was associated with increased connectivity between the rpSTG and a single cluster centered in the right temporal occipital fusiform cortex, in the region associated with distinguishing faces from other objects. Using this cluster in exploratory analysis as a seed for analysis, the increased connectivity extended to a region including the right planum temporale along with the rpSTG, involving regions associated with auditory processing.

Conclusions: There is evidence for association between greater impairment in social cognition and increased connectivity between regions involved with social perception, language processing, and recognition of faces, functions that are impacted by the core symptoms of ASD.

229 **174.229** Intranasal Oxytocin Differentially Affects Functional Connectivity in Women with and without Autism

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Background: Oxytocin, which is known to influence social behaviour and cognition, may be of therapeutic value for enhancing social functioning in individuals with autism spectrum conditions (ASC). We previously reported that intranasal oxytocin increased resting state connectivity across subcortical and cortical networks in neurotypical women and that this effect correlated positively with autistic-like traits [1]. Thus, we predicted strong oxytocin-induced increases in functional connectivity in the same corticostriatal circuit in women with ASC.
Objectives: To test whether the same effect of oxytocin on resting state connectivity observed in neurotypical women is present in autistic women.

Methods: To extend this study, 16 age- and IQ-matched women with a diagnosis of high-functioning autism or Asperger syndrome participated in the same double-blind placebo-controlled crossover experiment. Resting-state functional magnetic resonance imaging (fMRI) data were collected after intranasal administration of 24 IU oxytocin (Syntocinon, Novartis) or placebo. A total of 270 resting-state functional volumes (eyes-open, with fixation cross) were acquired using a multi-echo sequence and online reconstruction (TR = 2300 ms; field-of-view = 240 mm; 33 oblique slices, alternating slice acquisition, slice thickness = 3.8 mm, 11% slice gap; 3 echoes at TE = 12, 29, and 46 ms, flip angle 80°). Independent components

analysis was applied to examine connectivity between networks. Correlation matrices for all independent component (IC) pairs were computed with corrections for multiple comparisons.

Results: Mirroring our previous finding, we identified components involved in reward, emotion, social communication, language, and pain processing. Three IC pairs showed significant changes in activation between the oxytocin and placebo conditions in autistic women, although the effect sizes were small (≤0.80, Cohen's d). The independent component pair (IC11-IC21) previously found to show the greatest oxytocin-induced connectivity increase in neurotypical women did not show a significant connectivity change between placebo and oxytocin conditions in autistic women. While all neurotypical women showed significantly increased connectivity in this IC pair under oxytocin relative to placebo, several autistic women showed a substantial decrease in connectivity under the oxytocin condition (Figure 1). Overall, oxytocin-induced connectivity changes were more heterogeneous in autistic women compared to neurotypical women.

Conclusions: These findings are suggestive that response to exogenous oxytocin between autistic and neurotypical women. Within the autism group, individual differences in response to oxytocin may arise from differences in the oxytocinergic system or interactions between oxytocin and other hormones. In future work, we plan we explore this possibility by combining fMRI data and salivary hormone level data.

1. Bethlehem, RAI et al. Intranasal oxytocin enhances intrinsic corticostriatal functional connectivity in women. *Transl Psychiatry* (2017).

230 **174.230** Longitudinal Sex Differences in Early Brain Growth in Autism Spectrum Disorder

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Background: Atypical growth patterns of total brain volume during childhood have been reported in ASD. However, longitudinal studies are lacking, and most existing studies reflect the male bias of ASD. Thus, sex differences in early brain enlargement and growth trajectories have not been fully explored.

Objectives: This longitudinal research examines sex differences in the growth of total cerebral volume (TCV) from early to middle childhood in ASD relative to age- and sex-matched typically developing (TD) controls.

Methods: The longitudinal sample comprised three annual time points spanning early childhood with 237 ASD (77 female) and 115 TD (52 female) participants at Time 1 (T1; *M*=38.4 months), 134 ASD (41 female) and 76 TD (32 female) participants at T2 (*M*=51.5months), 85 ASD (27 female) and 59 TD (24 female) at participants T3 (*M*=64.3 months), and one additional time point during middle childhood with 52 ASD (11 female) and 42 TD (17 female) participants at T4 (*M*=136.1 months). Due to existing evidence that disproportionate megalencephaly may represent a distinct neurophenotype in ASD, current sample and analyses did not include participants with disproportionate megalencephaly. TCV was estimated using template-based registration of T1-weighted MR images (1mm^3 resolution). Primary analyses examined within-person growth in TCV during early childhood (T1-T3) using mixed level modeling; future planned analysis will examine growth of TCV into middle childhood (T1-T4). Age was separated into a within-person covariate (change in age since T1) and a between-subject covariate (starting age at T1). Mixed level models were conducted in R using lme4. Model comparisons were conducted testing interactions between sex, diagnosis, change in age. Tests of parameter estimates used Satterthwaite's degrees of freedom, as implemented in the lmerTest package.

Results: At T1, TCV was significantly enlarged in males with ASD compared to males with TD (b=+32.5cm^3, *t*=2.78, *p*=.0059), but not significantly enlarged in females with ASD compared to females with TD (b=+15.6 cm^3, *t*=1.18, *p*=.24). However, a significant sex by diagnosis interaction was not observed at T1 (*p*=.43). All groups exhibited substantial positive growth in TCV over time (Figure 1; *p*s ≤ 2e-16), however the rates of that growth differed by sex and diagnosis, as indicated by significant two- and three-way interactions with change in age (two-way: χ^2=36.1, df=2, *p*=1.5e-8; three-way: χ^2=4.26, df=1, *p*=.039). Compared to sex-matched TD controls, the rate of change in TCV was slower in ASD in both males (b=-.34 cm^3/month, *t*=-2.49, *p*=.014) and females (b=-.79 cm^3/month, *t*=-4.38, *p*=2.6e-5). However, the rate of growth was slowest in females with ASD (rate relative to males with ASD: b=-.69 cm^3/month, *t*=-4.59, *p*=7.9e-6).

Conclusions: Brain enlargement during early childhood is not as prominent in females with ASD as in males with ASD. Moreover, females with ASD have a slower rate of TCV growth during early childhood. Future analyses will examine TCV trajectories into middle-childhood.

231 **174.231** Machine Learning Analysis of White Matter Connectome Edge Density: A Path Towards Imaging Biomarkers for Autism Spectrum Disorders

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Background:

Neuroimaging studies, using Diffusion tensor imaging (DTI) and fiber tractography have found white matter network underconnectivity in many children with the social communication challenges indicative of Autism Spectrum Disorders (ASD). Thus, the structural connectome, representing the whole-brain network of macro-scale white matter connectivity, has emerged during the past decade as a powerful formalism for the study of neurological and psychiatric diseases, including ASD. However, to date there are no studies of ASD examining regional connectomic properties within the white matter. Edge Density Imaging (EDI) has recently been introduced as a framework to represent the anatomic embedding of these white matter connectome edges. In EDI, the edges or links of the white matter connectome – from probabilistic tractography – are constrained to network nodes based on standard atlas parcellation of the cortical and deep gray matter nuclei. Machine learning analyses are also gaining popularity for pattern recognition and development of classification (or regression) models based on multidimensional data. These algorithms seem particularly suitable for devising classifiers based on multitude of variables extracted from diffusion and connectivity maps.

Objectives:

In this study, we compared the white matter connectome and microstructure between children with ASD and typically developing children (TDC)

using voxel-wise analysis. Then, we applied different machine-learning algorithms for identification of ASD based on the white matter tract-based average Edge Density (ED) and conventional DTI metrics to determine the differences that were most associated with the clinical condition.

Methods:

We examined the structural connectome of children with (n=14) and without ASD (n=33) using tractography-based Edge Density Imaging (EDI); and then applied machine leaning algorithms to identify boys (8-12 years) with ASD based on EDI patterns. The Edge Density (ED) maps were computed from probabilistic streamline tractography applied to high angular resolution diffusion imaging (HARDI). Tract-Based Spatial Statistics (TBSS) was used for voxel-wise comparison and coregistration of ED maps in addition to conventional DTI metrics of Fractional Anisotropy (FA), Mean Diffusivity (MD), and Radial Diffusivity (RD). Tract-based average DTI/connectome metrics were calculated and used as input for different machine learning models: naïve Bayes, random forest, support vector machines (SVM), neural networks. For these models, cross-validation was performed with stratified random sampling (×1000) of the cohort into training and validation datasets. The average accuracy among validation samples was calculated.

Results:

In voxel-wise analysis, the body and splenium of corpus callosum, bilateral superior and posterior corona radiata, and left superior longitudinal fasciculus showed significantly lower ED in children with ASD. Overall, machine-learning models using tract-based EDI metrics had better performance in identification of children with ASD compared to those using FA, MD, and RD. The EDI-based random forest models had greater average accuracy (75.3%), specificity (97.0%), and positive predictive value (81.5%), whereas EDI-based polynomial SVM had greater sensitivity (51.4%), and negative predictive values (77.7%).

Conclusions:

In conclusion, we found reduced number of connectome edges in the posterior white matter tracts of children with ASD; and demonstrated the feasibility of connectome-based machine-learning algorithms in identification of children with ASD.

232 **174.232** Malleability of Neural Activity in Response to Treatment: Examining fMRI Biomarkers of Social Behavior and Anxiety Among Autistic Adolescents across the PEERS® Intervention

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Background: Autistic adolescents frequently experience clinical levels of anxiety that exacerbate social difficulties (van Steensel, Bögels, & Perrin, 2011). Improvements in both social behavior (Gates, Kang, & Lerner, 2017) and anxiety (e.g., Corbett, Blain, Ioannou, & Balser, 2017; Lei, Sukhodolsky, Abdullahi, Braconnier, & Ventola, 2017; McVey et al., 2016; Schohl et al., 2014) have been previously documented after receiving a social skills intervention. Recent literature highlights the importance of using neurobiological markers to assess for intervention response (Stavropoulos, 2017). No study to date, however, has examined changes in neural activity via fMRI and links with social behavior and anxiety across a well-validated social behavioral intervention for autistic adolescents.

Objectives: The present study will begin to address this gap by evaluating changes in neural activity (fMRI), 1) social behavior, 2) amygdala activity relative to anxiety subsequent to an evidence-based social skills intervention, the Program for the Education and Enrichment of Relational Skills (PEERS®).

Methods: Sixty-one adolescents (48 autistic, 13 typically developing) ages 11-16 were recruited for the present study. In this randomized controlled trial, autistic adolescents were randomly assigned to an experimental or a waitlist control group. All adolescents underwent fMRI at two timepoints – before and after the PEERS® intervention for the experimental group. Self- and caregiver-report measures of social behavior (Social Skills Improvement System, SSIS; Social Responsiveness Scale, SRS; and Test of Adolescent Social Skills Knowledge, TASSK) and anxiety were collected before and after intervention. Measures of anxiety (Child Behavior Checklist, CBCL and NIMH Diagnostic Interview Schedule for Children, Social Phobia, DISC) will be used to further classify the autistic groups as having or not having clinically-significant anxiety and social anxiety.

Results: Although the groups differed in their Ethnic identity (Table 1), neural differences are not expected based on this variable. Nonetheless, analyses will be conducted to examine potential effects based on Ethnicity due to the group difference. No other demographic differences were found (see Table 1). Preliminary results indicated that the intervention functioned as expected (paired sample *t* test of TASSK for the experimental group: $t(21) = -10.85$, $p < .001$; waitlist and typical group showed no change over time $p > .05$). Data analyses to be conducted include: two mixed model ANCOVAs to examine changes in amygdala activity over time and the moderating role of anxiety (Group*Time*Anxiety; Group*Time*Social Anxiety).

Conclusions: It is hypothesized that autistic adolescents in the experimental group with high levels of anxiety and social anxiety prior to the intervention will show decreased amygdala activity in response to the intervention, coinciding with improvements in social behavior and secondary effects on anxiety. Those with low levels of anxiety to start, on the other hand, will show increased amygdala activity, coinciding with improvements in social behavior (and no change in anxiety). The waitlist control and typically developing groups are expected to show no significant changes in neural amygdala activity over time. This study will be the first of its kind to examine effects of PEERS® on brain function via fMRI among autistic adolescents.

233 **174.233** Mapping Superficial White Matter Anomaly in Autism Spectrum Disorder: Effects on Functional Networks and Behavior

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Background:

Autism spectrum disorders (ASD) are life-long developmental conditions characterized by atypical social cognition, communication, and repetitive behaviors/interests [1]. Multiple neuroimaging studies have shown alterations in cortical morphology in this syndrome [2]. White matter changes remain less well understood, particularly their association to cortical structure and function.

Objectives:

We focused on the superficial white matter (SWM), a compartment that has gained only little attention so far in ASD neuroimaging. In addition to its role in genesis and maturation of the folded cortex [3, 4], its spatial proximity to the cortical ribbon ensures intrinsic correspondence, making it an ideal candidate for integrative studies on cortical grey matter morphology, function, and white matter organization in ASD.

Methods:

From the Autism Brain Imaging Data Exchange repository, we selected three sites that contained: *i)* males and females, *ii)* children and adults, and *iii)* diffusion MRI and T1-weighted MRI data. Following cortical surface extraction and its QC, our sample included 53 ASD and 57 controls. To examine the SWM, we generated a surface 2mm below the cortex by following a Laplacian potential field towards the ventricles (**Fig 1A**). Surface-wide statistics mapped alterations in fractional anisotropy (FA), mean diffusivity (MD), and a multivariate aggregate of both in ASD compared to controls, controlling for age, sex, and site. We carried out seed based functional connectivity analyses from significant clusters to evaluate pathological structure-function coupling. Finally, we examined associations to behavioral symptoms of ASD by correlating inter-individual differences in SWM measures with ADOS scores, and built path analytical models, evaluating the role of functional connectivity on the relation between diffusion anomalies and ADOS scores. Multiple comparisons were corrected using random-field theory at $p_{FWE}<0.05$.

Results:

Multivariate analysis mapped SWM diffusion anomalies in ASD compared to controls (**Fig 1B**) in bilateral precuneus and posterior cingulate (PCU/PCC) and the right temporo-parietal cortex. Effects were consistent in children and adults and across sites. Notably, functional connectivity analysis from these regions revealed decreased intrinsic connectivity in ASD compared to controls, with right PCC/PCU being disconnected from adjacent cuneus and with the right temporo-parietal cortex from insular and superior parietal cortex (**Fig 2A-C**). Again, connectivity reductions were similar across sites (**Fig 2D**). Notably, in the ASD group, inter-individual differences in SWM anomalies in both right hemispheric clusters correlated with degrees of functional connectivity reductions (SWM_{TPJ}: r=-0.38, p<0.0025; $SWM_{PCC/PCU}$: r=-0.25, p<0.037, **Fig 2E**). SWM anomalies were also correlated to more severe ASD symptoms, as indexed by total ADOS (r=0.27, p<0.04). Finally, associations between SWM anomalies and total ADOS scores were found to be partially mediated by reduced functional connectivity (z=1.93, p<0.06), suggesting a disease-related path between SWM alterations, functional connectivity, and behavioral symptoms (**Fig 2F**).

Conclusions:

Our study targeting the SWM in ASD offers a novel perspective on the interplay between white matter anomalies and atypical functional networks, providing a potential window to better understand the complex biological factors contributing to its diverse behavioral symptoms.

234 **174.234** Multimodal Stratification of ASD with the Help of DTI, MEG, and MRS

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Background: Efficient white matter and synapses are both necessary for accurate and rapid encoding of auditory sensory information. In autism spectrum disorder (ASD), slow auditory response latencies may contribute to abnormal auditory processing and, ultimately, language impairment. A structure-function relationship between M50 latency and diffusion MR indices of white matter maturation has been shown in typically developing children. However, the M50 latencies observed in ASD are heterogeneous and not well explained by white matter microstructure. GABA is an inhibitory neurotransmitter and abnormally low auditory system GABA has been observed in ASD. This study hypothesizes that M50 is dominantly modulated by white matter microstructure (indexed by dMRI) in one subgroup of ASD and is modulated by synaptic transmission function (indexed by GABA MRS) in a separate biologically-distinct subgroup.

Objectives: This multimodal study uses dMRI, GABA MRS and magnetoencephalography (MEG) to identify the multiple physiological mechanisms which underlie auditory processing efficiency in ASD and to potentially stratify children according to differing biological etiologies.

Methods: Participants included 46 children with ASD (mean age = 11.5±2.3) and 27 typically developing (TD) children (mean age = 10.9±2.1) with evaluable DTI, MRS and MEG data. DTI was acquired at 3T with 30 gradient directions at b=1000s/mm^2 and voxel size 2x2x2mm. The MNI template was used to measure DTI parameters including FA from Heschl's gyrus. MRS was performed using a single voxel macromolecule-suppressed, edited MEGAPRESS sequence (TR=1500ms, TE=80ms, 128 transient pairs, acq. time ~6min) with voxels (4x3x2cm) placed in left and right superior temporal gyrus and expressed relative to the reference creatine. The M50 response component to auditory stimulus tones was measured with MEG and identified as the first source localized post stimulus peak in the interval 50-150ms.

Results: A mixed model of M50 with hemisphere, diagnosis, GABA level, and cross terms revealed a main effect of FA (p<0.02) and an interaction between GABA and diagnosis (p<0.01). Analyzed separately in controls alone, increasing FA (p<0.05) and decreasing GABA (p<0.01) were correlated with shorter (faster) M50. In the ASD group, the relationship between FA, GABA and M50 was uncoupled. A subgroup of ASD subjects was identified with long (slow) M50 latencies relative to the typically developing M50 vs GABA curve (>95th percentile). Outlier group FA (0.287±0.004) was lower than FA among non-outliers (0.296±0.002, p<0.05), suggesting latency was prolonged in this subgroup compared to the "typical for their GABA level" value, perhaps through immature white matter, with commensurately slow conduction velocity.

Conclusions: This study observed higher GABA levels were associated with slower M50 responses in typically developing children. This relationship is possibly related to the inhibitory role of GABA in cortico-cortical circuitry mediating the M50 response, after the initial thalamocortical volley. Uncoupling of GABA to M50 as well as diffusion MR to M50 was observed overall in ASD, suggesting heterogeneous subpopulations. This study suggests stratification of ASD subjects may be performed based on which physiological factors dominantly modulate or limit the speed of sensory input. Stratification based on such mechanistic etiology can potentially pave the way for tailored/personalized therapy.

235 **174.235** Neural Responsivity to Social Rewards in Girls with Autism Spectrum Disorder

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Background: The social motivation hypothesis of autism spectrum disorder (ASD) posits that ASD is driven by a diminished sensitivity to the inherently rewarding nature of social stimuli, which contributes to reduced opportunities for social learning and thereby leads to the social challenges observed in ASD. Previous functional magnetic resonance (fMRI) studies have indicated that males with ASD do indeed display reduced neural activity to social rewards, but it is unknown whether this finding extends to females with ASD, particularly as behavioral evidence suggests that affected girls may not exhibit the same reduction in social motivation as their male counterparts.
Objectives: We aimed to test whether neural evidence supports the social motivation hypothesis among girls with ASD by investigating how social reward processing may differ between girls and boys with ASD, as well as between girls with ASD and typically developing (TD) girls.

Methods: As part of an NIH-funded multi-site network, fMRI data was collected during an implicit-learning socially-rewarded task from a total of 154 youths with ASD and TD controls. An approximately equal number of girls and boys contributed data to each group, and participants were between the ages of 8 and 17 years old. Prior to starting the fMRI scan, participants were told that a number of abstract fractal-like images would be presented multiple times over the course of the task, and each time an image appeared they should guess via button press whether it belonged to "Team 1" or "Team 2", after which they would receive feedback on their response. If the participant guessed correctly, feedback consisted of a smiling male or female face with the text "That's right!"; if the subject's response was incorrect, a sad male or female face was instead displayed along with the text "That's wrong."

Results: Our group-level analyses focused on the contrast Correct > Incorrect (i.e., happy face > sad face). We used both a whole-brain approach and a region of interest (ROI) approach where we focused on the nucleus accumbens due to its known importance in reward processing. Groups were matched on implicit learning rate. Girls with ASD displayed increased activity to socially rewarding stimuli, including greater activity in the nucleus accumbens relative to boys with ASD, as well as greater activity in the lateral orbitofrontal cortex, the ventrolateral prefrontal cortex and the anterior insula compared to typically developing girls.

Conclusions: These results demonstrate for the first time that girls with ASD do not exhibit the same reduction in social reward sensitivity as boys with ASD. Instead, girls with ASD display increased neural activation to such stimuli in areas related to reward processing and salience detection. This heightened neural sensitivity to social rewards may be a protective biological mechanism underlying the reduced prevalence of ASD among females and the sex differences in friendship patterns among youth with ASD. Importantly, our findings suggest that the social motivation hypothesis may not generalize to affected females and highlight the importance of studying potential sex differences in ASD.

236 **174.236** Neurobiological Correlates Associated with Clinical Improvement in an Open Label Trial Assessing Autologous Umbilical Cord Blood for Treatment of Young Children with Autism

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Background: While the exact mechanism underlying neural differences in autism (ASD) remains unknown, a number of studies have linked altered immune responses to brain overgrowth and altered white matter connectivity. As such, immune modulating therapeutic interventions have the potential of impacting neurodevelopment and clinical outcomes in ASD. In support of this, we have previously reported significant improvement following treatment with a single infusion of autologous cord blood
Objectives: The current study explored whether behavioral improvements were associated with differences in total cerebral volume (TCV) at baseline and changes in brain white-matter connectivity following treatment.

Methods: Twenty-five children participated in a phase I, open-label trial to assess the feasibility and safety of a single infusion of autologous cord blood in 2-6 year old children with ASD. Clinical improvement was measured through change in scores from baseline to 6 months on the Vineland Adaptive Behavior Scales-II Socialization subscale (VABS-SS) and the Expressive One-Word Picture Vocabulary Test-4 (EOW), as well as the Clinical Global Impression-Improvement Scale (CGI-I) score at 6 months. Brain volume and white-matter connectivity were measured at baseline and 6-months in a subset of 19 children. TCV was calculated from the baseline MRI using an automated template-based method to mask out brainstem and cerebellum. Changes in white-matter connectivity from baseline to 6 months were calculated from 25-direction Diffusion Tensor Imaging (DTI). DTI data were analyzed using deterministic tractography, the Connectome Mapping ToolKit (CMTK), and *a priori* defined nodes from a pediatric gray matter atlas. The relationships between TCV or white-matter connectivity and behavioral improvement were assessed with Spearmen correlations to account for non-normal distribution of clinical variables.

Results: Correcting for age, higher baseline TCV was associated with greater improvement on the EOW ($r=0.52$, $p=0.02$) and CGI-I ($r=-0.44$, $p=0.04$), and trend level improvement on the VABS-SS ($r=0.4$, $p=0.07$). Improvement across all 3 behavioral outcome measures was correlated with increased connectivity between the right frontal pole and the globus pallidus (GP; all $p\leq0.04$) and between the left fusiform and superior temporal cortex (STC; all $p=0.04$). Improvement on the VABS-SS and the EOW was associated with increased connectivity between the left STC and putamen (both $p=0.03$). Improvement on the VABS-SS and the CGI-I was associated with increased connectivity between the left inferior temporal cortex and STC, the thalamus and the hippocampus, and the temporal pole and the GP (all $p\leq0.04$). Finally, improvement on the EOW and the CGI-I, was associated with increased connectivity between the right frontal and temporal pole, the STC and GP, and the rostral middle frontal cortex and GP, as well as between the left fusiform and middle temporal cortex (all $p\leq0.04$).

Conclusions: Significant improvements in behavior in children with ASD were seen in a phase I, open label study after autologous cord blood infusion. The current results suggest that children with larger TCV at baseline showed the greatest levels of improvement. Furthermore, behavioral improvements were associated with increased white-matter connectivity in brain regions previously linked to social, communication, and language abilities.

237 **174.237** Perception of Art in High Functioning Autism

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Background:
Art exploration is a complex process conditioned by factors that include both basic visual principles and complex cognitive factors. It has often been reported that people with autism spectrum disorders (ASD) possess a different capacity for visual apprehension and artistic expression, explaining their artistic talent, particularly their holistic visual processing. However, no empirical study has explored if people with ASD had a different perception of art in a qualitative way. Conversely, several therapies based on art perception and artistic creativity have been designed to help deal with their socio-emotional deficits. The use of creative art therapy has been put forth to promote adequate emotional state regulation.

Objectives:

The general objective of this project was to investigate, with an eye-tracking technique, the visual explorative behavior of ASD participants. We expected to observe significant differences in the eye-tracking patterns of neurotypical versus ASD participants. A secondary aim was to study if exposure to creative art sessions modify gaze behavior patterns.

Methods:

13 participants with ASD and 11 neurotypical controls (18 to 49 years old) participated were recruited. In a dark and quiet room, participants sat in front of computer screen displaying photographs of 12 paintings taken from the Montreal Museum of Fine Arts (MMFA). Paintings were shown sequentially for 15 seconds each. Eye-tracking data were collected and analyzed using an Eye-Tribe camera and the Ogama software. All participants then attended 7 creative arts sessions at the MMFA. These sessions included visits of the museum with a guide explaining the paintings displayed, and creative workshops where participants could create their own art. A second session of eye tracking data acquisition was then performed, where participants viewed the paintings a second time.

Results:

Areas of interest (AOI) were selected on each painting, based on the focus of attention of the neurotypical group. Complete fixation time in the AOIs was calculated for each painting and compared between groups. We first compared the gaze behaviour during the first session of data acquisition. The salience analysis revealed that while neurotypical participants display a very homogenous gaze fixations behaviour which followed some general common principles (e.g., being attracted to saliency regions), a large variability was observed in ASD participants, who did not show the same attraction to salient regions, especially in the case of figurative paintings with social or emotional value. We then explored how the art therapy sessions influenced the gaze behaviour of ASD participants. Results show that gaze behaviour was different from the first session for all subjects, suggesting that art therapy-like workshops had an influence on the way ASD participants look at paintings.

Conclusions:

These preliminary results highlight a peculiarity in gaze behaviour in ASD when observing art paintings. This suggests a different way to perceive information in an art-related context, particularly in social dimensions. This could be due to a diminished influence of top-down processes on painting perception in ASD. We further show that art therapy sessions have an impact on how participants look at paintings.

238 **174.238** Pre-Scan Preparation in fMRI Research for Children with Autism: A Scoping Review

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Background: Functional magnetic resonance imaging (fMRI) plays a vital role in advancing our understanding of typical and atypical brain development, including for youth with autism. Progress in this field can be hampered by practical requirements of scanning, as successful image acquisition requires participants to remain still and tolerate the noise and confinement of the fMRI scanner bore. The common cognitive, emotional, and behavioral challenges associated with autism compound acquisition difficulties. Many non-pharmacological strategies are available to prepare children with autism for the fMRI environment and there is a need to understand the kinds of approaches that researchers can employ to have successful data acquisition.
Objectives: The current scoping review of the recent literature aimed to identify the pre-scan approaches used to prepare children and adolescents (3-21 years) with autism for the fMRI environment.

Methods: A review protocol was developed and refined further using the recommendations for scoping review reports. A search of scientific databases between the January of 2014 – February 2018 period uncovered 270 articles, of which 128 met inclusion criteria. Information on diagnosis, sample size, age-range, pre-scan preparation methods, and scanning success rate (Number of participants recruited/Number of participants who completed the fMRI session with acceptable quality scans) was extracted and charted.

Results: Out of the 38 articles reporting the use of a preparation protocol, 42% reported using a mock scanner, 16% using a mock scanner with additional behavioural, visual, and technological training strategies, 26% using sedation, 11% using natural sleep, and 5% others. The data acquisition success rate of studies reporting pre-scan preparation methods was on average, considerably better than previously reported (93% vs. 66%). Sedation led to the highest rate of success (99%), followed by natural sleep (95%), mock scanner (92%), and mock scanner with additional training and/or others (87%). Sedation and natural sleep methods were primarily implemented in studies of children with autism under 6 years of age, or with autism and ID. Five articles reported detailed descriptions of their pre-scan preparation protocols. Common strategies described within the mock scanner protocol included gradual exposure to MRI noise (simulated within the mock scanner bore); practice sessions often occurred the same day with varying durations (20 – 120 minutes). Studies implementing training in addition to the mock scanner described empirically supported behavioural strategies and technology-aided instruction.

Conclusions:

Results suggest that researchers who intend to begin a neuroimaging study with children with autism without intellectual disability may greatly increase their scanning success rate by implementing a pre-scan protocol with a single mock scanner session. Additional strategies such as picture schedules, video demonstrations, and inclusion of a preferred movie are other important strategies to consider. For younger children with autism and those with co-occurring ID, scanning during natural sleep or via inclusion of intensive behavioural strategies in addition to a mock scan protocol have been used with success. Documenting pre-scan preparation methods, success rates, and reasons for dropouts are important steps to standardizing the processes in future work.

239 **174.239** Rapamycin Effects on the Brains of C57BL/6 Mouse Models

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Background: Rapamycin is a specific inhibitor of mTOR (Mammalian Target of Rapamycin), which regulates multiple biological activities. There have been some researchers looking into rapamycin efficacy against Autism and other neurological diseases, and it has been verified multiple times that rapamycin does have the ability to ameliorate those diseases, but meanwhile, some data also implied that rapamycin could have potential toxicity towards brains.
Objectives: To apply rapamycin on wild type C57BL/6 mouse models and use MR imaging to examine change on whole brain regions, and any reversal change after ceasing the application of drug. Based on the ROIs (regions of interest), more behavioral tests and histology tests will be conducted to verify any correlations between brain volume change and potential adverse effect

Methods: To investigate the potential influence of rapamycin on the brain, we use 6 weeks/10 weeks old wild type C57BL/6 mouse models as subjects or vehicles. Rapamycin was dissolved in 0.25% polyethylene glycol and 0.25% tween prior to usage, and subjects were administered 6 mg/kg every Monday, Wednesday, and Friday by intraperitoneal injections for 4 weeks, while vehicles were administered with the same solution without rapamycin of the same amount and frequency. The drug application ceased from week 5 and all mice are still examined for another 6 weeks for potential reverse symptoms. All mice were examined by 7.0 Tesla MRI scanner at the end of each week, with contrast agent (MnCl2 Solution) applied a day in prior to scanning. All data retrieved by MRI scanner was processed by python and R.

Results: The outcomes of experiment were quite different between subjects of 6 weeks old and 10 weeks old. Upon the initiation of the drug application, subjects (of either 6 weeks old or 10) were experiencing a slower drop of brain volumes, followed by a fast drop from week 3. 10-week subjects' brain volume dropped to the lowest (3.43%) at the end of week 4 and an almost immediate recovery began when stopping using the drug starting from week 5. The volume went all way back to nearly the initial level after 4 weeks and stay steady since. From the t-statistics produced based on the MR images, only a few areas located mainly at cerebral cortex showed high significance of atrophy (0.1 FDR). However, 6-week subjects were experiencing a larger and faster decrease in brain volume and continued to drop after the cessation of drug (as low as 6.44%). T-statistics showed atrophy across the whole brain (0.1 FDR), especially in visual, auditory, motor, and somatosensory cortex regions. The recovery process also took much longer than 10-week subjects, and had only recovered less than 1% at the end of week 8.

Conclusions: The results showed that rapamycin does have the ability to cause brain atrophy and the younger the subjects are, the worse the possible influences seem to be. The adverse effect on the brain is partially recoverable according to the results, and possible influence on the subjects are still examined by detailed behaviour tests and histology tests.

240 **174.240** Reduced Beta Connectivity during a Music Familiarity Task in Children with Autism

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Background:
Background: Emerging evidence suggests autism is a disorder of brain connectivity and atypical reward processing has been proposed as an explanation for social deficits in ASD. Music is a valuable tool to study human cognition, emotion and reward networks and it is also an auditory stimulus that interests and motivates children with ASD.

Objectives: To examine both whole brain and seed analysis functional connectivity in the reward networks associated with familiarity and liking of music listening in children with ASD compared to typical controls.

Methods: 23 children with autism (ASD) and 23 typically developing children (TDC) children, between 7 to 14 years old, matched on age and sex were recruited. Magnetoencephalography (MEG) was used to measure brain activation and neural synchrony, while listening to different types of music (familiar liked, familiar disliked, unfamiliar liked and unfamiliar disliked). These music selections were chosen by the children and then matched with unfamiliar songs (of the same genre, tempo and mode) for presentation in the MEG.

Results: 23 ASD (mean age 10.09 ± 1.41) and 23 TDC (mean age 10.26 ± 1.85) of IQ>70 have been recruited. Findings revealed a network of reduced beta-band amplitude synchronization in the unfamiliar disliked music in children with ASD compared to controls (p=0.004, corrected). Also, we found increased low gamma amplitude synchronization in the familiar disliked music condition in children with ASD (p=0.003, corrected). Seed analysis of the reward networks are currently underway.

Conclusions: These findings reinforce theories suggesting that beta-band connectivity is important for establishing long-range communication among brain regions and reduced beta synchronization in the ASD group could reflect inadequate processing in task-dependent networks. On the other hand, gamma-band (30 to 80 Hz) abnormalities have been reported in many studies of ASD and are associated with impaired perceptual and cognitive functions.

241 **174.241** Reduced Regional Gray Matter Volume in the Frontal Lobe May be the Neural Basis Underlying Atypical Sensory Processing in Autism Spectrum Disorder

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Background: Atypical sensory processing, such as sensory hypersensitivity and hypoesthesia, exists in individuals with autism spectrum disorder (ASD), and affects social functioning. Although many studies have shown that sensory processing is an important feature for understanding ASD, the neural substrates underlying abnormal sensory processing in ASD individuals remain unknown. Current studies in typically developing subjects (TD) have suggested that atypical sensory processing is associated with reduced gray matter volume in the precentral gyrus; however, no studies have reported on reduced gray matter volume in the precentral gyrus in ASD individuals. Therefore, we hypothesize that a different neural basis contributes to atypical sensory processing in ASD.
Objectives: The present study aimed to investigate the structural abnormality that may be involved in atypical sensory processing in ASD.

Methods: We acquired structural MRI data using a 3T scanner and assessed individual differences in sensory processing using the Adolescent/Adult Sensory Profile questionnaire in adults with ASD (n = 11) without intellectual disabilities and psychotropic medications, and in sex, handedness-, and intelligence- matched TD subjects (n = 14). We used MRI Cloud to analyze structural MRI, which is a cloud-based tool for calculating the regional brain volume with a multi-atlas template. We used intracranial volume as a covariate in comparisons of regional gray matter volume and correlational analyses.

Results: ASD adults had significantly higher scores for low registrations (t = 4.969, p <0.001), sensory sensitivity (t = 4.554, p < 0.001), and sensory avoidance (t = 6.288, p < 0.001) than did TD subjects. The regional gray matter volume was lower in the ASD than in the TD adults in several brain regions, including the right middle frontal gyrus (F = 6.564, p = 0.018). Correlational analyses, revealed a negative relationship between gray matter volumes in the right middle frontal gyrus and hypersensitivity (r = −0.504, p = 0.012), thus indicating that reduced right middle frontal gyrus may be the neural basis underlying atypical sensory processing in ASD. Additionally, reduced gray matter volume in the right middle frontal gyrus was also associated with a more severe autism symptom measured using the Social Responsiveness Scale-2. (r = −0.427, p = 0.020), thus suggesting that reduced gray matter volume in the right middle frontal gyrus may be a common feature of atypical sensory processing and other ASD symptoms.

Conclusions: Current studies reveal that the right middle frontal gyrus is involved in reorienting attention from an exogenous stimulus. Our results suggest that reduced gray matter volume in MFG represents the neural underpinnings of sensory processing in ASD. Therefore, we propose that defective function in attention control may also be closely associated with hypersensitivity in ASD individuals. Additionally, reduced gray matter volume in the right frontal gyrus is a common neural basis underlying atypical sensory processing and other ASD symptoms such as social impairment and repetitive restricted behavior.

242 **174.242** Resting State fMRI and Attachment Difficulties in Children

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Background: Autism spectrum disorder (ASD) can be a risk factor for developing secure attachment. Correspondingly, attachment problems also disturb social development in the typically developing population, and in severe cases, attachment deprivation in a critical period can lead to autistic symptoms, having life-long effects on the individual's mental health. Although the etiology of ASD is more strongly associated with genetics, children with ASD and children with attachment problems may present with some overlapping difficulties in building social relationships. Despite the extensive neuroimaging studies on neural correlates underlying ASD, little is known about the neural correlates of attachment disturbance.

Objectives: In the present study, we compared DMN functional connectivity between secure and insecure attachment in typically developing children and correlated connectivity strength with neuropsychological measures to determine if attachment problems affect DMN function.

Methods: Resting-state fMRI data on a Siemens 3T MRI using 32 channel head coil was collected in typically developing 9-10-year-old boys (N=80, Mean age/SD = 9.62/0.69). Of these children, 46 were assessed as secure attachment and 34 as insecure according to the semi-structured attachment interview, The Separation Anxiety Test (Resnick, 1993). Subject's data were slice-time and motion corrected, smoothed, intensity normalized. Signal from the white matter and CSF were regressed out. The default-mode network (DMN) connectivity, which represents a relaxed mental state, stimulus-independent thoughts or self-referential processing, was investigated between secure and insecure attachment children using seed-based analysis for five core DMN seeds (pC, precuneus; PCC, posterior cingulate cortex; vACC, ventral anterior cingulate cortex; mPFC, medical prefrontal cortex; vmPFC, ventromedial prefrontal cortex), using FSL's FEAT program. Statistical images were thresholded using clusters determined by Z >2.3 and a corrected cluster significance threshold of p = 0.05.

Results: We found significantly increased functional connectivity among core regions of DMN in children with insecure attachment such that the vACC, vmPFC and PCC. Increased vmPFC connectivity was also found in dorsomedial prefrontal and hippocampal regions, which are known as parts of two subsystems of DMN, in children with insecure attachment. In addition, the increased functional connectivity in DMN was negatively correlated with the children's emotional openness scores (vACC connectivity with PCC: r=-0.44, p=0.00).

Conclusions: Our results are the first to show that early attachment experience contributes to the shaping of core DMN functional connectivity in typically developing children, implicating the importance of early experience. Given that atypical DMN functional connectivity has often been reported in ASD, our results may offer one model as to why some behavioural manifestations may overlap between these two conditions.

243 **174.243** Sensory Seeking and Salience Network Functional Connectivity in Females and Males with Autism Spectrum Disorder

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Background: Individuals with an autism spectrum disorder (ASD) are significantly more likely to experience atypical sensory sensitivities and seeking behaviors compared to their typically developing (TD) peers (Liss et al., 2006). Prior work in our lab has found that sensory over-responsivity (SOR) in autism is related to atypical resting-state functional connectivity in the salience network (SN), an intrinsic brain network thought to be related to where the brain directs attention (Green et al., 2016). However, most studies examining the neurological basis of sensory processing have been done with primarily male samples, so little is known about how ASD females process sensory information. Additionally, little is known about the neurobiological basis of sensory seeking (compared to SOR) though we hypothesize that seeking is also related to atypical attribution of salience to sensory stimuli.

Objectives: To examine SN functional connectivity underlying sensory seeking in males and females with ASD and to determine whether atypical seeking-related connectivity confers resilience in the form of better executive functioning.

Methods: The relationship between sensory seeking and SN functional connectivity was compared between ASD males and females in two samples of youth aged 7-18 years. In Study 1, resting-state fMRI was conducted on 78 ASD (43F) and 103 TD (55F) participants. The anterior insula (AI), thought to be the hub of the SN (Seeley, 2007), was used as the seed in whole-brain analyses. Seeking behaviors, determined through self-report on the Short Sensory Profile (SSP; Dunn, 1999), were correlated with AI connectivity. Because youth with ASD have been shown to be poor reporters of their own internal sensations (Shalom, 2006), we replicated the analysis in a second sample of 44 ASD (11F) and 31 TD (10F)

participants that had parent reports of sensory seeking on the SSP. Whole-brain analyses were thresholded at Z>2.3 and corrected for multiple comparisons at p<.05 for both studies. Executive functioning was measured with the BRIEF (Gioia et al., 2000).

Results: In both studies, there were no sex differences in seeking. In Study 1, ASD females with more abnormal sensory seeking behaviors showed greater AI connectivity with medial prefrontal cortex (mPFC) compared to their male counterparts. In Study 2, sensory seeking related to greater positive connectivity between the SN and mPFC across males and females with ASD. Better executive functioning was correlated with both more sensory seeking and greater SN connectivity with mPFC in both males and females.

Conclusions: Sensory seeking may potentially be used as a regulatory mechanism for ASD adolescents, as shown through correlations with prefrontal connectivity and executive functioning. This process appears to only have sex group differences when sensory seeking behaviors are self-reported, perhaps providing insight into the ways males and females with autism are able to report on their internal states. Results of mediation analysis will be discussed to determine whether seeking might mediate the relation between medial prefrontal connectivity and executive functioning.

244 **174.244** Sex Differences in Hemispheric Asymmetry in Autism

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Background: Autism spectrum disorder (ASD) is characterized by a striking male preponderance with three times more males being affected than females. While neuroimaging studies have started to pick up on studying sex differences in ASD, none has addressed the question of sex differences with respect to hemispheric specialization. ASD is characterized by a disruption of specialization in the brain with findings pointing to atypical hemispheric asymmetry across hemispheres (Herbert et al., 2002; Floris et al., 2016). Sex differences in hemispheric specialization have frequently been reported in neurotypical (NT) individuals with males showing more pronounced patterns of lateralization than females, however, no study has addressed this question in ASD.

Objectives: We aimed to explore sex differences in hemispheric lateralization across individuals with ASD and NT controls.

Methods: We selected high quality structural T1-weighted MRI data from the Longitudinal European Autism Project dataset including 94 females with ASD aged 6-30 years, 260 IQ-and age-matched males with ASD as well as 166 age-matched NT males and 90 NT females. T1-weighted images were preprocessed using SPM12 and the CAT12 toolbox. Specific preprocessing steps were adopted to meet requirements for the analysis of asymmetry: 1) images were segmented using a symmetric tissue probability map; 2) segmented images were flipped along the x-axis; 3) original (OI) and flipped images (FI) were used to create a symmetric DARTEL template and subsequently registered to it; 4) laterality indices was calculated at each voxel by the formula:(OI–FI)/(OI+FI)*2. Laterality images were restricted to the right hemisphere (RH) and smoothed with a 4mm FWHM kernel. Main effects and interactions were tested by regression of a GLM at each voxel with group and sex as fixed factors and age and scanning sites as nuisance covariates. Significance levels for clusters were set at a voxel-level cluster-forming $p<0.001$ and by their number of expected voxels (spatial extent threshold) according to Gaussian Random Field theory. Statistical outcomes were corrected for multiple comparisons at the cluster-level by controlling the topological false discovery rate (FDR) at $q<0.05$. Significant results were correlated with symptom measures such as the ADOS and ADI.

Results: Voxel-wise analysis of laterality in the RH revealed significant group-by-sex-interactions in the posterior cingulate cortex and the pars trinagularis. Males with ASD showed reduced leftward asymmetry compared to NT males, while ASD females showed increased leftward asymmetry compared to NT females. The opposite pattern was evident in the angular gyrus and supplementary motor area with ASD females showing reversed rightward asymmetry compared to NT females and ASD males showing reversed leftward asymmetry compared to NT males. Results remained the same when including handedness and FIQ as nuisance covariates. Correlation analyses with ADI- and ADOS-subscales did not yield any significant results.

Conclusions: Males and females with ASD exhibit differential patterns of structural hemispheric lateralisation compared to NT controls in language processing regions and default network hubs. While males with ASD show patterns that resemble those in NT females, females with ASD exhibit neural masculinization suggesting that models of 'gender-incoherence' of ASD also apply to atypical hemispheric lateralization.

245 **174.245** Sleep Problems, Brain Development, and ASD Risk in the First Two Years of Life

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Background: Children with ASD experience sleep problems at 2-3 times the rate of typically developing (TD) children (Liu, 2006; Maskey, 2013). Sleep problems in ASD may emerge as early as 30 months, and persist through adulthood (Humphreys, 2014; Croen, 2015); however, little is known about sleep patterns in infants at high familial risk for ASD or about possible effects of inadequate sleep on early brain development (Graven, 2008).

Objectives: Using data from a multi-site, longitudinal neuroimaging study of a large cohort (N=440) of infants at high risk for ASD (HR; with an older sibling with ASD) and low risk (LR; with a TD older sibling and no family hx of ASD), we examined parent-reported sleep problems from 3-12 months of age in relation to brain structure from 6-24 months of age.

Methods: Participants were assessed for ASD by expert clinicians at 24 months and underwent MRI (high-resolution 3T T1 & T2-weighted imaging data; $1mm^3$ voxels) at 6, 12, and 24 months. An automated segmentation algorithm derived hippocampal volume (HCV), total cerebral volume (TCV), caudate and amygdala volumes (Fig. 1). Children were grouped according to diagnostic outcome at 24 months (HR-ASD=72, HR-NonASD=241, and LR=127). Sleep problems were characterized from 3-12 months of age with the Infant Behavior Questionnaire (IBQ), a measure of infant temperament with 5 items related to sleep initiation and maintenance. IBQ sleep scores demonstrated adequate validity when compared with

scores from the Brief Infant Sleep Questionnaire, available for a subgroup of the sample (n=98; Fig. 2). Linear mixed models were used to predict HPC, amygdala, and caudate volumes (individual intercepts included as a random effect; outcome group, sleep score, age, quadratic effect of age, and group interactions with each included as fixed effects; TCV and scan site included as covariates).

Results: Infant sleep scores differed across the groups ($F(2,397)= 4.7$, $p<.01$); *post hoc* testing revealed greater sleep problems for HR-ASD vs TD and a non-significant trend for HR-ASD > HR-NonASD infants. Group moderated the relationship between sleep problems and hippocampal volume in infancy. Worse sleep in infancy was related to increased hippocampal volume from 6-24 months only for HR siblings who went on to develop ASD (HR-ASD; $\beta=57.16$; $t=3.15$, $p=.002$; Fig. 1). No relationship between poor sleep and hippocampal volume was found in the HR-NonASD and LR groups. The IBQ-HPC relationship was unique to the IBQ sleep items; no other IBQ subscales predicted HPC volume, and no significant sleep-amygdala or sleep-caudate relationships were found.

Conclusions: Sleep in the first 12 months of life may be related to hippocampal development in HR infants who go on to develop ASD. In contrast to prior studies with typically-developing older children and sleep-deprived animals (Taki, 2012; Guzman-Marin, 2003), sleep problems in HR-ASD infants were associated with increased (rather than decreased) HPC volume. The relationship between sleep and HPC volume is likely to be dynamic across development and this relationship may begin to differ early in the course of ASD in HR infants.

246 **174.246** The CO-Occurrence of MRI Findings and Autism Spectrum Disorders:What Is the Importance of Pineal Cyst???

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Background: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder, with persistent impairment in reciprocal social communication and social interaction, and restricted, repetitive patterns of behaviour, interests or activities.There are different findings on Magnetic Resonance Imaging(MRI) and their high prevalence may be an important tool in clinical assessment as is suggested in many studies. Pineal cysts, arachnoid cysts, choroid plexus cysts, enlarged perivascular spaces, *cavum septum pellucidum*, asymmetrical ventricles are some of the MRI incidental findings discovered in children with ASD.

Objectives: Evaluate the simultaneous occurrence between magnetic resonance imaging findings, namely pineal cysts which shows a high prevalence in this group, and children diagnosed with autism spectrum disorders.

Methods: Retrospective case-control study carried out on 161 children: 93 cases diagnosed with autism spectrum disorder (38 with level 1 severity and 55 with level 2 severity) were compared with 68 controls (non-autistic patients). All participants had done a magnetic resonance image and were patients of the paediatric psychiatry appointments.

Results: This study shows that the prevalence of pineal cysts is higher in autistic children comparing with non-autistic children (84.6% vs 15.4%, $p=0.041$). If the level of severity of the autism is discriminated into level 1 and 2, there is also a significant difference between the groups (15.4% vs 84.6% vs 0.0% in non-autistic, level 1 and level 2 ASD, respectively, $p<0.001$). The latter association was analysed calculating the odds of the presence of pineal cyst and having level 1 autism which was increased but with a wide variability (OR, 95%CI 13.75, [2.38 – 79.38]).

Conclusions: There is a possible association between pineal cysts and autism spectrum disorders as shown in this study. This association is stronger in the children diagnosed with level 1 autism, since it is the group with the highest prevalence of pineal cysts (11.8%). It would be interesting to further explore the factors underlying this correlation by extending the study to a larger sample.

247 **174.247** The Development of Frontal Cortex of the Adolescent with Autism Spectrum Disorders (ASD) and Its Relationship with Working Memory

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Background:

Working memory (WM) is one of the core components of executive function, which plays a central role in the pathology of Autism Spectrum Disorders (ASD). Although high-functioning autism (HFA) tend to have a normal range of IQ, WM is a main impact on the daily life. Adolescence is a period in which WM becomes increasingly important, but the supported brain regions like frontal cortex are still immature. Thus, the development of these brain regions and its relationship with WM ability, severity of adolescent HFA is extremely interesting.

Objectives:

This study aimed to investigate the development of the frontal cortex of the HFA. The resting-state connectivity and graph metrics were computed through the time course signals measured by an fNIRS device. The relationship between the neuroimaging results and the WM ability, severity of autism was also evaluated.

Methods:

In total, 12 typically developing (TD) children, 14 children with ASD and 18 adolescents with ASD were recruited. The IQ was measured by the Wechsler Intelligence Scale for Children (WISC-IV), and the diagnostic of ASD was confirmed by ADOS. All the participants were asked to close the eyes and sit still in a dark and quite room for 8 mins during the experiment. 13 emitters and 12 detectors were attached to the forehead forming 40 measuring channels, which covered the middle frontal gyrus (MFG), superior frontal gyrus (SFG), dorsolateral prefrontal cortex (DLPFC) and the supplementary motor cortex (SMA). The motion artifacts and physiological noise were first removed, and then the Pearson correlation coefficient r between DLPFC and all the other channels was calculated. the small worldness, network efficiency, betweenness centrality, degree was computed using a network sparsity threshold between 16% and 35% in increments of 1%. The area under the curve (AUC) was also obtained for each metric to avoid dependence on threshold levels.

Results:

Compared to children with ASD, adolescents with ASD showed lower connectivity between right SMA and bilateral DLPFC (p=0.022; p=0.021), and higher between left DLPFC and right SFG (p=0.012). The graph analysis revealed adolescents with ASD showed lower network efficiency than TD group (p=0.004) and children with ASD group (p=0.004). Moreover, the study found that the adolescents with ASD group showed lower

betweenness centrality, the degree and the nodal efficiency in channels within the DLPFC (p<0.05). Meanwhile the connectivity between bilateral DLPFC in the children with ASD group was significantly correlated with working memory index of WISC-IV (r=0.540, p=0.046), and the network efficiency of children with ASD group was correlated with the repetitive scores of ADOS (r=-0.681, p=0.010). The betweenness centrality of left DLPFC of adolescents with ASD group negatively correlated with working memory index (r=-0.493, p=0.038). The degree and nodal efficiency of left DLPFC of both ASD groups were negatively correlated with communication and reciprocal interaction of ADOS (p<0.05).

Conclusions: T

his atypical neural developmental trajectory of DLPFC related to the WM ability and severity of adolescent HFA. The DLPFC seemed to follow a "posterior to anterior" pattern in ASD, which was the opposite to that of TD.

248 **174.248** The Neurodevelopment of the Posterior Superior Temporal Sulcus As an Neuroendophenotype in Autism

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Background:

In functional and morphological studies among people with Autism Spectrum Disorder (ASD) and their families (Boddaert et al. 2004; Baron-Cohen et al., 2006, Spencer et al., 2011), one region of the social brain has been constantly disturbed: the posterior part of the Superior Temporal Sulcus (pSTS). Following the definition of the endophenotype (Gottesman & Good, 2003), the pSTS should be a potential neuroendophenotype in autism.

Cortical folding patterns of the pSTS and its three caudal branches (the anterior caudal branch (cSTS1), the intermediate caudal branch (cSTS2) and the posterior caudal branch (cSTS3)) (Segal & Petrides, 2012) have been solely investigated in ASD. Two studies only have demonstrated a longer cSTS1, specifically in the right hemisphere among children and adults with ASD (Levitt et al., 2003; Hotier et al., 2017). In our best knowledge, no study has established that neurodevelopmental abnormalities in pSTS exist among unaffected relatives of individuals with ASD

Objectives:

To compare the length of the three branches of the pSTS between three groups; one with ASD, one with their direct and unaffected relatives, and one healthy control group.

Methods:

We included 20 individuals with ASD, 70 of their direct unaffected relatives and 31 controls with no family history of autism [respectively: Mean Total Intellectual Quotient(sd) = 98(19); 115(14); 115(11) (p<0.0004) - Mean age (sd)= 18 (11); 34(16); 29(13); (p<7.73 x10^{-5})- Males/ Females % = 58/42; 44/56; 36/64; (p<0.22)]. Using the toolbox Morphologist in Brainvisa software, on structural MRI, we manually labeled the branches of the pSTS and extracted their length.

Mixed linear models were used with length of each branch of the pSTS in each hemisphere as dependent variable, group as independent variable and age, sex, Total IQ as control variables.

Results:

Only a specific effect of the group on the length of the right cSTS1 was present. The cSTS1 was significantly longer in unaffected relatives (52.1 mm) compared with healthy controls (43.3 mm) (p=0.004) and patients with autism (44.1 mm) (0.04). The length of right cSTS1 in the probands with autism did not significantly differ from healthy controls (p=0.8). No effect of the group, age or sex was present on the length of other branches of the STS, in the right or left hemisphere (p<0.05).

Conclusions:

We show that specific morphological abnormalities in a key region of the social brain are also present among unaffected relatives with autism. The morphology of the pSTS could be a candidate neuroendophenotype for autism.

249 **174.249** The White Matter Microstructure of Basal Ganglia Related Atypical Sensory Processing in ASD

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Background: Atypical sensory processing exists in individuals with ASD and white matter (WM) microstructure abnormalities may contribute to this. However, the underlying mechanisms have not been fully elucidated. Furthermore, it has been reported that atypical sensory processing is closely associated with other ASD symptoms, such as social impairment and repetitive restricted behavior and hence, it is assumed that these impairments share a common neural basis with atypical sensory processing. However, these assumptions remain to be clarified.
Objectives: This study aimed to investigate the relationship between WM microstructure and atypical sensory processing in ASD and the common neural basis with other ASD symptoms using diffusion tensor imaging (DTI) in an attempt to reveal the neural pathology of ASD, which contributes to atypical sensory processing.

Methods: We used DTI with a 3T scanner and the adolescent adult sensory profile (AASP) to investigate WM microstructure and abnormalities in sensory processing, respectively. We used MRI Cloud to analyze DTI data and calculated the fractional isotropy (FA) in each ROI. These data were acquired from 11 ASD patients without intellectual disabilities (FSIQ ≥ 80) and 14 sex-, handedness-, and intelligence-matched neurotypical subjects (NT).

Results: ASD individuals showed a higher score for both hypersensitivity (p < 0.01, d = 2.42) and hyposensitivity (p < 0.01, d = 1.17) on the AASP than did NT. A comparison of sensory processing for each sensory modality, revealed that ASD individuals obtained higher scores for touch

hypersensitivity (p < 0.01, d = 1.66), activity hypersensitivity (p < 0.01, d = 2.39) and hyposensitivity (p < 0.01, d = 2.04), and auditory hypersensitivity (p < 0.01, d = 3.05) and hyposensitivity (p < 0.01, d = 1.48). In comparisons of FA, ASD had a significantly lower FA in the white matter of the left putamen (p = 0.03, d = 0.93) and right supramarginal gyrus (p = 0.03, d = 0.91) than did the NT. Correlational analyses demonstrated that FA in the left putamen was negatively correlated with activity hypersensitivity (r = −0.556, p < 0.01) and hyposensitivity (r = −0.538, p < 0.01), and auditory hypersensitivity (r = −0.449, p = 0.02) and hyposensitivity (r = −0.434, p = 0.03). Conversely, FA in the right supramarginal gyrus was not associated with any AASP scores (all p > 0.05). Moreover, FA in left putamen was negatively correlated with the total score on the Social Responsiveness Scale-2, indicating the decreased FA in the left putamen is associated with a more severe autism symptom (r = −0.457, p = 0.02). These results suggest that WM microstructure abnormalities in the left putamen are closely associated with ASD pathology.

Conclusions: Decreased FA in the left putamen is associated with atypical sensory processing of activity and auditory sense in ASD. Additionally, decreased FA in this area was also associated with more severe ASD symptoms. These results suggest that individuals with ASD have an abnormality in the WM microstructure in the left putamen, which is associated both with atypical sensory processing and other ASD symptoms.

250 **174.250** Tract-Based Cluster Analysis: DTI Group Differences in Autism

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Background:

Previous studies have reported white-matter differences associated with autism on a wide range of anatomical regions using different methods. However, with conventional voxel-wise analysis it is difficult to associate anatomical specificity to changes occurring on a large and spread group of voxels, while the direct use of few selected tractography reconstructions or brain regions may limit the actual interpretation of global changes within the brain.

To investigate difference in microstructural organisation and diffusion properties between ASD and TD subjects we adopted a novel imaging analysis technique. Tract-based cluster analysis (TBCA[1]) is a method of voxel-clustering analysis that improves the anatomical specificity and the sensitivity of existing methods without being restricted to specific regions. Specifically, TBCA uses the anatomical coherence between white-matter voxels and the connectivity information provided by tracts to inform the voxel-cluster analysis within a non-parametric statistical framework.In this study, we present results using the TBCA approach on diffusion dataset from a large cohort as part of the UK-AIMS consortium (n=122).

Objectives:

To investigate white-matter differences in autism using diffusion imaging data from the UK-AIMS datasets and a new data-driven method of image analysis (TBCA).

Methods:

MRI acquisition: 61 male subjects with autism and 61 matched controls aged 18 to 45 years. Diffusion-weighted MRI data collected with b-value=1300 s/mm2, 32 diffusion weighted directions and 4 b0s volumes and isotropic voxel size of 2.4mm.

Data pre-processing: motion and eddy-current distortion correction were performed using ExploreDTI[2]. Whole brain DTI maps of Fractional Anisotropy (FA) were computed for each subject. Each FA map was normalised to the FMRIB58FA 1mm template using flirt/fnirt[3].

Statistical analysis: non-parametric cluster-level inference analysis was performed on FA voxels defined within a white-matter mask. For comparison, two methods were tested. One approach was based on the traditional cluster-level inference as implemented in SnPM[4] to detect significant clusters formed only by adjacent voxels. Method-2, tract-based cluster analysis with TBCA was applied to detect significant clusters formed by voxels anatomically connected and related to each other according to a connectivity template provide connectivity information for each WM voxel (for more details see Luque-Laguna 2018).

Results:

Figure-1-top: SnPM detected a single cluster covering a region white-matter region around the genu and the anterior body of the corpus callosum. Figure-1-bottom: TBCA consistently detected multiple clusters of voxels belonging to distinct white-matter tracts such as the left arcuate (green), left uncinate (blue), the genu (red) and the anterior body of the corpus callosum (pink). These tracts are consistent and in line with previous studies showing white-matter changes in adults with ASD.

Conclusions:

The new TBCA results show clusters where the diffusion properties of white-matter differ between ASD and TD subjects. These results also show an increase anatomical specificity simplifying the interpretation of these results. Further research is now required to replicate these results on additional dataset and on other quantitative metrics.

REFERENCES

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251 **174.251** Typical Cortical Concentration of GABA and Glutamate in Young Adults with Autism Spectrum Disorder

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Background: An imbalance of excitation and inhibition (E/I) in neural circuits has been postulated as a key neurobiological characteristic of autism spectrum disorder (ASD). Various evidence from genetics, animal models and post-mortem analyses point to a central role of the

inhibitory transmitter GABA, yet evidence in humans is lacking. Magnetic resonance spectroscopy (MRS) provides a non-invasive technique to measure concentrations of GABA and other neurometabolites *in vivo*. Several recent MRS studies have found reduced GABA concentration in children with ASD, lending support to the E/I imbalance model. However, results are inconsistent across experimental procedures, regions of interest, and sample characteristics, including the potential confounding effects of psychotropic medication use.
Objectives: Since developmental changes may underlie the mixed results of GABA in cross-sectional studies in children, we aimed to test GABA levels in young adults with ASD, at the end point of the developmental trajectory, while controlling for effects of sex and medication use.

Methods: Participants included 30 adults with ASD (19 male) with diagnoses confirmed through ADOS, ADI and clinical judgment using DSM-5 criteria, and included 39 age-, sex- , and IQ- matched neurotypical controls (22 male). MRS scans were acquired with a 3T scanner using MEGA-PRESS editing, in 5 different volumes of interest (VOIs; Figure 1A): medial occipital cortex, left temporal cortex, parietal cortex opposite to the participant's dominant hand, and in right and left lateral occipital cortex (functionally-defined human MT complex). GABA+ (GABA plus co-edited macromolecules) and Glx (glutamate plus glutamine) concentrations were quantified in each VOI using the Gannet GABA Analysis Toolkit, and scaled to water (Figure 1B). Measurements in the occipital VOI were repeated in two separate scanning sessions to assess test-retest reliability.

Results: There were no differences in GABA+ levels (Figure 2A), Glx levels (Figure 2B), or their ratio, between individuals with ASD and neurotypicals, in any of the VOIs (all t's<1.55). The same pattern of results was obtained when excluding participants treated with selective serotonin reuptake inhibitor drugs (SSRIs; NT: n=1; ASD: n=8), and when excluding participants treated with any psychotropic medications (NT: n=2; ASD: n=14). There were no sex differences in any of the MRS measures and no correlations with age. GABA+ and Glx concentrations did not correlate with ADOS, SRS, or Sensory Scale scores. Likewise, GABA+ and Glx did not correlate with behavioral measures of visual perception (motion discrimination thresholds or contrast detection thresholds, measured with psychophysical tasks). Test-retest repeatability analysis of the occipital VOI measurements revealed low coefficients of variation across sessions (GABA+: CV=4%; Glx: CV=6%) but poor intraclass correlations (GABA+: ICC=.24; Glx: ICC=.35; Figure 2C-D).

Conclusions: The current study provides a comprehensive set of measurements in 5 different VOIs in adults with ASD and found typical levels of both GABA+ and Glx concentrations in ASD, yielding no support for brain-wide alteration of E/I imbalance. We suggest that low test-retest reliability might limit the power to detect small group differences, and that better signal-to-noise is required in future studies.

252 **174.252** White Matter Microstructure of Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD)

ABSTRACT WITHDRAWN

Background: Previous researches have shown high rate of comorbidity (30-50%) between attention deficit hyperactivity disorder (ADHD) and autism spectrum disorder (ASD). Several studies reported that impaired structural brain connectivity was related to the core features of ASD and ADHD. However, only a few studies directly compared the white matter microstructure between ASD and ADHD. Sensory hypersensitivity is often existed in both individuals with ASD and those with ADHD, however little is known about the brain substrates related to sensory sensitivity in the two neurodevelopmental disabilities.
Objectives: The aim of the present study is to reveal the commonality and difference of white matter microstructure between adults with ASD and those with ADHD, especially concerning sensory sensitivity, using Diffusion Tenor Imaging (DTI).

Methods: A total of 218 adults participated in this study; 58 Normal Controls (NC), 105 ASD, 55 ADHD. Two medical specialists diagnosed ASD and ADHD according to DSM-5 criteria. ADOS-2 was conducted on 83 out of 105 ASDs. DTI data were processed using programs in the FMRIB Software Library (FSL) version 5.0. Automatic quality control was conducted with DTIprep. TOPUP was performed to correct susceptibility induced distortions. TBSS was used for voxelwise statistical analysis. Simple regression analysis using individual scores for sensory hypersensitivity was applied to FA values within clusters showing significant main effect of diagnosis on FA. The statistical threshold was defined at $p < 0.05$ (corrected for multiple comparisons). Age, gender and head motion were included as covariates.

Results: FA values of 7 clusters differed in FA across diagnostic groups. These clusters were located at genu, body, and splenium corpus callosum (CC) and posterior cocona radiata in right hemisphere. Post hoc analyses revealed both ASD and ADHD had lower FA compared to TD in 5 clusters. Two small clusters at genu of CC, voxel size 5 and 3, indicated reduced FA in ADHD compared to ASD and TD. Significant interaction effects of FA and sensory sensitivity were identified between Developmental Disabilities (DD) and NC in the cluster located at body of CC in right hemisphere.

Conclusions: Altered white matter microstructures in CC and posterior corona radiata were observed in both ASD and ADHD. Different effect of sensory hypersensitivity on FA was identified in CC between developmental disabilities and NC. This study suggested the similar alternation of white matter microstructure, including regarding sensory hypersensitivity, between ASD and ADHD. However, further studies are required to investigate the disorder-specific alternations since group differences in FA were observed between the two DDs in small regions.

253 **174.253** Shared Dynamic Emotional Face Processing in Children with ASD, OCD and ADHD and Controls: Data from the Pond Network

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Background: Autism spectrum disorder (ASD) is classically associated with poor face processing skills, yet increasing evidence suggest that those with obsessive compulsive disorder (OCD) and attention deficit hyperactivity disorder (ADHD) also have difficulties with understanding emotions. We contrasted fMRI measures of emotional face processing across these three clinical paediatric groups, compared with typically developing controls. We also investigated the developmental trajectories of face processing in these groups. As facial movements underlie facial expressions of emotion, we used dynamic faces, which have been shown to improve emotion identification.
Objectives: To determine a) if the processing of emotional faces differs across three developmental disorders (NDD), and b) if the neural mechanisms underlying emotional face processing develop differently in these groups.

Methods: 223 high-functioning children aged 5-19yrs were included in the current study, 87 with ASD, 44 with ADHD, 42 with OCD, and 94 typically developing (TD) controls. The fMRI stimuli were dynamic (480ms-long) faces (neutral-to-happy, neutral-to-angry) and dynamic flowers (closed-to-open), presented in 18 pseudo-randomized blocks (6 each of happy, angry, flowers) of 13.5s on a Siemens 3T MRI using a 12-channel head coil.

Subjects' data were slice-time and motion corrected, smoothed, intensity normalized and motion scrubbed (>0.9mm framewise displacement (FD)). Signal from the white matter, CSF, whole-brain, and 6 motion parameters were regressed out, and data were bandpass filtered (0.1-0.2Hz) and de-noised with FSL's FIX. FSL's FEAT was used to obtain the brain response for each subject to the happy, angry and flower task conditions. FSL's FLAME was used to investigate group-by-age interactions and group differences between the TDs and NDDs, using F-tests to examine shared differences to TDs across the NDDs, in the task condition contrasts, with sex and mean FD as covariates. Statistical images were thresholded using clusters determined by Z > 2.3 and a corrected cluster significance threshold of p = 0.05.

Results: F-tests investigating shared differences in the NDD group compared to TDs when processing happy and angry faces compared to flowers revealed shared increased activation in the right fusiform, bilateral lingual gyri and other occipital regions in the NDDs compared to TDs, with post-hoc tests revealing that this effect was being driven by the ASDs and OCDs. These two NDDs were also driving a significant F-test investigating group-by-age interactions to increased activation when processing happy compared to angry faces in the superior frontal gyrus, with ASDs and OCDs exhibiting a positive relation with age, and TDs exhibiting a negative relation. Furthermore, all three NDDs exhibited shared increased activation in the right occipital regions to happy compared to angry faces.

Conclusions: We provided evidence that children with ASD, ADHD and OCD demonstrate shared amplified activity in dynamic face processing compared to TDs, both across age and in their developmental trajectories, relying more on posterior brain regions with increases in frontal social-cognitive areas with age.

Poster Session
175 - Sensory, Motor, and Repetitive Behaviors and Interests
11:30 AM - 1:30 PM - Room: 710

254 **175.254** Longitudinal Change Profiles of Repetitive Behaviours in ASD Children, Adolescents and Adults over Two Time Points

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Background:
Restricted, repetitive behaviours and interests (RRB) are core features of autism spectrum disorder (ASD), some of which cause significant impairment and disrupt daily life (learning/socialisation). RRB are multi-faceted, ranging from self-injurious behaviour to circumscribed interests. Some evidence suggests that RRB symptoms decrease with age. Besides this, little is known about prognostic markers of RRB change, particularly outside toddlerhood. Here we test whether anxiety, sensory processing and/or executive function play a role.

Objectives:

To examine stability/change in RRB, in total and across different subdomains, and investigate factors that may predict change.

Methods:

164 children, adolescents and adults with ASD aged 6-30 years (M=15.55, SD=5.54) from the EU-AIMS Longitudinal European Project were included. RRB were assessed at two time points (T1, T2; time between: M=19.67 months, SD=3.37) using the Repetitive Behaviour Scale-Revised (RBS-R). Both total and subscale scores were examined. Anxiety was measured using the SDQ 'Emotional symptoms' score, sensory processing with the Short Sensory Profile. EF was indexed by cognitive flexibility (reversal learning: perseverative errors) and response inhibition (go/no-go: commission errors). Change scores were computed such that higher values indicate improvement. Change groups ('improve', 'no change', 'worsen') were calculated using +/-0.5 interquartile range of T1 median, due to skewness (1.49) – common on the RBS-R. We report effect sizes for Wilcoxon signed-rank test (*r*) and Spearman's correlations (r_s). Predictors of change were examined using linear regression.

Results:

At the group level, only the total and Stereotyped Behaviour subscale decreased significantly from T1 to T2 (total: effect size *r*=-0.15, *p*=0.006; stereotyped: effect size *r*=-0.16, *p*=0.004). Whilst total RRB severity was significantly negatively related to age cross-sectionally (T1:r_s*=-0.31,* T2:r_s=-0.26, *p*'s<0.001), degree of change did not vary with age (r_s=-0.08, *p*=0.29). *Change groups*: 18.3% of individuals showed improvement in total RRB, 69.5% showed no change and 12.2% worsened (Fig1). RRB subdomains showed similar profiles; 15.2-21.3% improved while 7.9-13.4% worsened. Change groups did not differ on age or IQ, however, there was a higher proportion of females in the 'worsen' group and a higher proportion of males in the 'improve' group (Fig2; X_2=6.49, *p*=0.03, φ=0.20). No differences were found between change groups in anxiety or sensory processing at T1. At T2, the 'worsen' group had significantly greater anxiety (X^2=11.19, *p*=0.004) and sensory symptoms (X^2=7.50, *p*=0.02) than both other groups. Change in sensory symptoms significantly predicted change in RRB (F(3,103)=5.358, p=0.002, R^2=0.24; sensory: p=0.004). Comparatively, change in anxiety significantly predicted RRB total at T2 (F(3,103)=4.285, p=0.007, R^2=0.22; anxiety: p=0.001). Groups did not differ on EF measures at T1 or T2, nor did performance changes between time points predict RRB change or T2 RRB total.

Conclusions:

We found RRB stability was considerably more frequent than change, though there was some evidence for overall RRB reduction over time. Males were over-represented in those who 'improved', whilst females were over-represented in those who 'worsened'. Findings support the close links between RRB, anxiety and sensory symptoms, but do not provide evidence for an EF role. Future research should further consider the mechanisms by which RRB symptoms ameliorate or deteriorate.

255 **175.255** Measuring Imitation Ability in Autism Using Dynamic Time Warping Applied to a Dance Videogame Task

R. N. Rochowiak[1], *C. Pacheco*[2], *R. Nicholas*[3], *E. Mavroudi*[2], *S. Rengarajan*[4], *G. Miller*[4], *B. Messenger*[4], *A. S. Pillai*[4], *R. Vidal*[2], *S. H. Mostofsky*[5] *and B.*

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Background:

Impaired motor imitation is commonly reported in individuals with autism spectrum disorder (ASD) and is thought to contribute to impaired development of reciprocal-social skills. To date, most imitation studies have relied on human observer coding (HOC) to detect presence/absence of certain elements based on behavioral coding schemes. The reliance on HOC is time-consuming, introduces coder bias and reliability issues, and limits assessment to predetermined elements delineated in coding schemes. Using a computer-based technique would eliminate coder bias, reduce time spent, allow for reliable comparisons across sites, and provide more complete assessment of movement dynamics. Further, most studies have examined imitation of single, discreet movements performed in unrealistic settings. Using a videogame task to assess motor imitation ability would allow for assessment across a range of realistic contexts.

Objectives:

This study aims to develop and validate the novel use of a machine learning algorithm, dynamic time warping (DTW), to investigate imitation ability in typically-developing (TD) children and children with ASD during performance of a dance videogame task.

Methods:

Thirty-six children aged 8-12 years (22 ASD; 3 females per group) participated. Children imitated a video avatar performing a 1-minute dance sequence comprised of 18 novel whole-body movements. Children's movements were recorded using two Kinect Xbox depth cameras at 30 frames-per-second, placed in front of and behind the child (Figure 1a). The x-y-z coordinates of 20 joints were extracted from the depth recordings using iPi Motion Capture Software.

HOC was used to assess imitation performance and to validate the accuracy of DTW. For each move, elements describing key changes in limb locations were defined (Figure 1a). Children received a score of 1 for each element performed; as such, higher HOC scores indicate better imitation accuracy (Figure 1b).

DTW temporally aligns the child's time-course to the avatar's time-course by minimizing the Euclidean distance between them. DTW distances of the 18 moves were averaged to make up the child's total DTW distance (Figure 1c). Higher DTW distances indicate greater difference between the child and the avatar, and hence poorer imitation. Preprocessing performed included positioning the hip as point of reference, normalizing the children's limb length to the avatar's skeleton, and adjusting the children's rotation to match the avatar's at the beginning of the activity.

Results:

HOC scores were reliability-coded by two hypothesis-blind coders (κ= .915, p< .001). HOC scores and DTW distances were significantly correlated ($r(35)$= -.77, p< .001) and this correlation held equally strong within the ASD ($r(22)$= -.77, p< .001) and TD ($r(14)$= -.74, p< .001; Figure 2) groups. Furthermore, DTW distances revealed significantly better imitation in TD than in ASD group (p= .02), and HOC scores confirmed this trend with near-significant values (p= .09; Figure 2).

Conclusions:

The present study provides evidence for the use of a computer-based algorithm (DTW) to investigate autism-associated differences in motor imitation during a naturalistic dance videogame task. This approach for assessing motor imitation could prove useful in establishing biomarkers for assessing diagnosis and response to intervention.

256 **175.256** Motor Skills in Children and Adolescents with Autism Spectrum Disorder

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Background: Children and adolescents with autism spectrum disorder (ASD) frequently display deficits in gross and fine motor skills, motor coordination, static and dynamic balance. These deficits, in turn, impair daily living tasks, such as feeding, handwriting, and buttoning, as well as motor performance in jumping, running, throwing, and sport-related activities. Subjects with ASD also present difficulties in integrating sensory input and motor output, particularly in anticipatory control and action planning.

Objectives: (1) To assess the prevalence, features and severity of motor deficits in ASD; (2) To define the clinical and patient history variables most differentiating ASD individuals with and without motor deficits; (3) To evaluate the applicability of the Movement Assessment Battery for Children-2 (Movement ABC-2) to test motor skills in ASD.

Methods: We performed a retrospective study on 100 ASD patients and a prospective study on 103 patients consecutively recruited at the Interdepartmental Program "Autism 0-90" of the "G. Martino" University Hospital in Messina (Italy). All patients were assessed using ADOS-2, ADI-R, Leiter-3, WPPSI-III, GDMS, PEP-3,VABS-II. Patients recruited for the prospective study were also assessed using the Movement ABC-2. All patients with neuroanatomical abnormalities at the MRI, history of seizures or severe EEG abnormalities, were excluded from the prospective study and data have been to this date analyzed for 55 patients (2-17 y.o., M:F=47:8).

Results:

Retrospective study - Motor deficits were detected by neurological examination in 60/100 (60%) ASD patients. Parents reported moderate-to-severe motor deficits in 57/100 (57%) for gross motor skills, 56/100 (56%) for fine-motor skills; 66/100 (66%) for visuo-motor coordination, 65/100 (65%) in bimanual coordination.

Prospective study – the Movement-ABC2 battery was completed by 26/55 (47.3%) patients. Motor deficits, either involving coordination, visuo-motor skills or balance, were recorded in 17/26 (65.4%) completers, confirming the estimates produced by our retrospective study. Non-completion of the Movement ABC-2 battery is significantly more frequent among patients with: (a) moderate or severe ASD (26/29, 89.7%, P=0.005); (b) co-morbid Intellectual Disability (27/29, 93.1%, P<0.00001); (c) deficits in receptive language with limited understanding of the instructions (22/29, 75.9%, P=0.007).

Conclusions: Moderate-to-severe deficits in motor skills have been recorded in 60-65% of ASD children and adolescents in our sample. The assessment of motor deficits in ASD is deeply influenced by autism severity, cognitive level and receptive language skills. The Movement ABC-2 battery is thus of limited use in ASD, because it can be reliably applied only to autistic subjects either high-functioning or at least endowed with

sufficiently developed receptive language. These limitations spur interest in new technologies applied to ASD children in naturalistic contexts. Addressing motor deficits in a personalized treatment plan may foster improvement not only in motor performance and self-esteem, but also in social cognition and executive functions.

257 **175.257** Multisensory Integration in Children and Adolescents with ASD: Susceptibility to the Flash-Beep Illusion

***S. Scholes**, K. Ainsworth and A. Bertone, McGill University, Montreal, QC, Canada*

Background: Atypical sensory processing is a key characteristic of Autism Spectrum Disorder (ASD; APA, 2013). One specific sensory process, which allows individuals to experience the world as a coherent whole, involves the ability to efficiently integrate stimuli from multiple sensory modalities, or multisensory integration (MSI). Research suggests that altered MSI may partially underlie sensory-related behaviours in ASD (Iarocci & McDonald, 2006; Zhou et al., 2018). There has been mixed evidence as to whether the MSI of non-social information (e.g. information void of social content) is altered in individuals with ASD (e.g. Stevenson et al. 2014; Bao et al. 2017). Additionally, little is known about the development of MSI across age.

Objectives: The goal of the study is to investigate the MSI of non-social information in individuals with ASD at different periods of development using the flash-beep illusion task (Shams et al. 2002).

Methods: Thirty-one individuals with ASD (27 males, 4 females) and 57 typically developing (TD) individuals (32 males, 25 females), aged between 6 and 18 years, completed a sound induced flash illusion task. On every trial, participants were presented with either one (1F) or two flashes (2F) with either zero (0B), one (1B), or two beeps (2B) congruently in time, resulting in six different audiovisual conditions; 1F/0B, 1F/1B, 1F/2B, 2F/0B, 2F/1B, and 2F/2B. The *fission* illusion trial is the 1F/2B combination, and the *fusion* illusion trial is the 2F/1B combination. Participants were asked to indicate if they viewed 'one' or 'two' flashes on the screen. In parallel to the task, participants completed the Wechsler Abbreviated Scale of Intelligence 2nd Edition (WASI-II) and the Sensory Profile Questionnaire.

Results: Participants were separated into four groups: ASD child (n=17; age <=12), ASD adolescent (n=14; age > 12), TD child (n=31; age <=12) and TD adolescent (n=26; age > 12). A 4 x 6 ANOVA (group x task condition) revealed a significant effect of condition ($p<.001$); a post-hoc Bonferroni comparison indicated that illusion trials were less accurate than non-illusion trials (suggesting participants were susceptible to the illusion). However, a significant group effect was also found ($p<.001$), with Bonferroni post-hoc analyses revealing a significant jump in accuracy between ASD children and ASD adolescents ($p<.001$), while there was no significant difference between TD children and TD adolescents ($p=.547$). This suggests a shift to being less susceptible to the illusion with age for ASD individuals but not TD individuals, specifically for the fusion illusion.

Conclusions: Our results revealed that TD individuals are susceptible to both illusions and this appears to be consistent across development. In comparison, adolescents with ASD were less susceptible to the fusion illusion than children with ASD, suggestive of less automatic MSI processes with age. Future research looking at MSI abilities, in ASD, for non-social information should do so within a developmental context.

258 **175.258** Predicting Self-Injurious Behavior at Age Three Among High-Risk Infant Siblings

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Background: Existing research suggests that self-injurious behavior (SIB) is a relatively common behavior disorder that can occur across the lifespan of individuals with autism spectrum disorder (ASD). Repetitive behavior is also a core diagnostic feature of ASD, but few empirical longitudinal studies have examined SIB specifically in the early years of life. We previously reported potential risk factors for SIB using psychosocial variables from 12 months of age to predict SIB at 24 months among a preschool sample of children at high familial risk for ASD (Dimian et al., 2017). In the present study, we extend these findings and examine SIB occurrence and associated potential risk factors at 36 months.

Objectives: 1) Extend our previous models on early potential risk factors with 12 months predictors of SIB occurrence at 24 months to predicting SIB occurrence at 36 months among toddlers at high familial risk for ASD; 2) investigate if sensory experiences and subtypes at 12 months of age predict SIB occurrence at 36 months, and 3) explore how topographies of SIB and stereotypy change across 12, 24 and 36 months of age.

Methods: Participants were from a longitudinal study of infants at familial risk for ASD. The present sample included 149 high-risk infants (65.8% male) who completed the following assessments at ages 12, 24, and 36 months: MSEL, Vineland-II, Sensory Experiences Questionnaire, and Repetitive Behavior Scales-Revised (RBS-R). The RBS-R was used to identify SIB and stereotypy. Descriptive analyses and binary logistic regression models were utilized to examine 12 month predictors for SIB at 36 months.

*Results***:** SIB was reported for 22% of participants at age 36 months and the risk of engaging in SIB was 3.36 times higher among children who received a diagnosis of ASD compared to children with no diagnosis. The first logistic regression model replicated Dimian et al. and included sex, MSEL and Vineland composite scores, and SIB and stereotypy from the RBS-R at 12 months. The overall model significantly predicted 36 month SIB ($\chi^2 = 29.7$, $p < .001$, $R^2_{pseudo} = 0.29$). Of individual predictors, Mullen composite score and stereotypy at 12 months were significantly predictive of SIB at age 36 months. A second model including Sensory subtype scores was evaluated. The overall model was significant ($\chi^2 = 38.9$, $p < .001$, $R^2_{pseudo} = 0.41$). Topographies of SIB and stereotypy changed in overall frequency over time and most children tended to engaged in hitting self against a surface.

*Conclusions***:** SIB was more prevalent among those children who received a diagnosis of ASD. Logistic regression results were mixed but the best fitting model indicated that presence of SIB, stereotypy, hyper and hypo responsivity, and lower intellectual functioning at age 12 months significantly predicted the occurrence of SIB at 36 months. These findings have implications for potential early intervention targets that could help inform prevention programming in the future, but more research is warranted.

259 **175.259** Predictive Motor Abilities in Children with Autism Spectrum Disorder: Evidence from Kinematics and Muscle Activity

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Background: Motor clumsiness has often been reported in individuals with autism spectrum disorder (ASD). However, as findings highly depend on the testbeds and inclusion/exclusion criteria, no common denominators or causal underpinnings of motor impairments in ASD have been identified. A recent theoretical framework from our group suggests that the seemingly distinct manifestations of ASD in multiple domains may share a common core: an impaired ability to make predictions. Difficulties in language, cognition, social interactions, repetitive behaviors, and motor coordination may all result from the same underlying impairment, albeit at different time scales. This study thus examined motor impairments through the lens of predictive control.

Objectives: We tested the hypothesis that individuals with ASD show reduced motor coordination when interacting with moving objects, specifically when performing actions that involve prediction. We examined whether impairments depended on the degree of prediction challenges in ASD.

Methods: Sixteen children with ASD (aged 7-12 years) and 26 age- and IQ-matched neurotypical (NT) children participated in a series of motor tasks involving catching in both naturalistic and virtual environments. While performing naturalistic ball catching, 3D joint kinematics and muscular activities in participants' arm, leg, and trunk were recorded to quantify predictive motor behaviors. A set of control tasks assessed postural balance, reaction time and movement speeds when reaching to a static ball. The same individuals performed virtual interception tasks that simplified the coordination challenges and also afforded manipulating the time window for prediction. Catching accuracy was evaluated by temporal and spatial errors. A control virtual task was designed to be analogous to the experimental tasks when assessing reactive action.

Results: In naturalistic ball catching, ASDs showed a lower percentage of successful catches compared to NTs ($p=0.01$). While NTs approached the ball with a relatively stable profile of hand velocity, ASDs exhibited a collision-like motion at ball contact, suggesting insufficient prediction. Reduced predictive control in ASD was also evident in the muscles; ASDs showed peak muscular activity in trunk muscles at catching moment while NTs showed preparatory muscle activation prior to catching ($p=0.02$). Further, ASDs exhibited more pronounced co-activation of biceps and triceps, consistent with abrupt ball interception ($p=0.01$). In contrast, postural sway during quiet standing and reaction and movement time during the control tasks did not show difference between ASDs and NTs ($p>0.3$). In the virtual interception tasks, ASDs' accuracy in catching indicated significantly worse performance, especially when occlusion of the ball trajectory enhanced the predictive challenge ($p=0.02$). In a control test of reaction time, ASDs did not differ from NTs, neither in reaction nor movement time ($p>0.5$).

Conclusions: Results from a suite of prediction-based tasks revealed that ASD children manifest reduced predictive motor control. Further, the impairment depended on the degree of predictive challenge. These findings suggest that the ability to predict may be a unified mechanism explaining phenotypic variations across ASD individuals. With this theoretical context, the results have implications beyond motor skills towards a more encompassing understanding of autism.

260 **175.260** Prescribing Yoked Prism Lenses- Examiner Agreement Using the Kaplan Nonverbal Battery

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Background:

Autism Spectrum Disorder (ASD) is marked by deficits in social communication and behavior, and difficulties in sensorimotor function, including visual processing.[1,2] Yoked prism lenses, an optometric intervention, target dysfunctions in the ambient vision system. ASD individuals wearing yoked prism lenses have demonstrated improvements in posture, spatial awareness, and behavior in double blind studies[3,4] Though results support clinical application, prescribing studies have been limited to one single investigator team [5,6] This study evaluates the clinical method for determining yoked prism prescriptions for ASD individuals using the Kaplan Nonverbal Battery (KNB). The KNB is a series of nine tasks that do not require verbal response from patients; it is scored using a 5-point scale focusing on 39 facets of the tasks.[7]

Objectives:

To determine inter-examiner agreement between two masked examiners evaluating yoked prism prescription using the KNB by live and video presentation.

To determine intra-examiner agreement between two masked examiners evaluating habitual correction using the KNB by live and video presentation.

Methods:

Ten nonverbal, or minimally verbal, ASD subjects between 9 and 17 years old were enrolled and completed a comprehensive eye examination. All subjects adapted to spectacles by wearing their refractive correction, or plano lenses if emmetropic, for four weeks. Subjects then completed two videotaped study visits; at each visit, they completed the KNB wearing their habitual spectacle correction and then wearing yoked prism lenses of five-prism diopters base up or down. Two examiners assessed subjects' performance on the KNB live. Two other examiners assessed the subjects' performance via video recordings. Examiners were masked to the prescription of the yoked prism lenses and other examiner responses. Agreement between and within examiners was computed using the weighted version of Cohen's kappa.

Results:

Nine out of ten subjects completed both study visits and all nine tasks of the KNB. Inter-examiner and intra-examiner agreement were calculated for both the live and video presentations. Both inter-examiner and intra-examiner agreement were markedly better when examiners scored results using video presentation. In the yoked prism lenses evaluation, overall inter-examiner agreement for live presentation was 0.726 (visit 1) and 0.357 (visit 2), but on video presentation increased to 0.702 (visit 1) and 0.678 (visit 2). In evaluation of the habitual correction, intra-examiner agreement on live presentation was 0.451 for examiner 1 and 0.579 for examiner 2, but increased to 0.861 for examiner 3 and 0.875 for examiner 4.

Conclusions:

Masked examiners using the KNB to determine the yoked prism prescription for nonverbal or minimally verbal ASD children showed good inter-examiner agreement when evaluating videotaped presentation, but not by live presentation. Intra-examiner agreement in assessing KNB when the subject wore their habitual correction also was very good. Clinicians and investigators using the KNB to determine yoked prism prescription

show good agreement when evaluating videotaped performance.

261 **175.261** Prevalence of Motor Impairment in Autism Spectrum Disorder: Analysis of a Population-Based Cohort

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Background: There is mounting evidence to support motor impairment as a key clinical feature of Autism Spectrum Disorders (ASD). With prevalence reports as high as 79%, and delays in motor milestones preceding other clinical features, motor impairment appears to be an important clinical feature that may be overlooked in the diagnostic process.

Objectives: The present study examined the prevalence of motor impairment at time of diagnosis in a large cohort of children with ASD, and to investigate the relationship between motor impairment and core features of the ASD phenotype.

Methods: Vineland Adaptive Behavior Scale (VABS) motor scores were examined in a sub-cohort of children aged ≤ 6 years from the Western Australian Autism Register (N = 2084; 81.2% males, 18.8% females). Motor scores were compared to other domains within the VABS (communication, daily living socialization), across DSM criteria, intellectual level, age and gender.

Results: A total of 35.4% of children scored in the low range on the motor skill subdomain of the VABS, and a further 43.7% in the moderately low range (combined total of 79.1%). This frequency was slightly lower than the other VABS subdomains, with 79.1% scoring in the low and 17.7% in the moderately low ranges for social skills (combined total of 96.8%), 62.3% scoring in the low and 29.3% in the moderately low ranges for daily living (combined total of 91.6%), and 65.7% scoring in the low and 24.9% moderately low ranges for communication (combined total of 90.6%). Whilst the prevalence of poor motor scores was high, motor impairment was only reported as a comorbid condition by diagnosing clinicians in 1.34% of the sample. Motor scores were lower in children diagnosed with ASD at a later age ($p<0.001$), and children with intellectual impairment (37.7% of the sample) had motor scores lower than those without ($p<0.001$). Examination of motor scores based on diagnostic criteria from the DSM revealed that those cases meeting the diagnostic criteria for impairments in non-verbal behaviour (i.e., body postures and gestures) and restricted and repetitive behaviours (i.e., motor stereotypies) displayed lower motor scores than those without.

Conclusions: The prevalence of motor impairment found in this large cohort was at least as common as one current diagnostic specifier. This highlights the need for further consideration of motor impairment within diagnostic evaluation for ASD.

262 **175.262** Sensory Reactivity Symptoms Are Related to Specific Anxiety Symptomology in Autistic Children

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Background:

Sensory reactivity symptoms are reported in around 60-90% of autistic individuals, such as being hyperreactive (e.g. over-sensitive to sounds), hyporeactive (e.g. under-responsive to touch), or sensory seeking (e.g. fascinated by lights). Additionally, over half of autistic children experience co-morbid anxiety disorders, which can impact learning, social inclusion, and future prospects. Sensory hyperreactivity can be distressing and has previously been linked to anxiety in autistic children. However, hyporeactivity and seeking behaviours are often neglected in research. Therefore, it is unclear if different sensory reactivity constructs relate to anxiety generally, as well as specific anxiety symptomology, such as generalised anxiety disorder (GAD) or obsessive-compulsive disorder (OCD).

Objectives:

This study aimed to elucidate the relationships between sensory reactivity sub-types (i.e. sensory hyperreactivity, hyporeactivity and seeking behaviour), and specific anxiety symptomology in autistic children.

Methods:

Sensory reactivity and anxiety were assessed for 40 autistic children (age 4 – 14 years, 11 females, 29 males) using a multidisciplinary approach, combining caregiver questionnaires, direct observation and self-report.

Caregiver reported sensory reactivity was measured by the Sensory Profile 2 (SP2) and Sensory Processing Scale Inventory (SPSI). Observed and caregiver-reported sensory reactivity was measured by the Sensory Assessment for Neurodevelopmental Disorders (SAND). Composite scores were derived from these measures for sensory hyperreactivity, hyporeactivity, and seeking behaviour.

Caregiver-reported anxiety was measured by the Spence Children's Anxiety Scale (SCAS), the Preschool Anxiety Scale (PAS), which provide a score for total anxiety symptoms, and sub-scores for symptoms of panic attack/agoraphobia, separation anxiety (SAD), physical injury fears, social phobia, OCD, and GAD. Self-reported anxiety was measured using the Dominic Interactive computer game, which provides scores indicative of GAD, SAD, and specific phobia.

The relationship between sensory reactivity sub-types and specific anxiety symptoms were analysed using a bivariate correlation analysis, and a partial correlation analysis controlling for age. Significant multicollinear relationships were then analysed using hierarchical regression to explore predictive relationships.

Results:

Bivariate correlation analysis revealed principal correlations between sensory hyperreactivity and specific anxiety symptoms; total anxiety symptoms ($r = .54$, $p = .002$), SAD ($r = .48$, $p = .005$), physical injury fears ($r = .48$, $p = .005$) and GAD ($r = .42$, $p = .03$). OCD related to sensory hyperreactivity ($r = .44$, $p = .01$), hyporeactivity ($r = .58$, $p = .001$) and seeking behaviour ($r = .37$, $p = .04$). Hierarchical regression analyses established that hyporeactivity and hyperreactivity explained 39% of the variance in OCD, $F(2,32) = 6.3$, $p = .002$.

Conclusions:

The results suggest that sensory hyperreactivity is primarily related to specific anxiety symptomology and predicts total anxiety symptoms, and that sensory hyporeactivity could be a key predictor of OCD in autistic children. Understanding the role of sensory reactivity symptoms in anxiety

is important for developing early clinical interventions, aimed at improving mental health outcomes. Future directions should determine the developmental relationship of sensory reactivity symptoms and specific anxiety symptomology, and further define the role of sensory hyporeactivity and seeking behaviour in the development and maintenance of anxiety symptoms in autistic children.

263 **175.263** Relations Among Repetitive Behaviors and Language in Toddlers at Familial Risk for Autism

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Background:
Previous studies have shown that restricted and repetitive behaviors (RRBs) are negatively associated with communication ability among school-aged children and adolescents with ASD (e.g., Dominick et al, 2017). However, the relationship between RRBs and communication during early childhood has not been well-characterized, and existing findings are mixed. Most previous work has examined communication as a single construct rather than decomposing communication into components of expressive, receptive, and social communication. Understanding whether RRB differentially relates to expressive, receptive, and social communication could shed light on previous disparate findings and inform intervention.

Objectives:

The purpose of this study was to examine relations among receptive and expressive language, socialization, and RRBs for 24-month-olds at high familial risk of ASD. A secondary purpose was to evaluate whether relations differ between children who did versus did not meet diagnostic criteria for ASD.

Methods:

Participants included n=426 toddlers at high familial risk for ASD. Of these, n=113 met criteria for ASD classification at age 24 months (HR-ASD) and n=313 did not (HR-Neg). We measured using the Restricted Behavior Scale-Revised (RBS-R, Bodfish et al. 2000), and represented RRB using a three-factor model with lower-order RRB, higher-order RRB, and SIB factors (Mirenda et al., 2010). We measured receptive and expressive language using the relevant subscales from the Mullen Scales of Early Learning, Macarthur-Bates Communication Development Inventory, and the Vineland Adaptive Behavior Scales (MSEL; Mullen, 1995; MCDI, Fenson et al., 1993; and VABS-II; Sparrow, Balla, & Cicchetti, 2005), and we measured socialization with the VABS-II. We used structural equation modeling to compare the extent to which data fit five models testing different relations among receptive and expressive language, socialization, lower-order RRB, higher-order RRB, and self-injurious behavior (SIB). Models controlled for sex and diagnostic status. The measurement model was confirmed using confirmatory factor analysis prior to running the full model, and all factors showed acceptable fit. We next compared model fit for groups on the basis of ASD classification (HR-ASD vs. HR-Neg).

Results:

The best-fitting model included receptive and expressive language predicting lower-order RRB, higher-order RRB, and SIB. This model had acceptable global fit with significant direct paths from receptive language to all RRB factors. No direct paths from expressive language to RRB were statistically significant. Global model fit was also acceptable for the separate groups of HR-ASD and HR-Neg. Factor loadings and covariances were similar between groups. When considering subgroups, the only significant direct path was from receptive language to lower-order RRB among the ASD group.

Conclusions:

These findings inform an understanding of early relations of RRB to communication by showing evidence of an association between receptive language and RRB for toddlers at high risk for ASD. Additionally, these findings suggest that associations among language and RRB differ minimally between children at high familial risk with and without an ASD classification.

264 **175.264** Repetitive and Stereotyped Behaviors in Autism: A Longitudinal Exploration of the Repetitive Behavior Scale-Revised throughout Childhood

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Background: Repetitive and stereotyped behaviors are a core domain of autism spectrum disorder (ASD); however, little is known about how these behaviors co-occur and evolve with time, and how they correlate with other developmental outcomes. Previous study results tend to differ depending on what measure is used. To date, the Repetitive and Behavior Scale –Revised (RBS-R; Bodfish et al., 2000) is the most frequently used in the literature. Mirenda et al. (2010) validated the use of this parent-report questionnaire in a large cohort of young children with ASD using confirmatory factor analysis based on models proposed in the literature. They reported that a three-factor model yielded the most parsimonious results and that the three factors correlated negatively with adaptive behaviors, while none correlated with IQ.
Objectives: The goal of this study was to explore the evolution of repetitive and stereotyped behaviors exhibited throughout childhood using the Mirenda et al. (2010) sample and to document the associations between the trajectories identified and developmental outcomes.

Methods: Data were drawn from the Pathways in ASD cohort (N=421). Participants were assessed using the Repetitive Behavior Scale-Revised at the time of diagnosis(T1), 6 months(T2) and 12 months(T3) later, and followed-up at ages 6 years(T4), 9 years(T5), and 11 years(T6). Assessments of developmental outcomes (Vineland Adaptive Behavior Scales for adaptive functioning, the Perceptual Reasoning Index of the WISC-IV for non-verbal IQ, and the Core Language score of the Clinical Evaluation of Language Fundamentals for language) were completed at T5 or T6 (only the most recent assessment was considered). To create a measure of the number of different behaviours exhibited that was independent of severity,

43 items on the RBS-R were recoded into dichotomous variables and summed. Scores 1-3 were assigned a 1 (exhibits behaviour), while items with a score of 0 remained (does not exhibit behaviour). Group based trajectory modeling analysis was then performed to describe children's RBS-R trajectories using these summed scores. One way ANOVAs were used to examine whether trajectory groups were associated with developmental outcomes.

Results: A five-group trajectory model was determined the best fit. Trajectory 1(11.5%) had the lowest numbers of RBS-R exhibited behaviours throughout the time period, followed by trajectory 2(28.2%). They both tended to decrease gradually with time. Trajectories 3(19.5%) and 4(24.8%) had higher numbers of exhibited behaviours at T1, but trajectory 3 decreased considerably from T2 to T4 whereas trajectory 4 slowly increased during the time period. Trajectory 5(16.1%) had the highest numbers of exhibited behaviours at all time points and tended to decrease with time. Children in trajectories 4(increasing) and 5(highest) had lower adaptive functioning (p<.001). Children in trajectory 4 also had lower language levels (p<.05). Non-verbal IQ did not differ between groups.

Conclusions: These results are a first step toward a better understanding of how the numbers of exhibited repetitive and stereotyped behaviors change over time in autism. Such longitudinal approaches can be useful in understanding how this domain of symptomatology is linked to development. Further insight involving the role of behaviour severity, in addition to its appearance, is also warranted.

265 **175.265** Restricted Repetitive Behaviors Related to Increased Activity at Ends of the Power Spectrum: Results from the ABC-CT Interim Analysis

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Background: Individuals with autism spectrum disorder (ASD) exhibit high variability across symptom domains. To better understand the neural mechanisms behind clinical heterogeneity, it is important to investigate whether symptoms are associated with specific facets of brain activity. While there have been many studies assessing brain function in ASD, relatively few have examined how brain activity correlates with specific symptoms of ASD independent of a task. Previous research has found that increased behavioral rigidity, a common symptom in ASD, is correlated with increased alpha power in typically developing individuals. However, this relationship has not been directly investigated in individuals with ASD.

Objectives: To investigate whether a relationship exists between behavioral rigidity and alpha power in a sample including individuals with ASD.

Methods: 215 children between the ages of 6 and 11 years 7 months were recruited. 152 met criteria for ASD and 63 were typically developing (TD). EEG data was recorded using an EGI 128 channel net at a sampling rate of 1000Hz for three minutes while participants viewed an abstract screensaver (changing colors). Restricted repetitive behaviors (RRBs) were measured using subscales of the Autism Diagnostic Observation Schedule 2 (ADOS-2) and the Social Responsiveness Scale (SRS).

Results: T-tests were run comparing power bands of the EEG frequency spectrum; delta (1 to 3Hz), theta (4 to 7 Hz), alpha (8 to 12 Hz) beta (13 to 35 Hz) and gamma (>35 Hz) bands between diagnostic groups. No group differences were found (p>0.05). However, RRB symptoms as measured by the ADOS-2 and SRS were correlated with the EEG measures. Increased ADOS-2 RRB symptoms were significantly associated with greater absolute delta power (r=0.12,p=0.019), absolute theta power (r=0.12,p=0.017), absolute beta power (r = 0.11, p=0.024) and absolute gamma power (r=0.18, p=0.00032) but not absolute alpha power (r=0.066,p=0.19). Correlations with the SRS measure of behavioral rigidity were likewise significant for delta (r=0.11, p=0.030), theta (r=0.11, p=0.029), beta (r=0.12, p=0.014), and gamma (r=0.18, p=0.00050) bands but not for the alpha band.

Conclusions: Compared to findings from prior research in TD adults, in this study, increased activity at the ends of the power spectrum (delta, theta, gamma, and beta bands), but not in alpha, were associated with RRBs in participants with ASD. Other studies that have found that the extremes of the power spectrum are increased in ASD while alpha power is reduced, and postulate that this difference is partially related to abnormal GABAergic inhibitory tone in ASD (Wang et al 2013). Our results suggest that RRBs are a behavioral correlate of this phenomenon. GABA is thought to reduce power in the extremes of the spectrum and increase power in the alpha band (Gabard-Durnham et al 2012). Increased RRBs may indicate increased dysregulation in GABA tone in individuals with ASD. These results are a step towards specific linkages between cortical mechanisms and clinical symptomology.

266 **175.266** Sensitivity to Sounds and Touch and Sleep Concerns in Children with ASD

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Background: Sleep problems are commonly reported in children with ASD. Hyper or hypo-reactivity to sensory input is one of the diagnostic criteria for ASD, and may play a role in severity of sleep problems.

Objectives: To examine the relationship of sensitivity to sounds and touch with sleep problems in children and adolescents with ASD as measured by the Composite Sleep Disturbance Index (CSDI).

Methods: U.S.-based primary caregivers of children with ASD were recruited from a validated and verified national autism registry. Parents completed an online survey on co-occurring conditions that incorporated family and child demographic information including the CSDI, a validated tool that scores the frequency and duration of six sleep habits (scored 0-2) over the previous month; total score range=0-12; score≥4 indicates a severe sleep problem. Parents were asked to rate their child's sensitivity to sounds and to touch on a scale from 0 to 3 with 0 = absent and 3 representing most severe. Descriptive statistics, Pearson chi-square, and logistic regression were performed.

Results: 604 parent/child dyads with responses about both sound sensitivity and touch sensitivity were analyzed. Responding parents were the primary caregiver, primarily female (94%), white (89%), and non-Hispanic (92%); mean age of 43.35 (SD 7.26; range 25-65) years. Children were

primarily male (81%), white (83%), and non-Hispanic (88%); mean age of 12.1 (SD 3.61; range 3-17) years. Median household income was $70,000-$79,000. On the CSDI, parents rated their child's sleep problems as Severe (score≥4)=374 (61.9%) vs. Not Severe (score<4)=230 (38.1%). Caregivers of children with severe sleep problems reported a higher rate of sound sensitivity ($\chi2(3)= 35.112$, $p=0.000$) or touch sensitivity ($\chi2(3)= 27.8749$, $p=0.000$) when compared with children without severe sleep problems (see Figures 1 and 2). Children with severe sleep problems had higher rates of moderate or severe sound and touch sensitivity when compared with children without severe sleep problems - Severe vs. Not Severe Sleep Problems: Moderate Sound-Touch Sensitivities 46% vs. 31%, Severe 14% vs 7% ($\chi2(3)= 42.8942$, $p=0.000$). Sound-Touch Sensitivity were highly correlated ($r=0.488$, $p=0.000$). Being female (OR 1.64, $p=0.036$) and younger age (OR 0.94, $p=0.020$) were weakly predictive of having combined sound-touch sensitivity.

Conclusions: The prevalence of reported severe sleep problems increases as parents report severity of either sound sensitivity or touch sensitivity indicating that sleep problems and touch/sound hypersensitivities are associated. Sleep problems are known to be associated with increased behavioral problems and can have negative impact on both child and family functioning. Further study is needed to determine causality, namely, if sleep problems exacerbate sensitivity to sound or touch, or if sound or touch sensitivity exacerbate sleep problems. The presence of parent reported sound or touch sensitivity in their child with ASD should prompt screening for other comorbid conditions such as sleep problems.

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267 **175.267** Sensorimotor Deficits in Individuals with Autism Spectrum Disorder and Their Unaffected Biological Parents

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Background: Sensorimotor impairments are highly prevalent in individuals with autism spectrum disorder (ASD), and reduced precision of eye movements in unaffected parents and siblings of individuals with ASD also has been documented. The degrees to which sensorimotor impairments are present across oculomotor and manual motor systems in unaffected parents and are familial have not yet been determined. Objectives: 1) To examine the precision of eye movements and manual force in individuals with ASD and their biological parents, and 2) to determine whether sensorimotor abilities are inter-correlated among individuals with ASD and their parents.

Methods: We studied 48 probands with ASD and 102 parents of individuals with ASD (ASD parents). Among the probands and parents, 34 family trios were studied (i.e., proband and each biological parent). Thirty-three typically developing (TD) controls were matched with probands on age (range: 4-27 years), gender ratio, and nonverbal IQ. An additional 47 TD controls were matched with ASD parents on age, sex and IQ. Participants completed a visually-guided saccade (VGS) task in which they fixated on a central cue, and made rapid eye movements (i.e., saccades) to peripheral targets presented at ± 12 and 24 degrees from center. Participants also completed a sustained precision grip force task in which they pressed opposing load cells with their thumb and index finger while they viewed a static red/green target bar and a white force bar that moved upwards with increased force. They were instructed to press when the target bar turned green so that the white bar reached the level of the target bar and hold it there as steadily as possible for 8 seconds. Participants completed the precision force task at 15%, 45%, and 85% of their maximum force.

Results: During the VGS task, probands showed reduced saccade accuracy compared to controls at 24 deg. ASD parents showed greater saccade error variability compared to controls at 24 deg. During precision gripping, probands' force was less accurate than controls during their initial pressing and when they sustained their force during the trial. ASD parents also were less accurate than controls during their initial pressing. Data collection is complete, and analysis of the familiality of sensorimotor issues in ASD is ongoing.

Conclusions: Our findings indicate that reductions in the precision of eye movements and manual motor behaviors previously documented in individuals with ASD also are present in unaffected biological parents suggesting that these deficits may be familial. Importantly, these deficits include reduced precision of both rapid movements controlled by predictive motor control processes as well as sustained motor behaviors guided by sensory feedback processes. These studies implicate multiple distinct sensorimotor control processes in the pathophysiology of ASD that may be important new targets for family genetic studies.

268 **175.268** Sensorimotor Integration in Autism Spectrum Disorders: A Behavioural Meta-Analysis

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Background: Sensorimotor skills are often reported as atypical in individuals with autism spectrum disorders (ASD). Daily motor behaviours as diverse as grasping an object or regulating walking gait require the integration of sensory information. While intact sensorimotor integration is essential to navigate our everyday world, little is known about how atypical sensorimotor skills in ASD may vary across development and with clinical symptom severity.

Objectives: The main objective of this study was to conduct a comprehensive quantitative meta-analysis of sensorimotor skills in ASD. The specific aims were: to assess the consistency of atypical gross and fine sensorimotor behaviors in ASD, to examine the relationship between sensorimotor skills and ASD symptom severity, and to examine the effect of age on sensorimotor skills in ASD.

Methods: An exhaustive search was conducted in Psycnet, PubMed, Web of Science and Cochrane Database to identify studies in ASD from 1980 to 2018 that involved quantitative evaluations of motor coordination, motor impairments, arm movement, gait, postural stability, visuomotor or auditory motor integration. A total of 232 studies were identified, reviewed and coded. The Comprehensive Meta-Analysis software 2.0 (Borenstein, Hedges, Higgins, & Rothstein, 2005) was used to calculate study effect sizes (Hedges' g) and analyze overall effect size using random effects models. The I2 index was used to examine heterogeneity across studies (Higgins et al., 2003). Visual inspection of funnel plots and a trim-and-fill procedure were used to assess the presence of publication bias (Duval & Tweedie, 2000).

Results: Results strongly support the presence of deficits in overall sensorimotor abilities in ASD (n=127, g=1.25, SE = 0.08; p< 0.001, CI=1.10-1.40). More specifically, these atypicalities extended to both fine motor abilities (n=76, g=1.16, SE = 0.1; p < 0.001, CI=0.96 -1.36) and gross motor abilities

(n=67, g=1.31, SE= 0.11; p < 0.001, CI=1.10-1.52). However, clinical severity did not show a significant relationship with sensorimotor behaviors in available studies (n=19, r= -0.15; p= 0.21, CI=-0.37-0.08). Finally, a smaller analysis found an association between increasing age and improved sensorimotor behaviors in ASD (n=5, r=0.37; p< 0.001, CI=0.19-0.52). Heterogeneity of variance for all analyses was moderate to large (34-86%, except 0% for age), supporting the use of a random-effects approach. No evidence of publication bias was found.

Conclusions: These meta-analyses strongly support the presence of sensorimotor impairments that extend to both fine and gross motor skills in ASD. Deficits decrease with age, but do not appear to covary with social/communication symptom severity. This work provides a novel contribution to the field by quantitatively examining relationships between sensorimotor skills, development, and clinical symptom severity in ASD. The ultimate mission of this research is to set a theoretical groundwork for future sensorimotor-based interventions (e.g., music and dance) in ASD. By better understanding differences in sensorimotor deficits in ASD, it is hoped that interventions can be better designed to target these deficits.

269 **175.269** Sensory Correlates of Autism Risk in the First Year of Life: A Multi-Cohort Study

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Background: There are reports that sensory features in the first year of life may be linked to early signs of Autism Spectrum Disorder (ASD). Sensory features refer to atypical responses to daily sensory stimuli in the environment. Responses can be described as hyper-reactive (sensitive or avoiding), hypo-reactive (poor registration) and/or as unusual sensory interests (seeking). Parents of children with ASD often report concerns regarding their child's development in the first year of life although diagnosis does not typically occur until 3-4 years. Sensory features are observable in young children in infancy. To date, however, there are few studies investigating which sensory features in the first year of life may indicate risk for ASD.

Objectives: This study examines the relationship of sensory features to ASD risk in 12-month-old infants from varying risk cohorts.

Methods: Infant participants were members of one of three baby cohorts – babies born to mothers with asthma (asthma; n=69; mean age=12.7 months), babies born preterm (preterm; n=30; mean corrected age=12.19 months) and general population controls (controls; n=50; mean age=12.3 months). All infants attended a study visit where developmental (Bayley-III), sensory (Toddler Sensory Profile 2/TSP2; Test of Sensory Function in Infants/TSFI) and ASD risk (First Year Inventory; FYI) measures were administered. Spearman rho correlation analyses were conducted by cohort examining the relationship of sensory features with ASD risk. Preliminary stepwise regression analysis was then used to identify the most salient sensory features predictive of increased ASD risk across all three baby cohorts. Cognitive function was included in all analyses as a co-variate.

Results: FYI Total Risk score was negatively associated with Bayley Cognitive Composite score in asthma and control baby cohorts (asthma r_s=-0.35, p=0.003; controls r_s=-0.35, p=0.02) but not the preterm group (r_s=0.27, p=0.16). In the asthma group, FYI Total Risk was further associated with TSP2 sensory sensitivity (r_s=0.41, p=0.001), sensory avoiding (r_s=0.26, p=0.03) and poor sensory registration (r_s=0.31, p=0.01). In the preterm group, there were no significant associations between FYI Total Risk and any of the sensory measures. In the control group, FYI Total Risk was associated with TSP2 sensory avoiding (r_s=0.33, p=0.02). No significant associations were observed between the TSFI total score and FYI Total Risk. Preliminary stepwise regression analysis revealed TSP2 sensory sensitivity as the best predictor of FYI Total Risk across all three cohorts (R^2=0.26, F=35.02, p=0.001).

Conclusions: The relationship of sensory features to ASD risk at 12 months of age varied by infant cohort. Sensory sensitivity, however, was identified as a moderate level predictor of ASD risk at 12 months of age independent of cognitive function and cohort membership. These findings suggest that early sensory sensitivity may be a common variant in infants with risk for ASD. Further elucidation of the variance in sensory features across infant cohorts, however, may assist in identifying distinct sensory phenotypes associated with early autism risk.

270 **175.270** Sensory Processing As a Transdiagnostic Mechanism for Behavioural Outcomes in ASD and ADHD

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Background:

The most commonly reported symptoms in autism spectrum disorder (ASD) are sensory processing issues. Atypical sensory processing has been found to contribute to specific aspects of autistic symptomatology, including decreases in speech perception and restricted interests and repetitive behaviours. The extent of the cascading influence that sensory issues have has yet to be determined. Furthermore, atypical sensory processing is not unique to ASD, and it is unknown whether the impact of sensory processing issues is unique to ASD. This project addresses these two outstanding research questions.

Objectives:

This project aims to examine the pathway from sensory processing issues to higher-order symptoms in ASD and compare this symptom trajectory between ASD and attention-deficit/hyperactivity disorder (ADHD) and their typically-developing (TD) peers.

Methods:

Data were collected from 2388 participants through a large-scale, multisite data collection project. 519 participants with ASD (N=202), ADHD (N=181), or TD (N=120) completed the measures of interest on adaptive functioning (Childhood Behaviours Checklist; CBCL) and sensory processing (Short Sensory Profile; SSP) and thus, were included in this study. Differences in functioning and sensory processing were assessed using an ANOVA, and linear regressions were utilized to predict overall functioning based on sensory processing in each group. Finally, a single hierarchical

regression with all clinical participants was used to assess whether sensory scores predicted CBCL scores above and beyond clinical diagnosis by entering diagnosis into the first model step and sensory processing scores into a second model step.

Results:

ANOVA results displayed significant group differences in sensory processing and adaptive functioning (Figure 1; all p-values<0.001). Post-hoc tests showed ASD and ADHD groups exhibited greater sensory-processing and behavioural issues than the TD group (all p-values<0.001). Compared to the ADHD group, the ASD group displayed significantly fewer behavioural issues (p=0.004). However, the ASD group presented with significantly greater sensory-processing issues in every subscale of the SSP (all p-values<0.004) except *Auditory Filtering,* where ADHD was greater than ASD (p=0.012), and *Underresponsive/Seeks Sensation,* where there was no difference (p=0.873).

Notably, in every group, sensory processing issues predicted total CBCL scores. In ASD and ADHD, CBCL scores were significantly driven by *Tactile Sensitivity*, *Underresponsiveness*, and *Auditory Filtering,* whereas the relationship in the TD group was driven by *Tactile Sensitivity, Auditory Filtering,* and *Movement Sensitivity* (see Table 1). The final hierarchical regression including all clinical participants found that sensory processing abilities predicted CBCL total scores above and beyond what was predicted by diagnostic group (Step1(Diagnosis): R^2=0.021, F-Change$_{(1,382)}$=8.373, p=0.004; Step2(SSP): R^2=0.417, F-Change$_{(7,375)}$=36.320, p<0.001).

Conclusions:

Individuals with ASD have unique behavioural and sensory processing issues relative to TD individuals and individuals with ADHD. Interestingly, sensory processing issues predict functional abilities in ASD as well as the other diagnostic groups. Despite unique sensory profiles between ASD and ADHD, the manner with which sensory issues relate to behavioural outcomes appears to be quite similar between ASD and ADHD. Therefore, although ASD and ADHD have their own distinct sensory symptom profile, sensory processing may act as a transdiagnostic mechanism that predicts outcome severity in various diagnostic groups.

271 **175.271** Sensory Processing in ASD and ADHD: A Multi-Groups Approach

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Background: Though the *DSM-5* diagnostic criteria for autism spectrum disorder (ASD) and attention/deficit-hyperactivity disorder (ADHD) show little overlap between the two disorders, studies have shown that children with ASD and ADHD have many overlapping issues, including sensory issues. Sensory processing impairments occur in several modalities including touch, taste, smell, and sound and can impact how a child perceives and responds to everyday events. In turn, these impairments have significant implications for a child's social communication, academic achievement, and quality of interpersonal relationships. Despite this, few researchers have directly compared sensory processing patterns in ASD and ADHD. Thus, while it is known that children with ASD and ADHD both exhibit atypical sensory processing, the extent to which these patterns operate similarly across groups remains unclear.
Objectives:

- To compare sensory processing across ASD and ADHD using the Short Sensory Profile (SSP);
- To evaluate the validity of the current seven-factor model in describing sensory processing patterns in ASD and ADHD using the SSP;
- To compare factor structures between ASD and ADHD.

Methods: Participants included 571 children and young adults (*Age range*=1.88-21.89 years, *Mean age*=10.01±3.98), with ASD (*n*=361) and ADHD (*n*=210) without any comorbidities. Parents completed a well-established questionnaire assessing sensory processing (SSP). Subscale scores on the SSP were compared across groups. Confirmatory factor analyses were performed using individual items comprising the SSP on each group separately to determine whether a seven-factor model to describe sensory processing holds the same meaning and measurement properties across ASD and ADHD groups. The seven latent variables were defined based on the original creation of the SSP where each item loaded onto the corresponding sensory system to which it belongs.

Results: Direct comparisons across diagnoses revealed that the ASD group showed greater impairment in tactile, taste/smell, movement, low energy, and visual/auditory (all p-values<.001), but not sensory seeking (p=.634) domains and the ADHD group showed greater impairment in the auditory filtering domain (Figure 1). For both ASD and ADHD models, all items on the SSP loaded onto the originally proposed latent variables well (>.40; Table 1), fit indices indicated acceptable overall fit (Table 1), and correlations among latent variables were low (<.85), indicating that these variables are tapping into distinct constructs in describing sensory processing patterns. Thus, despite significant differences in sensory processing between diagnostic groups, the factor structures still capture the same underlying latent variables for both groups.

Conclusions: Our results demonstrate that although there are differences in the way individuals with ASD and ADHD process sensory information, a single inventory of sensory processing can be reliably used to describe sensory processing *patterns* in both groups. The SSP measures components of basic sensory processing without referencing social or affective responses to sensory events, providing a good measure of sensory processing without tapping into other diagnostic features. These findings provide a useful next step for those interested in understanding the underlying structure of sensory processing in diagnostic groups who exhibit similar sensory processing patterns as those with ASD and ADHD.

272 **175.272** Sensory Processing in Relation to Sleep Disturbances in Young Children with Autism Spectrum Disorder and Fragile X Syndrome with and without Comorbid Autism Spectrum Disorder

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Background: Autism Spectrum Disorder (ASD) and fragile X syndrome (FXS) are highly comorbid, with approximately 60% of children with FXS also having ASD (Hagerman, Rivera, & Hagerman, 2008). Children with ASD or FXS are at increased risk for a variety of other challenges, including sensory processing abnormalities and sleep difficulties (Gagnon, & Godbout, 2018). Despite high prevalence of sensory and sleep difficulties in these populations, little is known about how these difficulties may impact one another. Previous studies have linked sensory hyperresponsiveness to sleep difficulties in the typical population (Shochat, Tzischinsky, & Engel-Yeger, 2009); however, this relationship is vastly understudied in those with neurodevelopmental disorders. Given the elevated prevalence of sensory and sleep challenges in these children, examining the association between sensory response patterns and sleep disturbances will shed light on the functional impact of these challenges in those with ASD, FXS and comorbid FXS and ASD.

Objectives: The present study characterizes sensory response patterns across three groups of young children: ASD, FXS-only and FXS comorbid with ASD. This study also investigates the effect of sensory response patterns on sleep disturbances across groups.

Methods: Participants included 18 children with non-syndromic ASD (i.e., nsASD; not associated with a specific syndrome), 16 preschoolers with FXS-only and 11 preschoolers with FXS+ASD between the ages of 36-72 months of age (*M* = 46.07, *SD* = 11.48). Clinical best estimate procedures were used to determine presence of comorbid ASD in the FXS+ASD group. Participants' parents completed the Sensory Experiences Questionnaire (SEQ; Baranek, 1999) as a measure of sensory processing, as well as the Children's Sleep Habits Questionnaire (CSHQ; Owens, Spirito, & McGuinn, 2000) as a measure of sleep.

Results: Results indicated significant group differences on sensory processing across domains ($F(1, 42)=10.61$; $p<.001$), such that the FXS-only group was significantly lower (i.e., better processing) across all sensory domains than both the nsASD and FXS+ASD groups (see Figure 1). Within group bivariate correlations revealed no significant associations between sensory response patterns and sleep scores in any of the groups ($p>.05$).

Conclusions: Findings suggest that children with nsASD and FXS+ASD experience similar levels of elevated sensory processing difficulties compared to those with FXS-only. Thus, elevated sensory impairments appear to be a shared feature across ASD independent of etiology. Despite group differences in sensory difficulties, no clear association between sensory difficulties and sleep were apparent in any of the groups. Given sample sizes, this may be due to issues with statistical power, or it may be that there are additional underlying mechanisms contributing to sleep difficulties in these populations. The similarities between the nsASD and FXS+ASD groups in their sensory response patterns enhance our understanding of a unique profile between FXS+ASD and FXS-only. These similarities indicate those with FXS+ASD may experience a greater impact on functional outcomes as a result of their elevated sensory processing challenges, and therefore require targeted intervention.

273 **175.273** Sensory Profile of TIP-TOE Behavior ASD Subjects

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Background: In a previous study we have validated the use of the Short Sensory Profile (SSP) scale in Italy confirming the existence of sensory impairments in ASD subjects that is related to ASD severity, particularly expressed as under-responsiveness or seeking stimuli and an increased or decreased response to auditory stimuli.

Since tip toe behavior (TTB) is likely to be related to sensorial disorders, it is interesting to assess how the sensorial pattern is different in ASD subjects with and without TTB, for which we developed a standardized protocol of the assessment.

Objectives: The aim of this study is to explore the sensory pattern of Severe ASD Subjects with or without TTB through a validated cross-cultural Italian adaptation of the SSP.

Methods: We administered the Short Sensory Profile in a sample of 50 Italian ASD children (7 females; 43 males; mean age 13.9 years). We chose capable special education teachers who carefully and thoroughly reported the children's behaviors. The ASD diagnosis was done using the DSM V criteria and was confirmed using the ADOS 2. The presence of Tip-Toe Behavior (TTB) was assessed using both direct observation as well as a structured checklist completed during the day by the main caregiver living with the subject through a standardized protocol.

Results: The SSP mean total score of the sample was 149.22 (range 119-182) evidencing the presence of sensory function impairment in our study group (the expected value ranges between 155 and 190). We also found a negative correlation values between ADOS CSS score and total SSP score ($r= -0.38$). The SSP mean total score of the TTB subgroup was 144.06 (median 142) while the SSP mean total score of the NON-TTB subgroup was 151.65 (median 152): both the TTB and NON-TTB subgroups mean total score ranged in the "probable difference" score. The mean total score values of the two subgroups were not significantly different according to the Mann-Whitney test.Comparing the mean score of SSP subscales between TTB and NON-TTB subgroups using a Mann-Whitney test we found a significant lower score of TTB subgroup only in the "Under-responsive/Seeks sensation" section ($p=0.027$). Instead the "tactile sensitivity" section was in the "probable difference" score for both TTB and NON-TTB without significant subgroups difference . We also evidenced a significant inverse relationship between toe walking severity and "Under-responsive/Seeks sensation" score ($r= -0.31$).

Conclusions: We confirm the existence of sensory impairment in ASD subjects related to ASD severity. TTB ASD subjects show a sensory function impairment when compared with normative values and a more severe sensory impairment in the "Under-responsive/Seeks sensation" section when compared with NON-TTB ASD subjects. This finding seems suggest that TTB subjects show this behavior as an high need of sensations instead of a tactile oversensitivity.

274 **175.274** Quantitative Assessment of TIP-TOE Behavior in Autism Spectrum Disorder: A Prospective Cohort Study

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Background: About 20-30% of ASD individuals display toe-walking to some degree. Previously, using a qualitative structured assessment, we described three mutually exclusive clinical functional classes: tip-toe behavior (TTB) during running (TTB1), TTB during walking and running (TTB2) and TTB during standing, walking and running (TTB3). In another study, we also found a positive relationship between the presence and severity of TTB and the Achilles's tendon shortening in ASD subjects. To our knowledge, no prospective quantitative TTB study is currently available.

Objectives: The aim of this prospective cohort study is to describe the natural history of TTB and NO-TTB ASD subjects at short-medium term using a quantitative standardized method.

Methods: We included 37 consecutive subjects (32 males; mean age: 12.32 years – SD 4.36) with ASD diagnosed according to the DSM V criteria, and then confirmed with ADOS–2. According to the qualitative assessment, 21 ASD subjects resulted NO-TTB, 2 resulted in TTB1 subgroup, 7 in TTB2 subgroup and 7 in TTB3 subgroup. The intensity of TTB expression during static and dynamic tests was quantified as a percentage of time spent on the tip toes and as a percentage of toe steps, respectively, through a standardized method previously described. The second assessment was repeated 11 to 38 months (mean: 21.41 months – SD 6.82; median: 23 months) after the first observation.

Results: The overall ADOS CCS was 6,67 (1,43 SD) in NO-TTB, 10 (SD 0) in TTB1, 7,57 (2.07 SD) in TTB2 and 8,29 (1,25 SD) in TTB3 (p = 0.014 between groups). The mean percentage time spent on the tip-toes (TSTT) during the static quantitative test in NO-TTB group, TTB1 TTB2, TTB3 was 0.1% (0.3 SD) , 0.5% (0.71 SD), 4.86% (6.36 SD), 29% (25.15 SD) respectively. The values of TSTT registered in No-TTB group and in TTB1 group remained substantially unchanged at follow up. Five subjects of TTB2 group decreased and two increased their TSTT respectively. The same happened in TTB3 group. The mean percentage of toe steps (PTS) during the dynamic quantitative test in NO-TTB group, TTB1 TTB2, TTB3 was 0.91% (2.36 SD), 3.5% (4.95 SD), 18.71% (6.36 SD), 48.71% (33.74 SD) respectively. The PTS registered in No-TTB group and in TTB1 group remained substantially unchanged at follow up. Five subjects of TTB2 group decreased and two increased their PTS respectively while four subjects of TTB3 group decreased and three subjects increased their PTS in TTB3 group.

Conclusions: This is the first study that used a quantitative structured assessment to describe change over time in TTB of ASD subjects. NO-TTB and TTB1 subgroups substantially maintained their condition at follow up. TTB2 and TTB3 subgroups showed a more variable behavior: some subjects decreasing TTB over time as commonly known, but some increasing TTB. This finding underlies the importance of a TTB sub-classification and a close monitoring with quantitative standardized protocols of TTB phenomenon.

275 **175.275** Sex Differences and the Neural Substrates of Repetitive Behavior and Restricted Interests

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Background: Repetitive behaviors and restricted interests (RBRI) are a broad and heterogeneous set of behaviors and thoughts that include stereotypic motor movements, compulsions, tics, self-injury, as well as obsessions, circumscribed interest patterns, perseverative thought and speech. RBRI are defining features of a range of neurodevelopmental and neuropsychiatric disorders (NDD/NPD), including autism, obsessive-compulsive disorders (OCD), tic disorders, intellectual and developmental conditions. In addition to their clinical significance, RBRI are also common in typically-developing children. Across NDD/NPD RBRI have established links to cortical-striatal-thalamo-cortical pathways, however the degree to which typical and atypical RBRI are subserved by common neural mechanisms is unclear. Structural sex differences in these pathways have also been observed which may indicate a mechanism for the male preponderance of many neurodevelopmental conditions involving repetitive behaviour, such as autism.

Objectives: To examine sex differences in RBRI and gray matter (GM) volume of cortical and subcortical brain regions that have been implicated in the pathogenesis of disorders characterized by RBRI.

Methods: Thirty-three children aged 6 to 15 years (17 females) underwent a 3T structural T1 magnetic resonance imaging scan. GM classification was performed using the Voxel Based Morphometry in SPM8 (Ashburner & Friston, 2000). SPM combines spatial information from the tissue probability map (TPM) of a standard template and the intensity information of the subject image to construct the segmented GM TPM of the individual. The value at a GM TPM voxel represents the percentage of GM content in that voxel (corrected for overall GM volume). GM TPMs were further segmented into 116 AAL atlas regions (Tzourio-Mazoyer, et al, 2002). We then calculated the average GM content in the following bilateral brain regions: supplementary motor area, cingulate cortex, caudate nucleus, putamen, globus pallidus, and amygdala. Parents completed the Childhood Routines Inventory-Revised (Evans et al., 2017). This is a 62-item measure of RBRI that was normed nationally, and reflects a two-factor structure: Repetitive Motor Behaviors/Compulsions (RMBC) and Rigidity/Insistence on Sameness (RIS).

Results: For males, the RMBC factor was significantly and positively linked to GM volumes of the left supplementary motor area, the left inferior frontal gyrus (pars triangularis) and the left cingulum. The anterior cingulum is further divided into anterior, middle, and posterior regions. For males, RMBC correlated with the left ($r(16)=.82$, $p=0.00009$) and right ($r(16)=.84$, $p=0.00008$) middle , and with the left ($r=.52$, $p=.04$) and right ($r=.54$, $p=.04$) anterior cingulum, but not the posterior cingulum.

For female participants, a distinctly different pattern emerged. The RMBC factor was significantly, and negatively associated with both the left and right caudate nucleus, and the left putamen, and left amygdala (see Table 1).

Conclusions: This preliminary study suggests that there are sex differences in key brain regions implicated in RBRI. These findings have potentially important implications for understanding the brain-behavior links that underlie neurodevelopmental conditions. Our future research will conduct similar analyses on a larger sample comprising both typically-developing individuals and a well-characterized cohort of probands with autism.

276 **175.276** Sex Differences in Repetitive and Restricted Behavior Using the Repetitive Behavior Scale-Revised

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Background: Repetitive and restricted behaviors (RRBs) are a core symptom of autism spectrum disorder (ASD). Some studies have found that RRBs occur at lower rates in females, particularly in those with higher IQ. Additionally, females are reported to have more socially accepted interests than males, while males with ASD often present with more atypical motor behaviors, restricted interests, and repetitive use of objects. The association between RRBs and developmental level is well established, and when controlling for age and IQ, these differences are found less consistently. The presence of potential sex differences in presentation and frequency of RRBs may have important implications for early detection and diagnosis of ASD. It is possible that if females present with fewer or different RRBs this could lead to delayed diagnosis or misdiagnosis, negatively affecting their access to appropriate intervention and treatment.

Objectives: To examine potential sex differences in the type and frequency of RRBs after accounting for the effects of age and IQ.

Methods: Participants included 391 children and adolescents with ASD ages 2-14 (319 males, 72 females) participating in a larger research study. As

part of the measurement battery, parents completed the Repetitive Behavior Scale-Revised (RBS-R), and IQ was assessed using the Mullen Scales of Early Learning or the Differential Ability Scales-2nd Edition. A one-way analysis of Covariance (ANCOVA) was performed to evaluate differences between males and females on the RBS-R total score, controlling for age and IQ. A one-way multivariate analysis of covariance (MANCOVA) was conducted to examine potential sex differences on the various subscales of the RBS-R, while controlling for age and IQ.

Results: RBS-R total score was significantly correlated with both age (r=-.006, p=.91) and IQ (r=-.124, p=.049). The ANCOVA revealed a significant difference $F(1, 388)=3.90$, p=.049, with females obtaining higher RBS-R total scores (M=33.69, SD=22.35) than males (M=28.90, SD=18.12) after controlling for age and IQ. A MANCOVA was conducted with sex as the independent variable and RBS-R subscale scores as dependent variables, and age and IQ as covariates. Females had significantly higher scores than males on the self-injurious behavior subscale, $F(1,93.19)= 6.30$, p =.013, h^2=.016, and the sameness behavior subscale, $F(1, 229.27)=6.01$, p=.015, h^2=.015, but not on any other subscale. However, after taking a more conservative approach and performing a Bonferroni correction (a=.0083), no significant differences in scores were found for any subscale.

Conclusions: The results reveal that there may be differences in type and frequency of RRBs displayed by males and females with ASD. Although sex differences were observed in overall RRB score and two subscales after controlling for age and IQ, these differences did not remain statistically significant after correcting for multiple comparisons. The effect of IQ remained significant following the correction, however, further demonstrating how IQ may account for the previously reported differences in RRBs between males and females with ASD.

277 **175.277** Smart Tablet-Based Gameplay Identification of Preschool Children with Autism: A Replication Study with Machine Learning Data Analytics Improvements

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Background: It has been proposed that one of the early markers of autism spectrum disorder (ASD) is a disruption in intentional movement evident from early childhood. Evidence suggests disruption to motor timing and integration may underpin the disorder, providing a new potential marker for its identification. In earlier work, we demonstrated machine learning analysis of children's movement patterns during smart tablet gameplay identified ASD with 83% sensitivity and 85% specificity (Anzulewicz, Sobota and Delafield-Butt, 2016).
Objectives: In this study, we sought to test the original performance accuracy with more generalised, new data. And we sought an iterative improvement on the machine learning data analytics to simplify and further generalise the models. Overall we aimed to achieve an accessible, computational identification of ASD in young children by smart tablet gameplay.

Methods: The original study of 37 children 3-6 years old with ASD and 45 children typically developing (TD) was augmented with a new dataset of 118 children with ASD and 420 TD children. In addition, 26 children 3-6 with another neurodevelopmental disorder that was not ASD was included. Feature selection was reduced by recursive feature selection and removal of low variance and high within-group correlations. New machine learning algorithms were trained on the new dataset (n=564), and these models applied to the original dataset (n=82) to test for generalisation.

Results: Dimensionality was reduced from 262 kinematic and descriptive metric features of children's gameplay patterns to 49 features. Ten repetitions of a ten-fold cross-validation procedure performed on the new dataset (n=564) identified children with ASD from their TD counterparts with 87% sensitivity and 85% specificity. Differentiation of OND from their TD counterparts was comparable, but with low confidence. Finally, we tested the models produced on the original study dataset (n=82). The model performed 83% sensitivity and 82% specificity accuracy, replicating the original finding.

Conclusions: This study produced new machine learning models for the identification of ASD from TD children on a large dataset with comparable performance to the first study, and with reduced feature selection. Moreover, we replicated the findings of our previous study with these new algorithmic models, tested on those original data and without prior training on those data. We consider this strong verification of the principle of machine learning data analytics in the successful, and potentially clinically useful early identification of ASD in young children. The basis of these features on calculations of motor kinematics supports the view movement differences are a fundamental feature of ASD that may be subtle to the eye, but significantly associated computationally.

278 **175.278** Temporal Processing in Autism Spectrum Disorder: A Systematic Review and Meta-Analysis

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Background: Studies of autism spectrum disorders (ASD) have reported deficits in processing rapidly timed unisensory information, as well as integrating sensory information from different sensory modalities (Zhou et al., 2018). Failure to temporally integrate sensory cues can lead to deficits in higher-order communication and social skills (Stevenson et al., 2014). However, it is unclear whether atypical processing of unisensory and multisensory temporal information is a consistent feature in ASD.
Objectives: This study used quantitative meta-analyses to examine two standard tests of temporal processing, the temporal order judgment (TOJ) and simultaneity judgment (SJ) tasks in ASD. The aims were to 1) determine if temporal processing shows consistent deficits in ASD, 2) assess whether atypical temporal processing exists in ASD for both unisensory processing and multisensory processing, and 3) compare the TOJ and SJ tasks to evaluate whether these two types of temporal judgment show similar effects in ASD.

Methods: An exhaustive search for ASD studies using TOJ and SJ tasks from 1980 to 2018 was conducted in five online databases (Proquest, PsycInfo, Pubmed, Scopus, and Web of Science). Data from 18 different studies (Nasd=369, Ntd=408) were retrieved and coded. A synthesis and analysis of the set of ASD studies was performed following the PRISMA guidelines (Moher et al., 2009). Analyses were performed on study effects (Hedges' g) using random-effects models, and heterogeneity of variance was measured using the I2 measure (Higgins et al., 2003). Visual inspection of funnel plots and a trim-and-fill procedure were used to assess the presence of publication bias (Duval & Tweedie, 2000).

Results: Individuals with ASD showed lower temporal acuity in simultaneity and order judgments compared to typically developing (TD) controls (n=18, g=0.444, SE=0.119, p<.001, CI= 0.210-0.677). Separate analyses of unisensory and multisensory studies provided stronger evidence for deficits in multisensory temporal processing (n=12, g=0.484, SE=0.121, p<.001, CI= 0.248-0.720), as the analysis of unisensory studies failed to reach

significance (n=7, g=0.463, SE=0.252, p=.066, CI= -0.031-0.957). Lastly, temporal acuity in ASD appears to be more impacted in SJ tasks (n=8, g=0.585, SE=0.147, p<.001, CI= 0.296-0.873), versus TOJ (n=10, g=0.321, SE=0.168, p=.057, CI=-0.009-0.650). Heterogeneity of variance for all analyses fell between low and moderate (4%-40%), and no evidence of publication bias was found.

Conclusions: ASD shows lower temporal acuity than TD, as assessed by two relative timing tasks. Poorer multisensory processing was found, but unisensory processing did not differ between ASD and TD. Finally, overall temporal processing differences are larger when considering only the SJ task, which involves a judgement about simultaneity rather than order of events, a task considered to be easier than TOJ. Future work will address the association between multisensory temporal processing in ASD and symptom severity, as well as whether performance on different tasks can identify individual differences in temporal processing.

279 **175.279** The Impact of Restricted and Repetitive Behaviours on Social Emotional Learning and Executive Functioning in Adolescents with Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is defined as a broad category with two symptom dimensions: social communication deficits and restricted/repetitive behaviours (RRBs) (APA, 2013) RRBs may be presented as stereotyped motor movements, adherence to non-functional rituals, or circumscribed interests (Richler et al., 2010), and can be the most disabling feature of the disorder (Bishop et al., 2007). Further, RRBs compete with social interactions and impact communication (LaGasse & Hardy, 2013). Moreover, research has found that RRBs could be a result of abnormal frontal lobe functioning (Pierce & Courchesne, 2001), a brain region involved in executive functioning. Results of studies examining RRBs in relation to executive functioning find that RRBs are associated with deficits in cognitive flexibility and planning (Lopez et al, 2005).
Objectives: The purpose of this study is to examine the relationships between RRBs and the social emotional learning and executive functioning profiles of youth with ASD, using measures commonly used in research with this population.

Methods: A total of 45 youth with ASD between 12 and 18 years old participated in this study. Social communication was measured using the *Social Responsiveness Scale* (SRS-2; Constantino, 2012), social emotional learning using the *Social Skills Improvement System – Social Emotional Learning Edition* (SSIS-SEL; Gresham & Elliot, 2017), executive functioning using the *Behaviour Rating Inventory of Executive Functions* (BRIEF-2, Gioia et al., 2015) and cognitive abilities using the Wechsler Intelligence Scale for Children (WISC-V; Wechsler, 2014). Participants were grouped into low RRB and high RRB severity groups using a median split of the SRS-2 restricted interests and repetitive behaviour subscale (RRB = 65).

Results: Low RRB and high RRB severity groups were compared on the SRS-2, SSIS-SEL, BRIEF-2, and WISC-V. MANOVAs revealed a significant difference ($p < .05$) on four subscales of the SRS-2 (social awareness, social cognition, social communication, and social motivation) and on four subscales of the SSIS-SEL (self-management, social awareness, relationship skills, and responsible decision making) demonstrating that youths with higher severity of RRBs have greater difficulties in these areas. Further, results revealed a significant difference ($p<.05$) on six subscales of the BRIEF-2 (inhibition, self-monitoring, shift, emotional control, initiate, and working memory) indicating that participants with higher severity in RRBs have more difficulty with these components of executive functioning. High and low RRB severity groups did not differ in their scores on the WISC-V ($p > .05$), demonstrating similar cognitive abilities.

Conclusions: Results contribute to the literature in identifying specific social emotional learning and executive processes related to RRBs. Additionally, our results support previous ASD research showing a relationship between executive functions and RRBs, specifically, to inhibitory control (Mosconi et al, 2009; South et al, 2007) and working memory (Lopez et al, 2005). Findings also highlight the negative impact that RRBs have on the social and executive profiles of adolescents with ASD and support interventions targeting these behaviours, as studies show that participation in peer-initiation interventions (Lee et al, 2007) and multi-component social skills interventions (Loftin et al., 2008) lead to decreases in RRBs and increases in social engagement.

280 **175.280** The Influence of Restricted Repetitive Behaviors on the Relationship between Autism Symptom Severity and Sleep Problems in Children

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Background:
Many studies have documented increased sleep problems in children with autism spectrum disorder (ASD) when compared to their typically developing peers[4]. Research has reported mixed results in terms of the correlation between ASD symptom severity and increased sleep problems[3]. Specifically, some studies found that ASD severity was positively correlated with sleep problems; while others did not find this correlation[2,4]. This study examined the role of restricted, repetitive behaviors (RRBs) as a possible mediator of the relationship between sleep problems and ASD symptomatology.

Objectives:

1. Is there a difference on reported sleep problems between children with high versus low ASD severity?
2. Is there a relationship between RRBs, ASD severity, and sleep problems in children with autism? If so, do RRBs mediate the association between ASD severity and sleep problems?

Methods:

Participants included children who were screened for ASD at a university research center in the Inland Southern California. From this sample, 148 children with ASD under the age of five (M= 3.91, SD= 1.04, range 1.60-5.80) were included. Intelligence quotient (IQ) had a mean of 69.15 (17.90) with a range of 41-120. Most children were male (30 female) and 48.6% were Hispanic (23.6% Caucasian; 21.6% other; 4.1% African American; .7% Asian, 1.4% declined).

Data were collected from the following measures: Autism Diagnostic Observation Schedule—Second Edition (ADOS-2), Child Behavior CheckList (CBCL), and Social Responsiveness Scale (SRS). Sleep problems scores were derived from the CBCL t-scores. ASD calibrated severity scores (CSS)

were derived from the ADOS-2 comparison score. Participants with a CSS of 4 or 5 were considered low severity and those with a CSS of 6 to 10 were considered moderate/high severity. RRBs were determined by the Autistic mannerisms/RRBs subscale t-score of the SRS.

Results:

Correlations were conducted to examine the differences in sleep problems between participants with high and low CSS. A negative correlation was found between CSS and sleep problems (p = .04). Correlations were also conducted for RRBs, ASD severity, and sleep problems. Positive correlations were found between RRBs and sleep problems (p < .01). No correlations were found between RRBs and CSS.

To examine the possible impact of RRBs (*M*) on the relationship between CSS scores (*X*) and sleep problems (*Y*), while for controlling for IQ, internalizing and externalizing problems, a mediation Model 4 was conducted using the SPSS PROCESS plug in[1]. The indirect effect was not significant, (95% CI = [-1.33, 2.58]), such that RRBs do not mediate the relationship between CSS and sleep problems.

Conclusions:

Findings from this study add to the existing literature on sleeping difficulties in children with ASD. In particular, this study provides insight into the relationship between RRBs, sleep problems, and ASD severity. Although RRBs did not mediate the relationship between CSS and sleep problems, both RRBs and CSS were correlated with sleep problems. Moreover, this also underscores the need to consider RRBs in interventions targeting sleep problems.

281 **175.281** The Movements of Children with Autism Can be Faster or Slower Than Their Typically Developing Counterparts, Depending on the Task

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Background: Atypical movement patterns in autism spectrum disorders (ASD) have been reported. Compared with typical developing (TD) children, children with ASD took more time to complete a point-to-point movement (Dowd et al., 2012), but adults with ASD performed faster horizontal arm swings than their typical counterparts (Cook et al., 2013). Incongruent kinematic results are common in the literature, which may imply that the kinematic features in ASD are task-dependent, but this is yet not well understood. Smart tablet gameplay has been proposed as a new paradigm to measure the movement features of ASD in young children (Anzulewicz et al., 2016). In this study, smart tablet games were employed to test for kinematic differences in autism, and the effect of the task.

Objectives: The study aims to compute the swipe kinematics during smart tablet gameplay, and to compare these characteristic movements between ASD and TD children within different gameplay contexts.

Methods: 37 ASD children (mean age: 4.5 years) and 45 age-matched TD children were recruited in the study. The children were shown two smart tablet games: “sharing” and “creativity” games. In the sharing game, the children were tasked to share the food pieces to four characters; in the creativity game, the children were tasked to select an object, trace the lines, and colour the object. Their touch trajectories on the smart tablet (iPad mini, Apple Inc.) were recorded during gameplay. The food-to-target swipes in the sharing game and the swipe gestures in the creativity game were identified using a customized MATLAB script. The travelled distance, duration, and speed of each swipe were calculated. For the sharing game, the difference between the travelled distance and the optimal distance (i.e. the straight line) was also calculated. Mann-Whitney U tests were used to determine kinematic differences between ASD and TD groups.

Results: A total of 4785 food-to-target swipes were identified in the sharing game (ASD: 1585 swipes; TD: 3200 swipes) while 6178 swipes were identified in the creativity game (ASD: 2793 swipes; TD: 3385 swipes). Significant differences between ASD and TD were observed in the sharing game that ASD demonstrated slower food-to-target swipes than TD (median of 50.12 mm/s vs. 58.84 mm/s), and that they deviated from the optimal distance more than TD (median of 3.9 mm vs. 2.59 mm). There was no significant difference in the optimal distance. By contrast, ASD showed significantly faster gestures than TD (median of 81.77 mm/s vs. 60 mm/s) in the creativity game.

Conclusions: The study compared the swipe kinematics between ASD and TD children in two smart tablet gameplay contexts. ASD demonstrated slower movement than TD in a goal-oriented food-to-target task, deviating more from the optimal trajectory. In contrast, ASD performed faster swipe gestures than TD in a relatively unconstrained creativity game. These data are the foundations to allow an understanding of how movement is controlled in autism within different contexts. Further, characterising movement features in ASD during smart tablet gameplay supports the development of algorithms that enable the early identification of ASD in serious game paradigms.

282 **175.282** The Role of the Corpus Callosum in Sensory Hyporesponsiveness of Children with Autism Spectrum Disorder

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Background: Atypical experience of sensory stimuli is commonly reported in individuals with Autism Spectrum Disorder (ASD) (Baranek et al., 2006) and in those without ASD who have higher autism-like traits (Robertson & Simmons, 2013). However the neurobiological basis of these sensory features is unclear. The white matter integrity of the corpus callosum (CC) is a viable candidate for the neurobiological basis of atypical sensory experience as it has common reports of group differences related to ASD (Travers et al., 2012), and has been shown to have an atypical developmental trajectory in children with ASD (Travers et al., 2015). Importantly, the corpus callosum is critical for the facilitation of hemispheric synchrony, which has demonstrated a role in typical sensory experience (Ouimet et al., 2010). Therefore, the white matter integrity of the CC may potentially correspond to individual differences in sensory features both within and beyond an ASD group.

Objectives: To characterize the relationship between CC white matter integrity and degree of sensory hyper- and hypo-responsiveness in children with ASD, children with typical development (TD), and children at higher genetic risk for ASD (ASD-Related).

Methods: Seventy-four children (6-10 years old) completed a diffusion-weighted imaging (DWI) scan and sensory measures (32 children with ASD, 26 children with TD, and 16 ASD-Related children). The ASD-Related group included children with an ADHD diagnosis and children with a first-degree relative with ASD, major depressive disorder, bipolar disorder, or schizophrenia. Groups were well-matched on age (p =.30). Hyper- and

hypo-responsiveness were assessed using the parent-reported Sensory Experience Questionnaire Version 3 (Baranek, David, Poe, Stone, & Watson, 2006). Multi-shell DWI was performed on a 3T GE Scanner with a 32-channel head coil with protocol: 63 encoding directions: b=0 (6); b=350 (9); b=800 (18); b=2000 (36) s/mm^2; isotropic 1.8mm voxels: 3.6 mm thick slices with 1.8 mm overlap. Median fractional anisotropy (FA) in each of ten CC sub-regions (Genu: G1, G2, G3; Body: B1, B2, B3; Isthmus; Splenium: S1, S2, S3) was used for correlational analyses. False discovery rate (fdr) was used for multiple comparisons.

Results: Hyporesponsivity was significantly correlated in the Autism group with FA in G2 (r=.46, p=.01 [fdr]), G3 (r=.47, p=.01 [fdr]), B1 (r=.61, p<0.001 [fdr]) (Figure 1). These CC sub-regions primarily connect to the frontal lobe. In contrast, hyperresponsivity was not correlated with any sub-region in any diagnostic group.

Conclusions: More severe hyporesponsivity symptoms were associated with greater white matter integrity in the CC genu and body, although no area of the CC was associated with hyperresponsivity. These results suggest that potential overconnectivity between the left and right frontal lobes may be associated with more severe hyporesponsivity. However, follow-up analyses will examine other DWI metrics to see if these hyporesponsivity associations are consistent with greater axonal packing, myelination differences, or both. Intriguingly, the present data suggest that hypo and hyper-responsivity may have different neurobiological substrates, although this will need to be corroborated by future research.

283 **175.283** Understanding ASD Traits from a Sensory Sensitivity and Habituation Perspective

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Background:
Sensory symptoms, including unusual sensory seeking, over-responsivity (SOR) and under-responsivity, are recognized as core features of Autistic Spectrum Disorder (ASD). However, their interplay with other facets of the ASD phenotype (i.e., social-communication and cognitive) is yet to be understood. The Empathizing- Systemizing theory views the autistic drive to analyze and construct systems as closely related to the unique sensory perception of individuals with ASD. Sensory evidence relies mostly upon the Sensory Profile questionnaire, which inquires about the affective response to daily stimuli with some overlap with social-communication features of ASD. Our study utilized sensory questionnaires aimed to isolate different perceptual aspects of sensory symptoms and bypass overlap with other clinical features. SOR may reflect an increased reaction towards a stimulus and/or a relatively slow sensory habituation, an overlooked aspect. Lack of Sensory habituation may contribute to the functional impairment of individuals with ASD. We hypothesize that both sensitivity and habituation play an important part in explaining specific ASD traits.

Objectives: To (1) examine the relationship between different ASD traits and sensory symptoms; and (2) determine the contribution of sensory sensitivity versus slow habituation to specific ASD traits.

Methods: Eighty typical adults rated their sensory symptoms with the Adolescent/Adult Sensory Profile (AASP), Sensory Perception Quotient (SPQ) and the Sensory Habituation Questionnaire (S-Hab-Q). Autistic traits including: social skills, communication, imagination, attention to details and attention switching, were reported via the Autism Spectrum Quotient (AQ).

Results: The AQ score showed a significant moderate correlation with the AASP/SOR score (r=.36, p=.001), with the SPQ sensitivity score (r = 0.33, p = 0.003), and S-Hab-Q score (r=.45, p=.002). Among the AQ subscales, attention to details stood out by correlating with the S-Hab-Q (r=.34, p=.024) and SPQ (r=.48, p=.001), while not with the AASP/SOR scores. Interestingly, the AQ communication and imagination subscales correlated with AASP sensory under-responsivity (*r=.33, p=0.31*) and seeking scores (r=*-.33, p=.0.31*) while not with any of the SOR scores in this study (*p* ≥.49). None of the sensory scores associated with the social AQ scores (*p* >.68).

Conclusions: Our findings significantly add to the "systemizing theory" which views SOR as the underlying cause of over-focused attention. Although "attention to details" would seem to be more associated with increased sensitivity, we found that habituation and sensitivity contributed equally. When scrutinizing other sensory aspects, we found that seeking and under responsivity correlate distinctively with communication and imagination ASD traits. These sensory symptoms may tap into developmental level rather than perceptual atypicalities. This study shows the importance of using sensory tools which measure perceptual aspects of SOR. Examining these correlations in a clinical sample of ASD and combining knowledge about sensory symptoms from questionnaire and physiological data is needed to further understand these correlations.

284 **175.284** Using Sensory Processing Behaviors to Differentiate ASD and ADHD Diagnoses

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Background: Children with autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) have overlapping issues with social communication difficulties. Social communication issues can include excessive talking, poor turn-taking during conversation, maintaining appropriate physical proximity, and poorly organized expressive language, all of which have been observed in children with ASD and ADHD. These commonalities can often impact the ability to provide accurate differential diagnoses. In addition to impairments associated with social communication, both groups show atypical sensory processing relating to difficulties in detecting, modulating, and interpreting incoming stimuli. However, the extent to which these sensory issues can inform diagnostic classifications remains unclear.
Objectives: To test whether the considerations of sensory behaviours in addition to social communication measures can improve differential diagnoses between ASD and ADHD.

Methods: Participants included children (N=207) with ASD (*n*=116, *mean age*=9.06±2.00) and ADHD (*n*=91, *mean age*=9.25±1.93) without comorbid diagnoses. Parents completed two well-established questionnaires evaluating social-communication abilities (Social Communication Questionnaire; SCQ) and sensory processing (Short Sensory Profile; SSP). Logistical regressions assessed the diagnostic predictability of each measure's individual subscales, and a follow-up hierarchical logistic regression determined if sensory processing scores improved diagnostic

prediction over and above the SCQ

Results: The SCQ significantly predicted diagnosis, with *Social Interaction* and *Restricted and Repetitive Behaviors* (*RRB)* subscales being individually predictive (see Table 1 for detailed statistics). The SSP also significantly predicted diagnosis, with *Auditory Filtering, Low Energy,* and *Visual/Auditory* subscales being individually predictive (Table 1). The first model of the follow-up hierarchical logistic regression including individually-predictive subscales of the SCQ, with SSP subscales added in the second model. Adding in sensory measures significantly improved our ability to delineate between ASD and ADHD diagnoses. There was a small increase in ***sensitivity***, with ASD diagnostic accuracy increasing from 82% to 85%, and a more substantial increase in ***specificity***, with ADHD diagnoses without ASD increasing by 11% (from 73% to 84%). This was particularly driven by the *Auditory Filtering* and *Visual/Auditory* subscales of the SSP where auditory filtering was more impaired in ADHD, and visual/auditory components of sensory processing were more impaired in ASD.

Conclusions:

Our results demonstrate that the inclusion of sensory processing measures, particularly *Auditory Filtering* and *Visual/Auditory* subscales significantly increased the ability to differentiate between ASD and ADHD diagnoses in childhood. Items on the auditory filtering subscale of the SSP measure distraction and attention, while those on the visual/auditory subscale measure sensitivities to loud sounds and bright lights, relating to hypersensitivity, a core symptom of ASD. Thus, these subscales likely tap into core features of each disorder, allowing clinicians to use scores on these subscales to differentiate between the two disorders. Our findings provide useful diagnostic information for clinicians, suggesting that only certain aspects of social communication abilities contribute to the accurate delineation of ASD or ADHD diagnoses in children, and that the inclusion of sensory measures has potential to increase diagnostic specificity.

285 **175.285** "Keep Calm and Use Context Clues": An Investigation into Interoceptive Awareness in Teens with Autism

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Background: Interoceptive Awareness (IA) refers to the level in which one notices internal physiological signals (i.e., interoceptive sensations) and shapes our emotional experience. IA underlies the ability to clearly interpret emotions such as anger, calmness, distractibility, and fear (i.e., specific affective emotions) as well as hunger, thirst, and body temperature (i.e., specific homeostatic emotions). Given that autistic teens are often reported to have difficulty with emotional regulation, and the underlying reasons for this are poorly understood, it is possible that IA is a key factor. Our hypothesis was that autistic teens will report differences in IA as compared to neurotypical controls.
Objectives: The purpose of our study was to develop a novel approach to understanding IA in teens with and without ASD in order to facilitate targeted, effective interventions for emotional regulation.

Methods: Our study consisted of a 55-item Likert Scale survey administered to autistic and neurotypical teens, assessing general IA (12 questions), specific homeostatic emotions (14 questions), and specific affective emotions (19 questions). Possible responses for all questions were never, sometimes, and frequently/always. All questions were compared between groups using a Fisher's Exact Test. A Bonferroni correction determined statistical significance, i.e., p-values <0.0009 were deemed significant.

Results: The study included 143 teens, 59 teens (41%) with ASD and 84 teens (79%) without. Autistic teens had a mean age of 14.5 years, and 75% were male. Teens without ASD had a mean age of 13.2 years, and 46% were male. Ten of the 12 items assessing general IA (83%), 4 of the 24 (17%) assessing specific homeostatic emotions, and 6 of the 19 (32%) items assessing specific affective emotions were significantly different between groups. Responses to questions assessing general IA were more likely to significantly differ between autistic teens and controls. For example, for the item, "Figuring out how I feel can be tricky," 39% of teens with ASD endorsed "frequently/always" as compared to 6% of teens without ASD ($p<0.0001$). Responses to questions assessing specific homeostatic and specific affective emotions were less likely to significantly differ between groups. To illustrate, there were no significant differences between group responses for the two items: (1)"I can wear shorts or no jacket outside … on a chilly winter day and not feel cold" ($p = 0.070$), i.e., assessing awareness of body temperature and (2)"I can feel changes in my muscles when I am angry" ($p = 0.347$), i.e., assessing awareness of anger. Open-ended and more abstract experiences appear to be challenging for teens with ASD to interpret as compared to the interpretation of IA when provided with context clues, perhaps making the experience more specific, detailed, and concrete.

Conclusions: Overall, autistic teens report differences in IA affecting interpretation of broad emotional states. This may play a key role in the emotional regulation challenges this population frequently experiences. In order to develop more robust IA, autistic teens may benefit from targeting the skills necessary to scaffold concrete details from their daily experiences onto more abstract emotional concepts, where inference and subtext analysis are required.

286 **175.286** Circumscribed Interests in Autism: Are There Sex Differences?

S. W. Nowell[1], *C. Harrop*[2] *and D. R. Jones*[3], *(1)University of North Carolina - Chapel Hill, Chapel Hill, NC, (2)University of North Carolina at Chapel Hill, Chapel Hill, NC, (3)University of Texas at Dallas, Richardson, TX*

Background:
Turner-Brown et al. (2011) found that circumscribed interests (CI) in ASD were more nonsocial, less age-appropriate, less functional than the interests of typically developing (TD) peers; yet, their sample was only 5% female. Sex differences in CI may contribute to delayed diagnosis or misdiagnosis for females on the spectrum. Therefore, it is important to characterize sex differences in CI to determine if differential approaches to assessment and intervention are warranted for females and males with ASD.

Objectives:

This study aimed to replicate and extend the findings of Turner-Brown et al. (2011) by examining sex differences in parent-reported quantity, content, and functional impairment of children's interests.

Methods:

Parent responses to the Interests Scale (Bodfish, 2003) were analyzed using ANOVAs to determine diagnostic (ASD vs. TD) and sex differences between 4 groups of children ages 6-10 years: ASD Males (n=27), ASD Females (n=27), TD Males (n=16), TD Females (n=17).

The Interests Scale (Bodfish, 2003) is a parent-report measure of children's CIs. Parents indicate whether or not their child is currently or has ever

been interested in 39 common categories of interests. Then, parents write down their child's primary interest and answer seven questions about the amount of functional impairment associated with that interest. Higher ratings on these items indicate greater severity of functional impairment. Cronbach's alpha for this sample was .81 for items measuring functional impairment of the child's primary interest. Individual item internal consistency ranged from .74-.82.

Results:

Groups were comparable on the quantity of interests reported on the Interests Scale $F(1,86) = .44$, $p \leq .51$, $\eta 2 = .00$. Children with ASD demonstrated significantly more nonsocial interests $F(1,86) = 7.87$, $p \leq .01$, $\eta 2 = .08$ and had significantly greater functional impairment associated with their interests on all seven parent ratings than TD children (see Table and Figure). A significant diagnosis*sex effect was found for the number of interests in the traditionally female category of Folk Psychology with TD females having the greatest number of Folk Psychology Interests compared to the other groups ($F(1,86) = 5.20$, $p \leq .03$, $\eta 2 = .05$), followed by TD males and ASD males. ASD females had the fewest current interests in Folk Psychology and were more similar to ASD males and TD males than their TD female peers.

Conclusions:

These findings replicated the results of Turner-Brown et al. (2011) in a sample that was balanced by biological sex (51% female compared to 5%), indicating that some aspects of the content and functional impairment of CI are characteristic of the autism phenotype regardless of sex. Even if the interests themselves may be different across sexes, the impact on daily life for children and their families is the same. Regarding sex differences, there was a significant diagnosis by sex effect for the number of current Folk Psychology interests. Females with ASD demonstrated the fewest interests in this category and their interests were more closely aligned to males with ASD than to TD males or TD females supporting the "Extreme Male Brain Theory" of autism (Baron-Cohen, 2010).

287 **175.287** Deconstructing the Repetitive Behavior Phenotype in Autism Spectrum Disorder through a Whole-of-Population Analysis

M. Uljarevic[1], *M. N. Cooper*[2], *K. Bebbington*[3], *E. J. Glasson*[3], *M. T. Maybery*[4], *K. J. Varcin*[3], *G. A. Alvares*[3], *J. Wray*[5], *S. R. Leekam*[6] *and A. O. Whitehouse*[2], *(1)Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, (2)Telethon Kids Institute, The University of Western Australia, Perth, Western Australia, Australia, Perth, Australia, (3)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (4)School of Psychological Science, University of Western Australia, Perth, Australia, (5)State Child Development Service, Western Australia Department of Health, Perth, Western Australia, Australia, (6)School of Psychology, Cardiff University, Cardiff, NSW, United Kingdom*

Background: Restricted and repetitive pattern of behaviors (RRB) are a cardinal feature of autism spectrum disorder (ASD), but there remains uncertainty about how these diverse behaviors vary according to individual characteristics. Firm findings in large, well characterized, heterogeneous cohorts are essential in order to advance the ASD research agenda. Therefore, the current study aimed to enhance our understanding of RRB by utilizing a unique repository of clinical data from the Western Australian (WA) Register for Autism Spectrum Disorders-a long-term prospective, population-based register of newly diagnosed cases of ASD.

Objectives: To characterize the nature of the relationship between Repetitive Motor Behaviours (RMB), Rigidity/Insistence on Sameness (IS) and Circumscribed Interests (CI) with other individual characteristics in newly diagnosed individuals with ASD

Methods: Participants (N= 2668; 18.1% females; Mage= 7.2 years [SD= 4.8]) were part of the Western Australian (WA) Register for ASD, an independent, prospective collection of demographic and diagnostic data (diagnosticians rate each of the DSM-IV-TR criteria on a 4-point Likert severity scale) of newly diagnosed cases of ASD in WA.

Results: The associations between RRB domains, indexed by Kendall's Tau, were weak, ranging from 0.00 for both CI and IS to 0.20 for IS and RMB. An older age at ASD diagnosis was associated with a lower rating for CI (OR 0.97; 95% CI 0.95,0.98) but a higher rating for IS (OR 1.05; 95% CI 1.03,1.07) and RMB (OR 1.07; 95% CI 1.05,1.09). Higher IQ was associated with lower CI (OR -3.88; 95% CI -5.26,-2.50) but higher IS (OR 3.52; 95% CI 2.13,4.91) and RMB (OR 0.55 95% CI 0.4 0.74). Male gender was associated higher RMB but not IS or CI. Higher social impairments were a significant predictor of higher severity of all three RRB domains; communication severity was a significant predictor only for CI.

Conclusions: The pattern of associations identified in this study provides suggestive evidence for the distinctiveness of RMB, IS, and CI, suggesting the potential utility of RRB domains for stratifying the larger ASD population into smaller, more phenotypically homogenous subgroups that can help to facilitate efforts to understand diverse ASD etiology and inform design of future interventions.

Poster Session
176 - Service Delivery/Systems of Care
11:30 AM - 1:30 PM - Room: 710

288 **176.288** An Ethnographic Study of the Experience of Patients with Autism Spectrum Disorder during Outpatient Encounters

S. King, *Developmental and Behavioral Pediatrics, Boston Medical Center, Boston, MA*

Background: Autism spectrum disorder (ASD) is often associated with increased rates of other comorbidities, with over 95% of patients with ASD displaying co-occurring conditions or symptoms such as gastrointestinal issues, attention-deficit/hyperactivity disorder, and sleep disturbances. The complexity of these cases often require regular treatment from a wide range of medical specialties, resulting in children with ASD utilizing a wider range of medical services with greater frequency compared to children in general. It has been reported that patients with ASD face additional barriers when accessing health care that result in many individual needs remaining unmet. In particular, over-stimulating environments, disruptive patient behaviors, and difficulties in communication between providers and patients have been cited as contributing to poor outcomes for patients with autism.

Objectives: The purpose of this study was to identify and describe barriers and facilitators to care for patients with ASD when receiving outpatient treatment in a hospital setting.

Methods: We used ethnographic methods to understand the experiences of patients with ASD and their families. Researchers followed 23 patients

and their families for the duration of their outpatient visit to Boston Medical Center, an urban safety-net hospital. All patients had a documented ASD diagnosis and were attending a regularly scheduled outpatient appointment. Extensive ethnographic fieldnotes were taken to capture all relevant features of medical visits and transcripts of these notes were coded to identify key themes and recurring patterns during patient visits.

Results:

There were 752 occurrences of barriers to care across all transcripts, representing 85 unique events or interactions. Barriers to care were distributed relatively evenly across thematic categories of Patient Behavior (29.4%), Other Hospital Factors (28.2%), Environment (27.1%), and Communication (15.3%). A majority of barriers to care occurred in the exam room (55.3%), with the distraction of caregivers or providers due to patient behavior representing a major issue (11.8% of cases). In addition to these barriers to care, 45 unique events or interactions were identified as facilitators. Most facilitators were related to Communication (42.2%) and Environment (36.4%) rather than Patient Behavior (4.4%) or Other Hospital Factors (4.4%). Like barriers, most facilitators were identified in the exam room (46.7%), with the bulk of facilitating events being patient-directed communication (28.9%) and direct caregiver participation (17.8%), including caregiver input on specific needs related to ASD (4.4%).

Conclusions:

These results suggest that the barriers to care for children with autism are diverse, spanning patient behavior, the hospital environment, communication between families and providers, and other hospital factors such as long wait times. To address these barriers, hospitals may want to focus on enhancing facilitators of care such as a sensory-friendly environment with age-appropriate toys and provider training that emphasizes patient-directed communication and attention to specific ASD-related needs. We hope that further discussion of these results will inform best practices for the outpatient treatment of individuals with ASD and guide future research in the area.

289 **176.289** A Quality Improvement Approach to Reducing Throughput Time for Pediatric Patients Presenting with a Chief Complaint of Mental Health to the Emergency Department

***A. Jhonsa**, Children's Hospital of Philadelphia, Philadelphia, PA*

Background:

Emergency department encounters for mental health concerns have been steadily rising over the past decade. Children with autism spectrum disorders have higher rates of ED utilization compared to neuro-typical peers, and of those encounters, thirteen percent were for psychiatric problems for children with ASD, compared to two percent for children without ASD (Kalb, 2012). In September of 2017, the crisis center in Philadelphia was closed, and there was a corresponding increase in volume of encounters for children with a chief complaint of mental health at the Children's Hospital of Philadelphia.

Objectives:

To demonstrate improvement in the system of care, specifically decreased length of stay in the emergency room of a large pediatric emergency department for patients being seen for a chief complaint related to mental health.

Methods: In collaboration with the triage team, the primary medical team, and social work, the psychiatry emergency department consult group undertook a quality improvement effort to identify redundant efforts and to streamline the process of care. The team identified the baseline process of triaging patients and requesting social work and psychiatry consults. Utilizing PDSA cycles, interventions for reducing the time to consult, and discharge were identified.

Results: Baseline data from 2017 showed an average length of time from triage to discharge of 391 minutes per patient presenting with a chief complaint of mental health among a total of 1,599 patient encounters. Based on the quality improvement efforts, the team identified duplication of efforts during the admitting process- patients were being seen by the triage team, the primary medical team, the social work team, and the psychiatry team. The psychiatry team was also duplicating efforts of the social work team in documentation. The team developed a mental health track board through which members of the social work team and psychiatry team could immediately be notified when a patient presented with a chief complaint of mental health, and could begin the evaluation process immediately. A process for streamlining documentation was also implemented to reduce duplication of efforts between the psychiatrist and social worker. These changes resulted in a 21% reduction in average time to discharge from 391 minutes in 2017 to an average of 308 minutes among 2,753 patient encounters in 2018. The reduction in median time was 30%, from a median time of 354 minutes per encounter to 250 minutes per encounter.

Conclusions:

Close collaboration among ED clinicians that reduce redundant processes can significantly decrease the time to discharge for patients presenting to the ED with mental health needs. This is particularly important for patients with ASD who are presenting more frequently to the ED, and are presenting more frequently for psychiatric emergencies, and for whom ED encounters are particularly challenging and stressful.

290 **176.290** Implementation of "Patient Behavioral Debriefings" in a Medical Behavioral Unit to Improve Care for Behaviorally Complex Patients, Including Patients with Autism Spectrum Disorders

***D. DeBrocco**, Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Post-event debriefings are a foundational behavior of high performing clinical teams (Sawyer T et al, J Perinatology, 2016). A solid literature base supports the utility of such facilitated discussions of significant clinical events for educational and quality improvement purposes. Debriefing as a post-experience analytic process of learning has a well-documented impact on bettering patient care, improving teamwork, elevating communication efforts, upgrading organizational systems, equipment and resources, supporting emotional processing of participants, and educating providers. As adult learning theory highlights that educational efforts are most effective when a topic is both relevant and carries emotional impact (Edelson DP, Arch Intern Med 2008; Fanning RM, Simul Healthcare, 2017), serious, unexpected, traumatic, and ineffective patient care events are important learning opportunities.

Objectives: To implement post-event debriefings in a Medical Behavioral Unit (MBU), a 10-bed inpatient medical unit at Children's Hospital of Philadelphia (CHOP), to enable iterative improvements to patient care.

Methods: The Medical Behavioral Unit provides care and support to behaviorally complex patients with medical needs. To develop a systematic approach to debriefing behavioral events, the CHOP debriefing tool for medical events was adapted to identify a consistent process and approach

to debriefings after patient behavioral events. This tool for debriefings, was implemented in February 2017 focusing on setting a collaborative tone and clear format for interdisciplinary discussion and improvement in patient care.
Results: The multi-disciplinary team, which includes Psychiatrist/ Psychiatric Nurse Practitioner, General Pediatric Hospitalist, Pediatric Acute Care Advanced Practice Provider, Nurses, Psychologist, Social Workers, Case Management, Child Life, Board Certified Behavior Analysts, Senior Nurse Aide, and Psychiatric technicians, now regularly debrief patient behavioral incidents in the MBU. This has led to rapid and highly individualized changes to care plans for MBU patients, whether a change in medication, or a team-wide change in how to approach the patient. The debriefings have enabled the entire team to more accurately understand patient needs and triggers and to adapt to those needs across disciplines. The debriefings have also led to more general changes in practice, for example the establishment of weekly scheduled meetings to discuss the ongoing care plans for long length of stay patients, and the development of consistent daily schedules to support patients with scaffolding and managing expectations. The consistency of schedule and the ongoing adjustments to care plans have been particularly helpful in supporting patients with autism spectrum disorders who benefit from structured routine, and have highly individualized behavioral triggers and needs. To date there have been 35 debriefings completed on the MBU since February 2017 on 23 unique patients.
Conclusions: The new model of debriefing in the Medical Behavior Unit where post-event inter-professional discussion leads to immediate changes in plans of care related to behavioral support, provides a mechanism for continuous review of unit processes and best practices, and has led to improved patient outcomes for children with ASD and other behavioral needs.

291 **176.291** The Medical Home and Its Predictors in Children with Autism Spectrum Disorder, Other Developmental Disabilities, and in the General Population

ABSTRACT WITHDRAWN

Background: The American Academy of Pediatrics recommends care in a medical home as the model for pediatric care. Receiving care in a medical home is associated with less delayed care and few unmet health care needs. While previous studies report that children with autism spectrum disorder (ASD) are less likely to receive care in a medical home than those without ASD, further study is needed to understand the predictors of having a medical home in children with and without ASD.
Objectives: We used data from the Study to Explore Early Development phase 2, a US multi-site case-control study of children 3-5 years old, to compare the percentages and assess predictors of having a medical home among children with ASD (n=769), other non-ASD developmental disabilities (DD, n=806), and the general population (POP, n=750).

Methods: Data on children's health and service utilization were collected via a maternal-reported form, which included information on five medical home components: 1) child has a usual place for care, 2) child has one or more personal doctors/nurses, 3) receipt of family-centered care (based on mother's experience with providers), 4) obtaining referrals for specialty services if needed, and 5) receiving help for child's care coordination if needed. A child was classified as having a medical home if the mother endorsed all applicable medical home components for that child (e.g., some children did not need referrals or care coordination). We compared odds of medical home between the three study groups adjusting for sociodemograhics, child health and developmental characteristics, and maternal health conditions using logistic regression. We also assessed predictors of having a medical home in logistic regression models stratified by study group.

Results: The percentage of children with a medical home was 46.3%, 52.0%, and 69.5% for ASD, DD, and POP, respectively. Compared to POP, the odds of having a medical home were lower in children with ASD (adjusted odds ratio [aOR]=0.65 [95% CI: 0.48-0.89]) and DD (aOR=0.65 [0.51-0.83]). These differences between ASD, DD versus POP were mostly attributable to three medical home components: referrals; care coordination; and family-centered care. Among the POP group, older maternal age and non-Hispanic white race were positively associated with medical home, while child cognitive score <70, sleep problems, and internalizing behaviors were inversely associated with medical home. In the ASD group, non-U.S. maternal birthplace and child internalizing behaviors were inversely associated with medical home. In the DD group, low family income, child internalizing behaviors, and mother diagnosed with ADHD were inversely associated with medical home.

Conclusions: Children with ASD or DD were less likely to receive care in a medical home than POP children. The predictors of having a medical home varied between study groups. Moreover, despite assessment of numerous child and maternal characteristics, we found only a few associations between medical home and individual-level variables in children with ASD or DD. These results suggest that additional research on other factors, including those related to the healthcare system globally, could inform ways to improve medical home access in children with ASD or DD.

292 **176.292** Service Use in Preschool Children with Autism Spectrum Disorder and Associations with Insurance Status

E. Rubenstein[1], *L. A. Croen*[2], *L. C. Lee*[3], *E. Moody*[4], *L. Schieve*[5], *G. N. Soke*[5], *K. Thomas*[6], *L. Wiggins*[5] *and J. Daniels*[7], *(1)Waisman Center at UW Madison, Madison, WI, (2)Division of Research, Kaiser Permanente, Oakland, CA, (3)Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (4)University of Colorado, Denver, Aurora, CO, (5)Centers for Disease Control and Prevention, Atlanta, GA, (6)University of North Carolina Chapel Hill, Asheville, NC, (7)University of North Carolina at Chapel Hill, Chapel Hill, NC*

Background:
ASD-related services can improve outcomes for young children with ASD but little is known about patterns of service receipt in young children. Further, insurance type may effect which services are received outside of school settings. Children may be on federally funded insurance programs ('public'), employer or personally paid for insurance ('private') or through specific service waiver be enrolled in both programs ('both'). Insurance may cover speech therapy, occupational therapy, behavior therapy, medication, social skills training, respite care, physical therapy, and some complementary and alternative medicines and treatments.

Objectives: To describe amount and type of services used among children age 3-5 years with autism spectrum disorder (ASD) and examine differences across health insurance status (public, private or both).

Methods: We used data on children with past ASD diagnosis in the Study to Explore Early Development, a US community-based study of neurodevelopment conducted between 2012-2016. Mothers reported child insurance status and service use at study entry. We estimated prevalence ratios for cumulative service use and odds ratios for each service type overall and by insurance status for out-of-school and both in- and out-of-school services combined using log-Poisson regression. In adjusted analyses we included maternal education, family income, number

of children in the household, and child year of birth to control for confounding.

Results: Of 803 children with past diagnosis of ASD, nearly 40% of children were not receiving out-of-school services at time of study entry. The most common out-of-school services were speech therapy and occupational therapy. In the sample, 34.7% were on public insurance, 50.6% were on private insurance, and 13.3% had both insurances. Children with public insurance had less total services than children with private or both insurances; however, after adjustment for socioeconomic and demographic confounders, children with private insurance alone received fewer out-of-school services than children with public insurance alone (prevalence ratio: 0.83, 95% confidence interval: 0.71, 0.97). Children with public insurance alone were least likely to receive out-of-school behavioral therapy and most likely to receive psychotropic medication compared to other insurance status. Total number and type of service use was similar between insurance statuses for combined in- and out-of-school services.

Conclusions: We found that while most preschool age children received at least one ASD-related service, many did not receive out-of-school services, especially behavioral therapy. Children on public insurance only were more likely to receive medication and less likely to receive behavioral therapy compared to children with any private insurance. Because receiving adequate service is important for young children with ASD to receive optimal outcomes, targeting policy and practice to improve the availability of evidence-based services to children in all types of insurance programs may improve service use and lead to improved outcomes.

293 **176.293** Shortage of Community Mental Health Clinicians Trained to Treat Autistic Adults

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Background: Autistic adults with co-occurring psychiatric conditions often do not have access to quality mental health services in their communities, in large part because few community mental health clinicians are trained to work with autistic adults. Improving access to quality mental health services will require increasing clinicians' knowledge about and confidence in adapting their clinical practice for this population. Little is known about how to best train community mental health clinicians to effectively treat autistic adults with co-occurring psychiatric conditions.

Objectives: To gather information about community mental health clinicians' knowledge of, skills in, and confidence in treating autistic adults, in order to inform a training program for clinicians working with this population.

Methods: One hundred community mental health clinicians who work with adults in an urban setting completed an online survey (see Table 1 for demographic information). The survey was described as designed to elicit clinicians' opinions of outpatient therapy methods, without specific mention of autism, in hopes that clinicians with a wide range of experiences with autistic clients (i.e., even those with little to no experience) would participate. Participants answered questions about their clinical experience with autistic adults and their prior autism training. Participants also completed a measure of their confidence in working with autistic adults, using an adapted version of the Therapist Confidence Scale-Intellectual Disabilities (TCS-ID).

Results: Most respondents (70%) indicated that they had no autistic adults on their current caseload, although 60% reported some experience providing mental health services to an autistic adult. Most participants (76%) had not received any formal training (e.g., CE workshop, graduate school coursework) in working with autistic adults. Almost all (96%) respondents indicated that they would likely attend such a training if it were offered through their agency. On average, clinicians reported feeling only "slightly knowledgeable" about treating autistic adults. On a scale ranging from 1 (not at all confident) to 5 (extremely confident), clinicians reported significantly less confidence treating autistic adults (M = 2.65, SD = 1.00), than treating adults without autism (M = 3.71, SD = .76), $t(99) = -9.98$, $p < .001$.

Conclusions: This study highlights the need for training to increase community mental health clinicians' knowledge and confidence related to working with autistic adults. Better understanding the current landscape of community mental health services for autistic adults is crucial for future development of provider training programs. Most clinicians expressed a desire for more training in mental health interventions for autistic adults. However, one challenge is that most clinicians do not currently have an autistic adult on their caseload, which could limit the real-time practice of skills learned in a training program.

294 **176.294** The Impact of Intellectual Disability on the Health Service Utilization of Middle Aged and Older Adults on the Autism Spectrum

L. Bishop-Fitzpatrick[1] *and E. Rubenstein*[2]*, (1)University of Wisconsin - Madison, Madison, WI, (2)Waisman Center at UW Madison, Madison, WI*

Background: Preliminary evidence suggests that autistic adults live shorter lives and have more physical and mental health problems compared to the general population. Since so little is known about the larger population of middle aged and older adults on the autism spectrum, it is imperative to leverage existing population-level data to characterize their health service utilization to inform individual and systems-level prevention efforts that can help people on the autism spectrum live long, healthy, and self-determined lives in their communities.
Objectives: This study describes the health service utilization of a unique sample of all middle aged and older Wisconsin Medicaid beneficiaries with an identified autism spectrum disorder diagnosis and tests differences between those autistic adults with and without co-occurring intellectual disability (ID).

Methods: Participants were 143 middle aged and older autistic adults aged 40-88 with two or more Medicaid claims for an ICD-9 code corresponding to an autism spectrum disorder on two different days with (N=64) and without ID (N=79). We examined service claims from all providers (inpatient, outpatient, long-term care, home health, and dental) for service use and physical and mental health conditions between 2012-2015. We categorized service use based on service type and tested differences between autistic adults with and without ID in frequency and type of service use. We categorized physical and mental health conditions based on an established system for grouping ICD-9 codes (Croen et al., 2015) while also presenting prevalent individual conditions.

Results: Autistic adults had, on average, 176.4 (SD=220.6) claims during the four-year study period. In the full sample of autistic adults with and without ID, 66.4% had dental, 43.9% had outpatient, 32.9% had inpatient, 13.3% had home health, and 7.7% had long-term care claims. Findings indicate that autistic adults with ID were more likely to have dental (X^2=7.1, P=0.008) and home health (X^2=7.4, P=0.007) claims compared to adults without ID. Many physical and mental health problems, including immune (70.6%), cardiovascular (49.0%), sleep (85.3%), gastrointestinal (49.7%), neurologic (55.9%), and psychiatric (72.0%) conditions were highly prevalent in our full sample. When comparing odds of the categorized

conditions between those with and without ID, we saw increased but not statistically significant odds of neurologic and gastrointestinal conditions and decreased but not statistically significant odds for immune, cardiovascular, and psychiatric conditions in middle aged and older adults on the autism spectrum with co-occurring ID.

Conclusions: This is the first US study to use claims data to characterize the health and health service utilization of middle aged and older adults on the autism spectrum with and without intellectual disability. Our findings suggest that people on the autism spectrum have a high prevalence of health problems in midlife and old age, regardless of intellectual disability status. However, autistic adults with ID were more likely to have received dental and home health care. While more research is needed to confirm these findings and understand mechanisms, our results underscore the importance of prevention for high prevalence of physical and mental health problems in autism at the individual and systems level.

295 **176.295** A Novel Approach for Building Clinical Capacity of Pediatric Providers in Rural and Underserved Communities Predominantly Serving Native American Populations in the Southwest.

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Background: ECHO Autism and ECHO Autism STAT are novel approaches for building provider capacity to treat patients with Autism Spectrum Disorder (ASD) in rural and underserved communities. Developed by clinicians and researchers at the University of Missouri Thompson Center, these approaches connect rural primary care providers (PCPs) to an interdisciplinary team of ASD experts at a university setting. Their impact has led to increases in PCP self-efficacy in managing patients with ASD and in early identification of symptoms using validated screening tools (Mazurek, et al., 2017; 2018). Through funding from the Autism Treatment Network (ATN)/Autism Research Intervention for Physical Health Network (AIR-P), both ECHO approaches have been implemented in New Mexico and Northern Arizona since January 2017.

Objectives: The objective of this project was to review the feasibility of and challenges associated with implementing the ECHO Autism and ECHO Autism STAT approaches with providers in rural and underserved areas of New Mexico and Northern Arizona.

Methods: The ECHO programs were designed for PCPs and included biweekly, 90-minute virtual clinics using zoom technology. Clinics focused on case presentations and included a standard, brief didactic curriculum about autism screening and identification, medical and behavioral management, and evidence-based intervention. ECHO Autism included training on the M-CHAT-R/F, while ECHO Autism STAT added a two-day training on the *Screening Tool for Autism in Toddlers (STAT*) and ECHO Autism STAT diagnostic model.

Results: Implementation of ECHO Autism and ECHO Autism STAT revealed challenges in three areas: recruitment, provider engagement, and operational efficiency. Recruitment was more time-intensive than anticipated. We contacted clinic managers, disseminated printed and electronic brochures, and presented at a local conference. The most effective method was in-person presentations at staff meetings by professionals of similar training background. Involvement of clinic administration was critical for provider engagement due to the potential impact on patient scheduling. The day, time, duration, and frequency of the clinic were chosen to minimize impact on scheduling and optimize provider availability. Clinician engagement was maximized when they presented their own cases and shared knowledge with participants experiencing similar challenges. Follow-up documentation of recommendations and resources provided targeted and concrete action items. Resource constraints limited implementation of some recommendations, such as access to community interventions. . Operationally, the efforts of the ECHO clinic coordinator proved invaluable for supporting operations and responsive communication between all parties. Centralizing information in an online platform offered consistent communication between everyone, as well as easy access to information discussed during the clinics. Due to the rural nature of several practices, we experienced difficulties with internet connectivity to utilize the online platform and video technology.

Conclusions: Implementation of ECHO Autism and ECHO Autism STAT proved feasible, but highlighted important considerations that will benefit others who are considering this model for their communities. These extra efforts, though substantial, can positively impact patient care within rural and underserved communities, and may be applicable to other communities who face similar challenges as those in New Mexico and Northern Arizona.

296 **176.296** Evaluating Feasibility and Acceptability of Echo Autism in India: A Telementoring Model to Build Physician Capacity in Diagnoses and Management of Pediatric ASD.

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Background:

A significant treatment gap exists in Low and Middle Income Countries (LMICs) for children with Autism Spectrum Disorder (ASD). Often, delayed age of diagnosis in LMICs (Samms-Vaughan,2014) translates into loss of access to intervention in the crucial early years. Potential contributors to delays in diagnoses include physician related factors- limited physician knowledge about ASD, incorrect beliefs about efficacy of therapy and long waiting lists. Additionally, both psychiatric (e.g. ADHD, Anxiety, OCD) and medical co-morbidities (e.g. constipation, sleep issues) are significantly over-represented in children with ASD requiring physician knowledge about addressing them simultaneously. Possible solutions include training professionals in diagnoses and management of ASD and co-morbidities.

Objectives: To evaluate the acceptability and feasibility of ECHO Autism-a tele-mentoring model to increase physician access to best-practise care for children with ASD, piloted in Mumbai, India.

Methods: The Extension for Community Healthcare Outcomes (ECHO) framework shown to be effective in improving self-efficacy and ASD specific practice parameters of primary care physicians in the U.S.A. (Mazurek,et al.,2017) was culturally modified and utilized for the current study. A “hub” team of multi-disciplinary experts at a child development center in Mumbai was connected by secure video-conferencing technology to the “spokes”- 27 primary care and developmental pediatricians, psychiatrists and neurologists working with children with ASD across India, Sri Lanka, Bangladesh, Nepal, Iran and Bahrain who chose to participate in the pilot. Baseline survey revealed that 87% of participating physicians “wanted to learn more about autism” and “81% “desired more confidence in ability to identify and manage ASD”. Over the course of 8 bi-weekly sessions, participants learnt through discussion of cases from their own practice, peer feedback and didactic modules. Content included best practice

methods in screening, early diagnoses of autism, principles of intervention, management of challenging behaviors, psychiatric and medical co-morbidities and involving families in care. Primary outcomes evaluated included participant acceptability of the content and delivery process. In addition, feasibility was evaluated by considering participant attendance, retention rates and changes in knowledge and self-efficacy.

Results:

Participants represented a broad geographic reach spread across 18 cities in 6 Asian countries.17 participants (63%) attended ≥ 75% of the sessions (7-8/8) with average attendance per session being 19.87 (Range 17-24). On a scale of 1-5, participants rated the course as highly satisfactory (*M*=4.34, SD =0.64). Participant knowledge increased on completion of the course (Pre-test *M*= 48.5, SD=12.89; post-test *M*=58.0, SD=12.71; *Z*= -2.56, p=0.01). Total self –efficacy scores as measured by a self-reported questionnaire (Mazurek,et al,2017) adapted to the Indian pilot improved significantly from the pre-test (*M*= 83.8, SD=22.87) to post-test (*M*=120.5, SD=25.59; *Z*= -3.86, p=0.0001) on a Wilcoxon Signed –Rank test. Qualitative feedback from participants emphasized need for videos and demonstration of live cases and information about intervention strategies.

Conclusions: The ECHO Autism model improved physician knowledge and self-efficacy in diagnoses and management of ASD in LMICs in Asia, potentially impacting many underserved communities across these sites. While acceptable and feasible in its current format, further context-specific adaptations to meet the unique needs of physicians practicing in low resource settings are explored.

297 **176.297** Extension for Community Health Outcome (ECHO) Autism - Uruguay: A Coordinated Strategy to Improve Access to Health Care for Children with Autism Spectrum Disorders.

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Background: Uruguay provides universal healthcare through an Integrated National Health System with public and private providers. Although in recent years this system has contributed to improving the health of children, the special care required for children with neurodevelopmental disorders presents difficulties including delays in early diagnosis and lack of access to autism specialists and rehabilitation services. Children with developmental concerns and/or autism often have long waits to see a specialist and receive services. In 2014, the Universidad de la República partnered with Project ECHO at University of New Mexico Health Sciences Center (UNMHSC) to use this model to increase capacity to evidence based medicine in Uruguay. Project ECHO is an innovate framework that uses multipoint video-conferencing to support community physicians and practitioners through case based learning via an "all teach, all learn" approach. ECHO is a cost effective mechanism to improve access to health care for conditions like autism. A multidisciplinary team including pediatricians, neuro-pediatricians and child psychiatrists started the ECHO Autism program in Uruguay in 2015. The goals of ECHO Autism Uruguay include increasing community physician knowledge about identification of symptoms of autism and treatment of autism in the community.

Objectives: To share the experience of the ECHO Autism program in Uruguay during the first three years of implementation, including analysis of case presentations and participates self-perception of skills and knowledge gained.

Methods: Analysis of ECHO Autism clinics from June 12, 2015 to June 8, 2018 including clinical cases presented and participant's self-perception of changes in skills and competences. The following skills and competencies were assessed: identifying developmental delay including autism before age 3, autism diagnosis, support family needs, comorbidity management, psychopharmacology, resource attainment and interprofessional communication.

Results: 30 ECHO Autism clinics were conducted during the study period. Thirty clinical cases were presented: mean age 4.5 years old (range 1– 12); most of them were male (n=25). Twenty patients presented with medical and psychiatric comorbidities, eight of them with two or more. Reasons for presentation in the ECHO Autism clinic were: difficulties in therapeutic approach focused on management of comorbidities (n=22) and diagnosis (n=8). Median age at time of concern was 18th months (range 12-60). Forty-five participants were connected in at least 50% of ECHO Autism clinics. After ECHO Autism implementation, a statistically significant improvement in participant self-perception of skills and competences in all fields evaluated was observed.

Conclusions: ECHO Autism is the first ECHO project in Uruguay focused on a primarily pediatric condition. The results of this experience shows that ECHO Autism is feasible and effective in this population. Additionally, it has an important role to improve access to diagnosis and treatment of children with autism spectrum disorder. A community of practice was achieved through participation in the ECHO Autism clinics, and self-perception about skills and competences in diagnosis and treatment of ASD improved. ECHO Autism in Uruguay is a meaningful approach to autism care and offers improved access to best practice care.

298 **176.298** University of Wyoming Echo for Autism: Leveraging Education Systems to Provide Behavioral Services in Frontier Communities.

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Background: Individuals with autism who live in rural/frontier communities often face numerous challenges accessing services. For example, in Wyoming, there are only a handful of trained professionals with experience in autism to serve the whole state and most individuals with autism live hundreds of miles away from a skilled provider. Given this, most families must rely on the educational system to access even basic services. Unfortunately, many educators receive little to no training on how to support such students with autism. Therefore, professional development opportunities are critical to enhance the capacity of educators to support students with autism. Project ECHOÔ was originally developed to overcome similar challenges facing physicians. University of Wyoming has adapted ECHO to enhance educators' knowledge and skills related to behavioral strategies for autism, and implemented it throughout the state over the last two school years.

Objectives: 1) To describe the adaptation of ECHO for Education: Autism, 2) to the describe the ability of this program to reach remote schools, 3) to describe the impact of this program on teacher knowledge and skills, and 4) describe additional adaptations being made to the model to further support families to work with their schools on behavioral supports.

Methods: Starting in the 2016-2017 school year, ECHO for Education: Autism was deployed in each of the 48 Wyoming school districts . In line with agreements with the state, each session was free and open to anyone. As a result, participants included teachers, paraprofessionals, allied health

professionals, administrators, principals and family members. Attendance was tracked at each session using the iECHO platform used by all ECHO replication sites. Change in educator knowledge and skill was assessed using a traditional and retrospective pre/post design (before and after the school year) and weekly evaluation questionnaires.

Results: After two years of implementation, this program has offered a total of 68 weekly sessions and served 307 unduplicated participants (1247 duplicated participants). Participants have come from all 48 school districts in the state. Weekly evaluations revealed a large impact on participants' self-reported skills, M_{pre} = 2.89 (.87), M_{post} = 3.37 (.78), t = 18.27, p <.001, d = .58, and knowledge, M_{pre} = 2.89 (.83), M_{post} = 3.57 (.73), t = 20.6, p <.001, d = .75. Traditional pre/post assessments revealed knowledge and skills significantly improved over the school year, M_{pre} = 3.06 (1.14), M_{post} = 3.79 (.82), t = 4.38, p <.001, d = .74; retrospective pre/post revealed a similar effect, M_{pre} = 2.87 (1.19), M_{post} = 3.40 (1.03), t = 4.49, p <.001, d = .48.

Conclusions: ECHO for Education: Autism had significant reach statewide. It also seems to have improved skills and knowledge, although it remains unclear how much this has impacted student level outcomes. Based on this success, an additional network for families of children with autism was developed and is undergoing testing. This model has the potential to improve capacity of education systems in rural settings to serve students with autism. Additional research is needed to understand student academic and behavioral outcomes.

299 **176.299** Service Deserts and Service Oases: Utilizing GIS to Evaluate Service Availability for Individuals with ASD

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Background: ASD is a pervasive neurobehavioral disorder characterized by deficits in social communication and interactions, and restricted/repetitive behaviors, interests, or activities.[1,2] ASD's core symptoms and common co-occurring psychological disorders require specialized behavioral and psychological services throughout the life of individuals with ASD.[3,4] However, access to high quality specialty services can be hindered by socio-environmental determinants, such as a lack of available ASD providers within communities where individuals with ASD and their families live.[5,6]

Objectives: As a response to the paucity of literature related to the *availability* of community-based ASD services, this study utilized GIS methods to map the locations of ASD agencies across the state of Michigan. We hypothesized: 1) Population will be correlated with the availability of service such that fewer agencies will be located in less populated areas as compared with more populated areas; 2) SES will be correlated with the availability of ASD services such that areas with low SES will have fewer ASD services as compared with areas with medium and high SES; and 3) An interaction will be found between population and SES such that areas with low SES and high population densities will have fewer available ASD services as compared to areas with medium or high SES and high population densities.

Methods: We compiled a list of ASD providers within Michigan by conducting a systematic, iterative web-based search by county. We then geocoded the location of verified ASD specialty service providers using ArcGIS 10.4.1, and used network analysis to assess available ASD services in relation to population distribution, socioeconomic disadvantage, urbanacity and immobility.

Results: Individuals living in rural areas had significantly fewer ASD agencies available within 10 miles than individuals in suburban and urban areas—average distance to nearest ASD provider was 12.43 miles for rural areas versus 2.82 miles in urban and 3.36 miles in suburban areas. Spatial autocorrelation (Moran's I) indicated that the spatial distribution of ASD agencies was not random (p<0.01, Moran's Index<0.01); areas with greater socioeconomic disadvantage had fewer nearby ASD agencies available. Finally, Getis-Ord GI* clustering analysis was used to determine statistically significant spatial disparities. While most urban areas had good availability of ASD services, the region of Metro Detroit exhibited a significant disparity in availability, such that wealthier suburbs had good availability of ASD agencies while few agencies were available in the poorer urban area. Thus, high population and low SES alone do not seem to determine the distribution of ASD agencies.

Conclusions: Knowing the landscape of ASD availability (and the specific areas that are particularly poorly serviced) gives service providers and healthcare planners the opportunity to advocate for increases in ASD services in these underserved areas. Additional services research is needed to identify system-level barriers contributing to disparate service availability. While addressing gaps in urban and rural regions may be difficult, use of evidence-based dissemination and implementation strategies may facilitate adoption and uptake of more nimble treatment options such as integration of behavioral health and primary care, school-based health centers, mobile autism clinics or telehealth services.[7-10]

300 **176.300** A Pilot Study to Enhance Psychologists' Delivery of Feedback during the Autism Spectrum Disorder Diagnostic Evaluation

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Background: Serving children with Autism Spectrum Disorder (ASD) is a significant public health concern (CDC, 2014). Although up to 44% of children with ASD receive a comprehensive evaluation before age 3, up to 25% of children with ASD do not receive any services (Bowker et al., 2011; CDC, 2014). Researchers have suggested that tailoring the diagnostic evaluation feedback can lead to reducing time to parent initiation of services (Mandell & Novak, 2005; Zuckerman et al., 2016). To date, only one study has examined a training to practice delivery of an ASD diagnosis and found it helped trainees increase flexibility, attentiveness, and responsivity to parents (Kawamura et al., 2016).

Objectives: To develop and pilot a toolkit to improve and individualize psychologists' communication to families following an ASD diagnostic evaluation. Specific goals of this study are to: (a) examine psychologists' perception of feasibility, usefulness, acceptability and appropriateness of a toolkit for feedback in a community based clinic using mixed-method data; and (b) examine the impact of the toolkit on psychologists' perceptions and practice.

Methods: Seven psychologists at a regional children's hospital were recruited to participate in a toolkit training, and complete a 4-item "confidence in tailoring feedback" prior to and following the training in addition to a feedback survey two-months post-training and a ten-month follow-up interview. All participating psychologists were female and the majority were Non-Hispanic White. Interview data were analyzed using a Rapid Assessment Process (RAP; Beebe, 2001); open-ended survey responses were coded using an open-coding process (Haine-Schlagel et al., 2013); and survey responses (on a Likert scale from 1-strongly disagree to 5-strongly agree) were analyzed using SPSS. In addition, parents served by participating psychologists before and after toolkit training were asked about psychologists' use of key toolkit strategies.

Results: Psychologists responses to the feedback survey close-ended responses indicated: 1) very high training acceptability (M=4.70; SD=.39); 2) high toolkit feasibility (M=4.21; SD=.57)utility to increase parent readiness to act on recommendations (M=4.14; SD=.90), satisfaction (M=4.36; SD=.56); 5) appropriateness (M=4.50; SD=.50) and planned sustained use of the toolkit (M=4.43; SD=.54); and 3) moderate toolkit utility for tailoring evaluation feedback (M=3.89; SD=.48). Feedback survey open-ended responses indicated specific tools that were most useful.

For the second objective, only four providers completed the confidence items both before and after training and examination of the mean responses for each item indicate consistent trends in the expected direction (i.e., improved confidence after the training). Effect size estimates indicate that parents served after toolkit training reported that the psychologist was more likely to prioritize recommendations and provide clear guidelines for how to obtain the evaluation report than parents served before the training. Psychologist follow-up interview themes indicated sustained use of certain toolkit components but not always as intended.

Conclusions: Both quantitative and qualitative pilot data indicate that a toolkit to assist psychologists in tailoring their feedback and recommendations following an ASD evaluation is feasible, useful, acceptable, and appropriate and may impact psychologists' perceptions about tailoring the evaluation feedback process as well their feedback delivery practices.

301 **176.301** A Review of Family Navigation: An Exemplar for Children with Autism

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Background: Significant disparities exist in access to diagnostic and treatment services for children with autism spectrum disorder (ASD), especially for low income, racial and ethnic minority families. *Family Navigation* (FN) is a promising intervention to address these disparities by reducing system and patient-specific barriers to accessing ASD diagnosis and treatment. FN is an evidence-based care management intervention delivered by a trained community health worker who assists families in overcoming barriers to accessing a defined set of services over a time-limited period. There is a growing evidence base for FN to accelerate the diagnosis of ASD and early intervention access. However, no published data exist on how best to deliver FN, which components are most critical (and for whom), and what strategies to employ for implementation (i.e., "core components").

Objectives: To review existing FN work and describe the core components of FN for ASD.

Methods: The research teams from four large studies (total N of children = 550) of FN for ASD completed the Template for Intervention Description and Replication (TIDieR) checklist to outline intervention components including: physical materials, who provided services, how/where /when/how often service was provided, tailoring or modification, and assessment of intervention fidelity and implementation. A qualitative synthesis of these TIDier checklists was used to determine the core components.

Results: Ten components were identified: (1) intensive training to navigators on motivational interviewing, navigation intervention, problem solving approaches, and ASD diagnostic and treatment services; (2) ongoing supervision and case review; (3) shared language and cultural concordance between the navigator and the family; (4) individual (navigator to family) face-to-face, phone, and email encounters, which occur in family's homes, clinic, or other community/service settings where the family requests support (e.g., Supplemental Security Income office); (5) identification of barriers to appropriate care (e.g., language, cultural beliefs, transportation, distrust/emotional barriers, medical system barriers, financial barriers); (6) creation of a family-specific action plan to improve access to care; (7) care coordination for the entire family and the provision of a necessary link to community-based resources; (8) emotional support throughout the entire process (i.e., from FN referral through access to ASD treatment up to 100 days); (9) checklist of key navigator tasks that are family-specific and vary in intensity based on each family's needs (e.g., helping to schedule appointments); (10) ongoing, systematic fidelity monitoring (e.g., Family Navigators audiotape one randomly selected session for each client; audiotapes are then reviewed by the FN supervisor and used to provide feedback on FN delivery)

Conclusions: Family navigation in the context of childhood ASD is designed to reduce the time to an ASD diagnosis and access to treatment, and mitigate racial, ethnic, and socioeconomic disparities in service access. Through a qualitative synthesis of large-scale studies testing FN for ASD, we identified 10 core components of FN training and treatment delivery. We will discuss the importance of each component and implications for future implementation research and practice of FN for ASD.

302 **176.302** Age at ASD Diagnosis and Influential Factors: A Meta-Analysis and Systematic Review for 2012-2018

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Background: Between 1990 and 2012 the global mean age of ASD diagnosis was reported between 38 and 120 months. Although global measures take place to reduce the age at ASD diagnosis, the global current age of ASD diagnosis is unknown.

Objectives: To conducted a meta-analysis regarding the global average age at ASD diagnosis and a systematic literature review regarding influential factors on the age at ASD diagnosis between 2012 till 2018.

Methods: We performed a PubMed literature search with 'age' AND 'diagnosis' AND 'ASD' in title or abstract. We limited the search to studies published in English from January 2012 through February 2018 reporting the average age at ASD diagnosis of any ASD. Influential factors on the age of diagnosis were assessed from these identified studies. We conducted random-effects meta-analysis to assess the global mean age at ASD diagnosis. Also, we specified the mean age at diagnosis for study samples < 10 years of age so results can be interpreted within the scope of early detection.

Results: We found 40 studies reporting the average age at ASD diagnosis in 36 countries (n = 2141 215 individuals). Results show that the mean age at diagnosis (n=28 033 individuals) ranged from 29 to 571 months and meta-analysis show that the overall mean (95%CI) age at diagnosis was 55.5 (44.8;66.2) months. When studies were selected comprising children only <10 years of age (n=17 760 individuals), the mean age at diagnosis ranged from 30.81 to 74.7 months and meta-analysis showed that the overall mean (95%CI) age at diagnosis was 43.5 (40.0;47.0) months. Type of ASD diagnosis, ASD severity, additional diagnosis and region are the most frequently reported factors affecting the age at diagnosis.

Conclusions: Our systematic literature review and meta-analysis between 2012-2018 showed that the overall mean age at ASD diagnosis is 55.5 months, compared to the range of 38 and 120 months based on a literature review between 1990 and 2012. Although comparability of these outcomes is complex due to study design factors, these results indicate that although a younger age of diagnosis seems to be obtained, improvement in early detection of ASD should have constant attention.

303 **176.303** All Hands on Deck: Increasing Knowledge of Autism Signs and Symptoms By Evaluators in the Part C System Toward Earlier Detection and Referral for Early Intervention Services

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Background:

Despite evidence that early intervention (EI) for Autism Spectrum Disorder (ASD) can improve language and behavior and optimize outcomes for children by making crucial differences in early brain development (Dawson et al, 2012), only a fraction of children with ASD are identified in early childhood (Baio et al, 2018). Standardized ASD screening procedures and knowledge are not yet in widespread practice in pediatric settings (Radecki et al 2011); however, implementation of these procedures community-wide is needed to address disparities in age of detection based on many factors (Giarelli et al 2010). In many communities, EI providers also lack sufficient training to recognize red flags for ASD (Zwaigenbaum et al, 2015; IACC, 2017).

Objectives**:**

Evaluators are among the first professionals to see children referred for delays and are in the pivotal position of using assessments and clinical judgment to refer children with developmental delays meeting criteria for services in the Part C system. This project aimed to increase evaluators' knowledge and comfort with early detection of ASD in infants and toddlers by providing access to an 8 hour web-based course and conducting three webinars to support participants' learning.

Methods:

This study examined the feasibility and impact of providing training to 20 EI evaluators on red flags for ASD in toddlers. The study utilized automated completion and mastery metrics as well as surveys on a Likert scale. Participants also provided text responses to reflect options not listed. This exploratory study examined demographics, education level, professional role, impact on knowledge and comfort with identifying ASD, willingness to discuss ASD with families, and satisfaction with the training.

Results:

- 20 EI evaluators represented 8 of 18 districts
- 3 districts served a highly populated metro area; 5 served rural areas .
- 75% MA degree; 25% BA degree
- 3 SLPS, 12 intake coordinators,13 special instructors. Several individuals held more than one role.
- 70% of participants participated in all three webinars.
    - 47% of participants completed all six modules
    - 37% of participants did not complete modules
    - 50% responded to both a pre- and post-survey.
        - From pre- to post, participants reported an increase in knowledge and confidence in:
            - describing red flags for ASD to families
            - answering questions about ASD
            - creating IFSP goals to address social communication deficits.
        - All participants reported that the webinars were relevant and engaging and that the best way to learn is through both online modules AND webinars

Conclusions:

Data gathered from participants indicated high satisfaction with the project and an overall increase in evaluators' confidence in identifying and describing red flags for ASD in young children. This data informs future collaborations in the community with the goals of supporting EI evaluators to deepen their knowledge of ASD in toddlers, their ability to describe red flags for ASD to families during the EI evaluation process, and building the capacity in the Part C system to identify and provide evidence-based intervention for children who are at-risk for autism. This project could easily be replicated statewide and child and family outcomes measured.

304 **176.304** An Integrated Health Care Model for Patients with Autism Spectrum Disorder

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Background: More than 70% of children with Autism Spectrum Disorder (ASD) have a co-occurring psychiatric or medical condition, requiring frequent access of the healthcare system over a range of sub-specialties (Dang et al., 2017). Due to the complexity of navigating care for this population (Fig. 1), the majority of families with children with ASD are more likely to experience delays in care and lower satisfaction with the care they do receive (Kogan et al., 2008).

The Integrated Care Model involves a coordinated and co-located collaboration between primary care and mental health providers working together to care for the patient (Ader, 2015). Outcomes in the general population have demonstrated significant improvements in the mental

health of youth in an integrated compared to a standard setting (Asarnow et al., 2015), however there is a gap in the literature when it comes to patients with ASD.

Objectives: To develop, implement, and assess an integrated model of care within an existing behavioral health clinic focused on the care of individuals with ASD and other developmental disabilities with the aim of improving patient care and outcomes.

Methods: Development of the model to integrate medical services into the existing behavioral health clinic began in May 2018. To track client utilization a referral tracking system was built into the clinics Electronic Health Record system. A staff survey was designed to assess buy-in, feedback, and perceived needs/benefits of the introduction of the model. Additionally, the Parental Stress Index (PSI) and Youth Satisfaction Survey (YSS) were selected to assess the impact of the integrated model on the clients and their families. Integrated services began being offered at the clinic in August 2018.

Results: Over the past year, 245 individuals with ASD were seen at the clinic (82.9% male; age range 3-54 years, *M*=13.9, *SD*=7.45). Nearly half (48.8%) of clients who were assessed at intake reported concerns over additional health problems, with the most commonly reported related to speech problems, dental issues, asthma, and vision problems. Feedback from staff surveys suggest strong buy-in with 93% reporting that they were likely-very likely to utilize the new medical services. The pediatrician currently is on-site once a week to provide services and clinic staff are already regularly utilizing this resource for consultation on client issues. Additionally, monthly educational sessions are hosted by the pediatrician for the staff to discuss medical topics of interest. Data collection is ongoing and analyses on referrals, PSI, YSS, and staff surveys will be conducted to explore the impact of the introduction of the model on the clients.

Conclusions: Building on the current work of the clinic, the team is streamlining workflows, and incorporating systems for assessment of the impact of the model. Providing an integrated care model to families will allow them to receive efficient, coordinated and holistic care at one site. Should our integrated model prove effective at improving access to care and the quality of life of families impacted by ASD, we hope the integrated care model becomes a common practice for ASD clinics.

305 **176.305** Autism Parent Training in a Developing Country: A Public/Non-Governmental Organization (NGO) Partnership.

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Background:

Multidisciplinary support services for autism spectrum disorder are minimal in the public service and often inaccessible due to the high cost privately. Repeated advocacy efforts have also failed to impact significantly the public service provisions. The stark reality is that many families do not access basic services like speech therapy and occupational therapy. Many children do not receive adequate access to school placements.

Early detection and intervention is the way forward but in a developing country, impacting service provision is limited by resource challenges regarding funding, management, political will, infrastructure limitations, and limited human resources.

This project accessed funding from a NGO to train professionals within the public health system to provide parent training modules to parents in their service regions.

Objectives:

We studied the impact of a NGO sponsored training in providing training to parents of children with ASD.

Methods:

In March 2016, December 2016 and November 2017, a local Rotary Club, a Child Health Department of a tertiary institution, a Community Paediatric team in a Regional Health Authority (RHA) and a foreign university autism research and treatment centre came together to host autism parent training modules. Selected professionals from all five Regional Health Authorities in the country were invited to be trained. Parents from various public clinics were invited to attend. Eight modules were completed. Professionals trained then offered training to parents in their respective regions.

Results:

Within twenty four months subsequent to the initial training, sixty percent of the RHAs held some form of parent training for local families.

In one RHA, a child psychiatry team and a community paediatric team collaborated to provide parent training during afternoon sessions within working hours in a local health centre. Materials were provided through the RHA print centre. Light refreshments were sponsored by a drug company. Eight training sessions were carried out during the twenty four month period. On average thirty parents were invited for the training but the average attendance rate was 60% of parents invited. Initial feedback indicated that parents found the training beneficial. Data regarding the outcome after training is to be collected.

In another RHA, training was carried out in a local health centre for small groups of parents with positive feedback from parents. A medical officer teamed up with nurses in the health centre to provide the training.

In another RHA, an initial large group parent training session was carried out. Further sessions were not initiated.

Training was also provided in the context of clinical consultations in paediatric follow up clinics.

Conclusions:

In keeping with the United Nations mandate for upgrading services for Autism this Public/NGO partnership has served to improve capacity by empowering and training parents. Given the constraints, financial and otherwise, this type of partnership may be the way forward in developing countries. While the partnership has bolstered capacity, further supports and strategies beyond provision of initial training is necessary to achieve sustainable improvements in care within developing countries.

306 **176.306** Barriers to the Implementation of Effective Transition Services for Adolescents with Autism Spectrum Disorder

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Background: In the years following high school, young adults with autism spectrum disorder (ASD) report lower rates of employment, post-secondary education, and independent living than do individuals with other disabilities (Newman et al., 2011). Though evidence-based practices

exist to support individuals with disabilities generally during the transition from high school to post-school education or employment, little research has focused on evidence-based practices specifically targeting high school students with ASD (Test, Smith, & Carter, 2014). Current literature summarizes recommended best practices for preparing adolescents with ASD for transition (e.g., Gerhardt & Lainer, 2011), yet these recommendations are implemented inconsistently at best (Carter et al., 2010). The present study utilized a qualitative approach to investigate barriers to the implementation of effective transition services for adolescents with ASD.

Objectives: The primary objective of the present study was to document barriers impacting the implementation of best-practice transition services for adolescents with ASD, from the perspective of multiple stakeholders. In particular, the present study sought to describe challenges unique to individuals with ASD during the transition period.

Methods: A series of focus group discussions were held to access the perspectives of parents of adolescents and young adults with ASD, as well as school and community professionals working with individuals with ASD. Focus groups were homogenous with respect to stakeholder group (i.e., parents, school professionals, community professionals). Focus group transcripts were analyzed using a constant comparative approach (Boeije, 2002), resulting in a series of themes representing an array of barriers to transition planning and transition services.

Results: Analysis of focus group transcripts yielded 21 separate themes. Nine themes were related specifically to challenges associated with core symptoms or associated characteristics of ASD, such as social challenges, independent living skills, and self-determination. Ten of the themes focused on challenges or barriers existing at the systems level, either within families, within school or agency systems, or in interactions among these systems. These included service availability and access, limited knowledge about ASD, and challenges finding appropriate employment. The remaining two themes highlighted the importance of interpersonal relationships and the challenge of burnout. Examining the frequency of references to specific themes across stakeholder groups indicated that similar patterns emerged in the discussions of parents, school professionals, and community professionals.

Conclusions: The barriers described by focus group participants answer not only the question "What interferes with the *implementation* of transition services?" but also the question "What barriers are transition services *not addressing* for individuals with ASD?" The implementation of best practice transition services is hindered by limited availability of such services, a lack of personnel to provide them, and uneven knowledge about ASD, among other challenges. However, there also do not exist sufficient services to address the full range of challenges associated with the characteristics of ASD. For instance, existing transition services typically do not include mental health services, instruction in independent living skills, or executive functioning strategies. As efforts to improve transition services and outcomes continue, it will be important to consider and address the barriers described by stakeholders.

307 **176.307** Behavioral Artistry: Identifying the Characteristics of Effective Therapists in the Applied Behavior Analysis Treatment of Autism

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Background: Richard Foxx's article "Twenty-five years of Applied Behavior Analysis: Lessons Learned" summarized insights from decades of research and treatment in the field of ABA, concluding that the effectiveness of therapy may be negatively impacted by limited repertoires among today's behavioral interventionists. Foxx believes there are important differences in the outcomes of ABA treatment between persons who deliver services strictly in a traditional way ("Behavioral Technologists") and those who demonstrate a broader set of humanistic/interpersonal behaviors ("Behavioral Artists") including care, flexibility, optimism, and humor, among others. Our previous research standardized the reliable measurement of Foxx's Behavioral Artistry (BA) traits using Cattell's Sixteen Personality Factors (16PF) Questionnaire, and socially validated BA by demonstrating parents of children with autism significantly preferred descriptions of behaviors aligning with BA characteristics.
Objectives: The purpose of this study was to investigate differences in the quality of ABA treatment for children with autism when delivered by therapists who have higher or lower levels of Behavioral Artistry.

Methods: ABA therapists at a university-based autism center completed the 16PF questionnaire and were assigned an overall percentage of BA traits based on their corresponding 16PF scores. Therapists with the highest (75% or greater) and lowest (25% or lower) BA percentages were observed during multiple 10-minute videotaped DTT and NET therapy sessions. There were 13 therapists in both the High-BA and Low-BA groups. Foxx's characteristic "Likes People" subsumes a majority of the BA traits. Thus, Likes People was operationally defined, including four behavioral components: Pleasant Facial Expression, Positive Tone of Voice, Sustained Gaze (at client), and Body Position/Orientation. For each therapist, partial-interval recording (10-second intervals) was used to determine a percentage of occurrence for each behavioral component across three observations. Additionally, a subjective rating (0-100) of Likes People was scored by data collectors for each observation session. A percentage of Behavioral Technologist behaviors (defined as fidelity of implementation of trained components of DTT and NET therapy) was also scored. Differences by therapist gender, university major, number of months of experience, and type of therapy session were analyzed.

Results: Therapists in the High-BA group scored higher on all objective and subjective ratings of Likes People, and on Behavioral Technology, than those in the Low-BA group. Differences were statistically significantly higher *(p=0.05)* for Pleasant Facial Expression. Females scored higher than males in both groups. There were significantly fewer ABA majors in the High-BA group. Low-BA therapists had significantly more experience. Therapists in the Low-BA group scored lower on Positive Tone of Voice during NET sessions. IOA for Likes People interval scoring was 94.2% overall.

Conclusions: Therapists with higher levels of interpersonal behaviors associated with Behavioral Artistry were rated qualitatively better in their delivery of ABA treatment for children with autism, suggesting important implications for hiring, training, and supervising effective ABA interventionists. Hypothetically, therapists who are warm, attentive, creative, optimistic, and persevering will generate more positive outcomes for individuals with autism in schools, clinics, and homes. Future research should investigate whether High-BA therapists have better client outcomes and whether BA can be effectively trained.

308 **176.308** Caring for Children with ASD in Primary Care: Perceived Barriers and Needs for Support

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Background: Access to comprehensive, coordinated, and evidence-based healthcare is critical for children with autism spectrum disorder (ASD), particularly given their complex healthcare needs and co-occurring medical and psychiatric conditions. However, children with ASD experience greater unmet healthcare needs, higher healthcare costs, and worse access to specialty care than children with other special healthcare needs. Children with ASD from underserved populations face even greater difficulties accessing specialty care. Primary care providers (PCPs) are ideally positioned to address these disparities by offering consistent, timely, and culturally-responsive care for children in their own communities. However, many PCPs have difficulty providing evidence-based screening and management of children with ASD. A better understanding of perceived barriers and needs for support among PCPs would directly inform future efforts to enhance care for children with ASD within the primary care setting.

Objectives: To examine the perceived barriers and needs for support in providing care for children with ASD among a large geographically diverse sample of PCPs.

Methods: Data were examined from a multi-site study of a new PCP training program focused on caring for children with ASD. The sample included 114 PCPs caring for underserved children in 14 US states, including general pediatricians (n=82), internal medicine-pediatrics physicians (n=6), family medicine physicians (n=7), nurse practitioners (n=15), physician assistants (n=2), and other PCPs (n=2). At the baseline assessment (prior to participating in the 6-month training program), PCPs were asked to indicate the specific barriers they faced in caring for children with ASD in their practices (from a list of 10, which included an open-ended "other" option), and also responded to an open-ended text response question: "What do you need to improve care for children with autism in your practice?" Descriptive statistics were conducted to characterize the frequency with which specific barriers were endorsed. Qualitative methods were used to code and analyze the themes reported in open-ended responses.

Results: The most commonly endorsed barriers included lack of time (84%), lack of confidence in managing behavioral issues in children with autism (84%), and lack of knowledge about autism resources (80%). Many PCPs also endorsed lack of access to autism specialists (64%), lack of prior training in autism (57%), lack of confidence managing medical problems in children with autism (50%), and lack of knowledge about autism symptoms (30%). Fewer PCPs reported lack of support from administration (17%) or inadequate reimbursement (28%) as barriers. Qualitative analyses of perceived needs for support revealed six themes, the most common being need for additional resources (expressed by 48% of PCPs), desire for more knowledge and confidence (52%), and a need for greater access to diagnostic and behavioral specialists (25%).

Conclusions: PCPs commonly endorsed multiple barriers to caring for children with ASD. Many of the most commonly reported barriers related to needs for additional knowledge and training in how to manage and support children with ASD, suggesting a need for specific PCP training programs. Additional barriers suggest a need for enhancing the broader health system, including allowing for lengthier visits and improved reimbursement.

309 **176.309** Clinician Perspectives and Processes Impact Genetic Testing Completion in Autism: A Mixed Methods Survey

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Background: Despite consensus guidelines that genetic testing should be offered to all patients with non-syndromic autism spectrum disorders (ASD), research shows low utilization rates for any genetic test (41-51%), and lower (13-20%) for chromosomal microarray (CMA). In 2013, the Boston Children's Hospital Autism Spectrum Center instituted practice guidelines calling for Fragile X and CMA testing for all children with non-syndromic ASD. Data from February 2015 through January 2016 demonstrated that only 40% of our patients with a new ASD diagnosis were undergoing CMA despite these guidelines.

Objectives: To better understand the low rate of completion of genetic testing, we conducted an anonymous mixed methods survey of providers in the Boston Children's Hospital Autism Spectrum Center about their perspectives on genetic evaluation in ASD, current processes and barriers to testing.

Methods: A survey was sent electronically to 59 providers in the Department of Neurology and the Division of Developmental Medicine at Boston Children's Hospital. Nurse practitioners, neurologists, psychologists, developmental-behavioral pediatricians and neurodevelopmental disabilities specialists who perform diagnostic evaluations in the Autism Spectrum Center were included. Trainees in clinical psychology, developmental-behavioral pediatrics and neurodevelopmental disabilities were also included. Questions covered the areas of current practice, knowledge gaps, and obstacles clinicians face.

Results: Thirty providers completed the survey for a 50.8% response rate, with equal representation across Neurology and Developmental Medicine. The majority of respondents were attending physicians (n=15, 50.0%), followed by physician trainees (n=8, 26.7%), attending psychologists (n=5, 16.7%) and nurse practitioners (n = 2, 6.7%). These providers were performing new diagnoses frequently, with 86.7% of respondents diagnosing ASD at least 1-3 times per month. All clinicians recommended genetic testing often or always, and 69.0% believed that families are often interested in genetic testing (compared to 3.4% = "always," 27.6% = "sometimes").

The most common reason providers did not recommend genetic testing for ASD was forgetfulness (n=7, 23.3%). While 96.7% of respondents endorsed discussion of the importance of testing with families, only 40% affirmed they typically discuss testing methods like identification of deletions/duplications on CMA, and just 3.3% endorsed explanation of the possibility of detecting consanguinity with single nucleotide polymorphism-based CMAs. In terms of process gaps, for patients initially denied coverage, some providers (19.2%) did not pursue genetic testing further, while others (30.8%) referred families to the Genetics Division to resolve insurance coverage issues. One major barrier appeared to be prior authorization for genetic testing, with 52.0% of providers reporting being uncomfortable with the process. Free-text comments on barriers to genetic testing centered on the "confusing and difficult" insurance authorization process and need for additional resources.

Conclusions: Providers across Neurology, Psychology and Developmental Pediatrics are on the front lines of the initial genetic evaluation of children with ASD. We identified variability in provider self-reported comfort, counseling and processes, which impact which children with ASD complete standard-of-care genetic testing. Further work and resources are required to generate a simple centralized system to tackle this complex but surmountable challenge for providers and families alike.

310 **176.310** Development and Psychometric Testing of the Healthcare Provider Self-Efficacy Scale – Adult Autism

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Background: A growing number of studies show that autistic adults experience significant healthcare disparities and that healthcare providers are ill-equipped to provide high-quality care to adult patients on the autism spectrum. Interventions to improve care must be informed by providers' specific training needs which may be assessed using measures of providers' self-efficacy. However, there are no existing validated instruments to assess provider self-efficacy in caring for adult patients on the spectrum.

Objectives: Develop and psychometrically test the Provider Self-Efficacy Scale - Adult Autism, a measure of providers' self-efficacy in providing healthcare to autistic adults.

Methods: We used a community-based participatory approach throughout the project, in partnership with academic researchers, autistic adults, supporters, and healthcare providers. We used our prior qualitative research and our team's expertise to create a 1-page questionnaire for primary care providers. The new self-efficacy scale includes 6 items prompting providers to rate their confidence in several aspects of providing care to adult patients on the autism spectrum. Response options use a 5-point Likert scale (1=not at all confident to 5=very confident). The 6 items were dichotomized at 4-5=high confidence and totaled (range 6-30). The survey also includes 2 items on how challenging or rewarding providers felt it was to provide high-quality care to adults on the autism spectrum (0=not at all to 10=extremely) and 7 items on demographic characteristics, training, and experience. We surveyed 143 primary care providers from 8 primary care clinics in Oregon and California, USA. Approximately half practiced internal medicine and half practiced family medicine. We assessed the self-efficacy scale's internal consistency reliability using Cronbach's alpha and convergent validity using pair-wise correlations and t-tests.

Results: The Provider Self-Efficacy Scale-Adult Autism had good internal consistency reliability with an alpha of 0.87. It showed strong convergent validity, as follows: Participants who had provided care to 6 or more autistic adults had higher self-efficacy scores than those with less experience (mean 19.8 vs 17.6, p=0.006). Self-efficacy was positively correlated with providers' ratings of how rewarding it is and negatively correlated with ratings of how challenging it is to provide care to adults on the spectrum (r=0.24, p=0.005; r=-0.5, p<0.0001, respectively). A minority of providers reported high confidence in: communicating with patients (25%); performing physical exams or procedures (43%); accurately diagnosing and treating other medical issues (40%); helping patients stay calm and comfortable during visits (38%); identifying accommodation needs (14%); and making necessary accommodations (16%). There was no difference in self-efficacy score by provider gender, degree (MD/DO vs NP/PA), specialty, or training status. There was a slight positive association between self-efficacy score and provider age (r=0.17, p=0.04).

Conclusions: The Provider Self-Efficacy Scale-Adult Autism demonstrated strong internal consistency reliability and convergent validity. Providers showed low confidence in all aspects of providing care to autistic adults. Training needs may be highest in the areas of communicating with patients and identifying and making necessary accommodations. Future research is needed to validate this scale further and to understand how to meet providers' training needs most effectively.

311 **176.311** Early Intervention ASD Practices through Part C Systems: Results from a Nationwide Inquiry

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Background: Part C of IDEA federally mandates that early intervention is provided to children under three years of age in order to enhance the development of infants and toddlers with disabilities, reduce educational costs, and enhance the capacity of families to meet their child's needs (IDEA, 2004). Governors determine which state agency administers the program. These agencies, guided by the Interagency Coordinating Council, determine eligibility including whether children at risk for disabilities, including Autism Spectrum Disorder (ASD), are served. Early interventions for children with suspected or confirmed ASD should address core and associated features through evidence-based Naturalistic Developmental Behavioral Interventions (NDBIs; Schreibman et al., 2015) that actively involve caregivers (Zwaigenbaum et al., 2015). However, community agencies often do not have the accessibility to ASD specific interventions and thus families are not recipients of these practices (Hume et al., 2007; Stahmer et al., 2005; Siller et al., 2013).

Objectives: To evaluate Part C practices across all 50 states regarding management of children with ASD.

Methods: Agency administrators within the state agency that determines intervention eligibility were contacted via phone and/or email. They were asked three questions about treatment dose, whether a specific method(s) of intervention was recommended, and whether Applied Behavior Analysis was provided through Part C. They were also encouraged to provide additional comments, challenges, or state-specific issues regarding treatment provision for children with ASD. Responses were entered into a database so descriptives could be calculated and comments could be evaluated to detect themes.

Results: To date, agency administrators from 27 states have responded. Dose ranged from 30 minutes per week to 25 hours per week. Eleven states recommended a specific method. Reported recommended methods included ABA (4 states), Floortime (3 states), Pivotal Response Training (2 states), and the Early Start Denver Model (2 states). Two states did not recommend a particular method, however they did refer clients and providers to the evidence-based practices identified in the National Standards Project (NAC, 2015). Two broad themes emerged within open comments: Medicaid waiver and Individualized Family Service Plan (IFSP). State guidelines relative to Medicaid waiver often influenced whether a Part C program recommended ABA services or other supplemental interventions. Dose and method were frequently determined by the IFSP, as intended by law. Twelve state agencies indicated that they provide ABA services through Part C or refer families for ABA services through the Medicaid system.

Conclusions: Part C early intervention practices for children with ASD vary widely across the 27 states analyzed for the current proposal. However, the IFSP was consistently used to determine dose and method. Funding mechanisms, primarily Medicaid, was frequently referenced relative to supplemental (ABA) interventions. Two NDBIs (PRT and ESDM) were recommended by four of the 27 states (15%). These preliminary findings provide insight into community early intervention practices and highlight the research to practice gap highlighted by previous studies (Dingfelder & Mandell, 2011). These findings also provide researchers with a clear picture of real-world early intervention practices and highlight opportunity for community based research. Data collection is ongoing.

312 **176.312** Effective Methods for Increasing Gesture Use for Children with ASD

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Background:
Gesture development, use, and repertoire differ in young children with ASD (Manwaring et al., 2018 and Watson et al., 2013). Gestures play a fundamental role in social interaction and therefore are often an important intervention outcome in early interventions. Ingersoll (2006) taught imitation and spontaneous use of descriptive gestures in young children with autism using a naturalistic behavioral intervention and found all participants increased their imitations of gestures. Techniques used included RIT (reciprocal imitation training) which is a naturalistic intervention with the combinations of incidental teaching, milieu teaching, and pivotal response training. Ingersoll (2010) studied the impact of object and gesture imitation training on language use in children with ASD and found that teaching gestural imitation training alongside object imitation training lead to higher rate of language use than just object imitation alone. Cardon (2012) taught caregivers to implement video modeling imitation training via iPad for their children with autism and found all participants demonstrated increases in the level of imitation and made gains in expressive language. These are two of many intervention methodologies that teach gestures, what's left unknown is a comparison of those interventions to establish which are effective. While the previous research indicates ample evidence of what gestures look like, and their relationship to social communication, there is little evidence of what methods are most effective for reaching these gestures and which methods are most often used by practioners.

Objectives:

1. To evaluate which methods are most effective for increasing gestures use; and 2. To survey practicing speech language pathologists to determine which methods are most frequently used to teach gestures to young children with ASD.

Methods:

An evidence-based systematic review of literature is currently being completed. Methods were considered effective if gesture use was a dependent variable and increased post intervention.

The second step of this research study was to survey practicing Speech-language pathologists regarding their methods used for teaching gestures. Pending human subjects board review, the three question survey will be distributed through the American Speech-Language-Hearing Association (ASHA). The survey asks questions such as what methods are being used during intervention, what methods have been effective in teaching gestures, which methods have been ineffective, how have these methods effected social communication?

Results:

Based on established criteria, 80 articles were initially included that used a specific methodology to teach gestures to children with ASD under 5 years of age. Articles were summarized and analyzed for information pertaining to methods currently being taught and their effectiveness not only in teaching gestures to children with ASD.

Conclusions:

Preliminary findings support Naturalistic Developmental Behavioral Interventions (Schreibman et al., 2015) as the most effective method, along with an emphasis on imitation. Imitation includes techniques such as: RIT (reciprocal imitation training) and VMIT (video modeling imitation training). Parent implemented trainings incorporated within the methods being used are crucial to the effectiveness of the therapy process as well.

313 **176.313** Evaluation of Autism Training for Parents in Dhaka, Bangladesh

ABSTRACT WITHDRAWN

Background:
Institute of Paediatric Neurodisorder and Autism (IPNA), Bangabandhu Sheikh Mujib Medical University (BSMMU) at Dhaka, Bangladesh arranged early intervention and home management training for parents of children with Autism.

Objectives:

Evaluating the ASD (Autism Spectrum Disorders) child's parent's knowledge, experience after diagnosis of their child's ASD, management techniques before and after training on early intervention and home management in a specialized center.

Methods:

It was a comparative study. The study was conducted among 34 parents of ASD children with two different evaluation sheets. A training was conducted for two days in four sessions with PECs, ABA methods and different culturally adapted structured methods with hands-on exposure by experienced trainers. An evaluation sheet was collected before the training conducted and another one collected after the training was completed.

Results:

Before the training programme it was observed that most of the parents had known very little about Autism but they except their ASD children warmly. Most of them didn't know scientific ways of management of their children or how to behave with them. In that training parents were learned about what autism mean and ASD children management at home by their daylong activities. The training was conducted for two days in four sessions with Picture Exchange Communications (PECs), Applied Behavior Analysis (ABA) methods and different culturally adapted structured methods with hands-on exposure. After the training every participants wrote down their experiences in an evaluation form. Observing the after evaluation form it was clear that their understanding level about Autism was increased and they were interested to work scientifically with their ASD child.

Conclusions:

Most of the parents wanted to attend that type of parents training for long time and frequently.

314 **176.314** Evaluation of a Certified Autism Peer Support Service Model: Implementation Challenges and Successes

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Background: The growing and underserved population of adolescents and young adults with autism faces a need for innovative, effective service models and employment opportunities. To meet this need, Philadelphia is implementing a new peer support model for transition-aged youth and young adults with autism. Certified peer support service models utilize individuals with 'lived experience' who receive training to support their peers in navigating services and other daily living activities and needs. Certified peer support service models have a robust evidence base in veteran[1-3] and mental health[4-6] populations, and a limited evidence base has found initially promising results from peer support services implemented for children and adults with autism. One study reviewing peer support among young children with autism found that, across single-case experimental design studies, young children with ASD across a range of presentations benefited from peer autism-specific support.[7] Published research has also focused on the use of peer support for children with autism in school settings among children, and found that it was effective in promoting peer engagement.[8] No research has been conducted on peer support services among adolescents and young adults with autism. The launch of peer support services in Philadelphia represents an opportunity to evaluate this service model in a large, diverse US city.
Objectives: The evaluation of the certified peer support service in Philadelphia will focus on changes in employment status, social and communication measures, and self-reported quality of life measures. A secondary outcome of the evaluation to shape policy and programs moving forward will be qualitative feedback from certified peer specialists with autism delivering the peer support services on their experience.

Methods: A battery of instruments capturing self-reported demographic information, employment status, social responsiveness, and quality of life measures will be completed pre- and post-service implementation by both the certified peer specialists delivering the service and the individuals receiving the peer support service. A focus group of individuals delivering the 12-week peer support service will also be conducted after completion.

Results: Certified peer support services are scheduled to launch in Philadelphia in early 2019. Certified peers will receive required training and complete both the pre- and post-service measures. Individuals receiving the peer support service will also complete both pre- and post-service measures. Immediately following the conclusion of service delivery, certified peers will also participate in a focus group to inform continuing service design and delivery. Results from these efforts will be presented from both quantitative and qualitative analysis.

Conclusions: Certified peer support services offer an innovative opportunity for individuals with autism to receive needed support through service navigation and the life course trajectory. Certified peer support services also present new opportunities for employment, and initial research suggests these services are effective in children and adults. The application of certified peer support services to youth and young adults in Philadelphia represents a potentially replicable service model implemented through Medicaid.

315 **176.315** Evaluation of a Community-Based Autism Clinic

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Background:
Community-based autism clinics that serve primarily low-income, minority, and underserved populations are limited in the U.S. despite evident disparities to diagnosis and services based on race, ethnicity, and social class. To address the needs of underserved children with autism and their families in Atlanta, Georgia, the Autism Clinic at Hughes Spalding Children's Hospital, an affiliate of Children's Healthcare of Atlanta (CHOA), was established in 2002. The Autism Clinic provides a comprehensive continuum of autism services by offering one full day of multi-disciplinary services and a half-day of limited services per week from a range of professionals, including a developmental pediatrician, nurse practitioner, and a speech and occupational therapist. When needed, the clinic utilizes a CHOA language interpreter, social worker, nutritionist, nurse navigator, and/or special education specialist.

Objectives:

The purpose of this study is to evaluate the quality of care provided by the Autism Clinic at Hughes Spalding Children's Hospital in Atlanta to identify strengths of this model of care and areas for improvement.

Methods:

We conducted a Quality of Care Survey (53 item questionnaire plus demographics) with caregivers who utilize services at the Autism Clinic to evaluate three levels of care: Access to Care; Family Centered Care; and Care Coordination, as well as overall level of satisfaction with the range of services received at the clinic. See Table 1 for caregiver demographics.

Results:

Caregivers were most satisfied with various components of Family Centered Care, including providers spending enough time, listening carefully, encouraging questions, and offering specific information needed (91%, 99%, 96%, 96%, respectively). Caregivers where less satisfied with the time to first appointment (Average = 127 days) and access to services outside the clinic (78% of participants were usually, always or sometimes frustrated with accessing autism services). Overall, caregivers were satisfied with the diagnosis process, how the diagnosis was communicated, referrals provided, follow-up services, and range of services offered at the clinic (See Figure 1).

Conclusions:

We identified strengths in the quality of care offered by the Autism Clinic at Hughes Spalding Children's Hospital, including various components of family centered care and the overall experience of the diagnosis process. These strengths support the multi-disciplinary model provided by the Autism Clinic; a model of care particularly effective for underserved families because they are able to see four or more different providers in one visit. However, there are needed areas of improvement since 43% of families did not feel prepared for the first visit. We recommend the development of a bilingual information sheet about the types of providers and services offered at the clinic and what to expect during the initial visit. Parents also indicated that they did most of the care coordination for their child (71%). To help navigate the coordination between various autism providers, we recommend a designated autism clinic care coordinator, a specialist that works with Medicaid systems of care, and a parent advocate who can help meet the diverse needs of underserved families.

316 **176.316** Examining Navigational Support for Children with ASD and Their Families

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Background: There are urgent calls for integrated services and responsive navigation networks for individuals with ASD and their families. To our knowledge, no other initiative has systematically examined ASD-based navigational support networks across jurisdictions, with a robust research approach.

Objectives: The objective of this study was to (i) describe existing and desired yet absent elements of navigational support for children with ASD and their families and thus unmet needs, (ii) identify evidence-informed navigational practices and frameworks, and (iii) evaluate navigational processes in regional sites, consisting of three diverse Canadian jurisdictions (Edmonton (AB), Vancouver (BC), Whitehorse (YT)). Key questions addressed were: (i) what are evidence-informed navigational approaches relevant to ASD, (ii) what are facilitating and streamlining processes of navigation, and (iii) what is the scope and impact of navigational resources working together to offer timely and more equitable service access to individuals with ASD and their families. Interdisciplinary and cross-sectoral partners in this study include 60 community organizations/representatives.

Methods: This study builds on a collective framework methodology that incorporates mixed methods and participatory action research approaches. Organizational sectors represented comprise a range of stakeholders including self-advocates and advocacy groups, parents and families, government ministries, not-for-profit entities, service providers, and other inter-sectoral representatives. A scoping review and interviews were used to document the full range of navigational processes – from models and outcomes to lived experiences.

Results: In our initial scoping review, 2,044 peer-reviewed studies were retrieved, with 385 studies meeting initial screening criteria and 108 studies ultimately meeting inclusion criteria for full article review and synthesis inclusion. Corroborative primary interviews and focus groups were conducted with multiple stakeholders: self-advocates (n=15), family members (n=19), and service provider/advocate stakeholders (n=52). Jurisdictional models of navigation, as depicted by primary and secondary data analysis, discourage a 'one-size fits all' approach to service navigation in ASD. Findings support a systems-relevant and integrated network of navigational supports that are grounded in open channels of communication and iterative, family-oriented, community-directed design features. Such program characteristics are reported to foster proactive and reflective responsivity to the diverse service needs of individuals with ASD across the lifespan. Such guiding parameters reflect inter-agency, cross-ministerial, and cross-sectoral linkages.

Outcomes/Impacts: Navigation is documented to entail: case identification, need determination, identification of barriers to timely care, targeting of barriers for ameliorative change, facilitation of access to care, and systematic evaluation. Various levels and 'sectors' of navigational support have been determined to include: prevention; universal supports; specialized services; complex care; and urgent care. Needs of individuals with ASD and their families – requiring navigational support – are demonstrated within multiple 'life trajectory' pathways: transitions across the lifespan, community participation/engagement, family well-being, navigation across the continuum of care, safety in one's neighborhood, housing security, and personal health and mental health.

Conclusions: Family navigation is experienced differentially, with outcomes that reflect and impact individual and family quality of life. Effective navigation services can advance integrated, coordinated, seamless care and timely follow-up.

317 **176.317** Examining the Sustained Use of a Cognitive Behavioral Therapy Program for Youth with Autism Spectrum Disorder and Co-Occurring Anxiety

K. Pickard[1], *R. E. Boles*[2], *A. Blakeley-Smith*[3], *L. G. Klinger*[4], *A. Keefer*[5], *A. Duncan*[6], *S. E. O'Kelley*[7] *and J. Reaven*[1], *(1)JFK Partners, University of Colorado Anschutz Medical Campus, Aurora, CO, (2)University of Colorado School of Medicine, Aurora, CO, (3)Univ. of Colo. Denver-JFK Partners, Aurora, CO, (4)TEACCH Autism Program; Psychiatry, University of North Carolina, Chapel Hill, NC, (5)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (6)Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (7)University of Alabama at Birmingham, Birmingham, AL*

Background: Children and adolescents with autism spectrum disorder (ASD) are at high risk for developing co-occurring anxiety. In response to this concern, researchers have adapted cognitive behavior therapy (CBT) for youth with ASD. Results of a number of randomized controlled trials have demonstrated significant reductions in youth anxiety following CBT participation when it is delivered within controlled research settings. Although promising, only a handful of studies have examined the effectiveness of CBT programs when implemented within community settings and even fewer have examined the sustained use of CBT programs in community settings after implementation efforts have ended.
Objectives: The present study is a follow-up to an initial NIH-funded implementation trial that examined both implementation outcomes and youth treatment outcomes in response to an evidence-based, group CBT program for youth with ASD and co-occurring anxiety (i.e., Facing Your Fears (FYF); Reaven et al., 2018). This study aims to understand: 1) the percentage of clinicians who continue to use FYF four years following the implementation trial; 2) adaptations that have been made to FYF in order to sustain its fit within community settings; and 3) factors that influence clinicians' sustained use of FYF.

Methods: 34 clinicians working with youth with ASD (Mean age = 34 years; 94% female, 88% White) initially implemented FYF across four university clinics as part of the initial implementation trial (Reaven et al., 2018). A comprehensive, mixed-method survey will be sent to clinicians asking them whether they still use FYF in any capacity, in addition to questions regarding: 1) adaptations they have made to FYF (Stirman et al., 2017); 2) barriers and facilitators to the sustained use of FYF; and 3) strategies used to train new clinicians in using FYF. Participants will also complete quantitative measures of CBT knowledge, attitudes towards evidence based practices (EBPAS; Aarons, 2004), and organizational cultural and climate (ORC; Lehman et al., 2002).

Results: Based on well-established frameworks of sustainability (Chambers, Glasgow, & Stange, 2013), we expect that providers who continue to use FYF have made a number of adaptations to the program to support its fit within their community setting (e.g., adaptations to program length, session duration, and core components implemented; Stirman et al., 2017). We also expect that providers will identify key factors that influence their sustained use of FYF, including their attitudes, self-efficacy, organizational climate, and external funding.

Conclusions: Results from the present study will be critically important to better understand the barriers and facilitators to the sustained use of EBPs for ASD in community settings. Doing so will address critical gaps within the ASD field, as the absence of sustained EBP use may signal gaps in proactive implementation efforts and/or the fit of EBPs within community settings on a long-term basis.

318 **176.318** Experiences with Family-Centered Care Among Parents with Concerns about Autism Spectrum Disorder or Developmental Delay in Their Toddlers

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Seattle, WA

Background: Family-centered care (FCC) is an approach to healthcare that considers the needs and priorities of the whole family; as such, it has been associated with increased parent satisfaction, decreased parent stress, and improved child outcomes (Rosenbaum et al., 1998). Accessing FCC may be of particular importance for families of children with ASD, given the children's complex healthcare needs and the parents' high levels of stress (Hayes & Watson, 2013). This study compares experiences of FCC across two groups of parents: those with concerns about autism for their toddlers (ASD) and those concerned about other developmental issues (DEV). In addition, we compare experiences with FCC across two systems of care frequently accessed by both groups: primary care and early intervention.
Objectives: (1) To examine whether parents who are concerned about ASD for their toddlers differ in the components of FCC they experience compared with families who have DEV concerns; and (2) to examine whether parents' experiences with FCC differ between their primary care providers (PCPs) and early intervention (EI) providers.

Methods: Participants were 59 families, 37 with ASD concerns (including 5 with an ASD diagnosis) and 22 with DEV concerns. Groups did not differ on any key child or parent demographic variables, including age of child in months (ASD: *M*=28.03, DEV: *M*=25.77). The *Measure of Processes of Care* (MPOC-20; King, King, & Rosenbaum, 2004) was completed by parents to assess five domains of FCC: Enabling and Partnership (EP), Providing General Information (PGI), Providing Specific Information (PSI), Coordinated and Comprehensive Care (CCC), and Respectful and Supportive Care (RSC). All families completed the MPOC-20 for both their PCP and EI provider. A 5(Subscale) x 2(Concerns group) x 2(Provider type) mixed design ANOVA was used and Bonferroni adjustments were applied to correct for pairwise comparisons.

Results: A significant interaction between MPOC-20 Subscale and Concerns group (F=3.744, p=.019) was followed by planned comparisons (Figures 1a and b). The ASD Concerns group reported: (1) significantly higher levels of RSC than EP, PGI, and PSI, but comparable CCC; (2) significantly lower levels of PGI relative to the other 4 scales; and (3) PGI levels that tended to be lower than those in the DEV group (p=.069). In contrast, comparable levels across the FCC subscales were found for the DEV group. Planned comparisons between Concerns group and Provider type revealed significantly higher ratings for EI providers than PCPs for the ASD concerns group only (EI: *M*=5.309, PCP: *M*=5.865, p=.005).

Conclusions: While both groups of parents reported high levels of comprehensive and respectful care, the ASD Concerns group experienced more inconsistency in FCC across domains. Parents with ASD concerns assigned lower ratings of general information provision relative to other FCC domains, and higher ratings of respectful and supportive care relative to information provision and enabling/partnership. In addition, the ASD concerns group, but not the DEV concerns group, provided higher ratings of FCC for EI providers than for PCPs. These results have potential implications for improving the experience of parents of children with ASD concerns within the healthcare system.

319 **176.319** Increasing Access to Autism Spectrum Disorder Diagnostic Consultation in Rural and Underserved Communities: Streamlined Evaluation within Primary Care

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Background: With the increasing prevalence of autism spectrum disorder (ASD) and wide-spread delays for diagnostic evaluations and initiation of services, there is a growing need for novel systems of triage and care for children with ASD and their families. To combat growing disparities within rural and underserved communities, integration of behavioral-health services within primary care settings is often the preferred service model. In prior work, we embedded ASD consultation and support clinics within our medical center's primary care clinics. This change resulted in dramatically reduced waits for diagnostic consultation and follow-up. Many young children with ASD (and those without) were identified using a streamlined diagnostic model involving diagnostic interview, standard ASD rating scales, and the Screening Tool for Autism in Toddlers (STAT). These findings supported preliminary feasibility, accuracy, and clinical utility of this embedded streamlined assessment model that resulted in accurate diagnostic decision making, high levels of family/provider satisfaction, increased show rates, dramatic reductions in wait times, and reductions in referrals to an overtaxed tertiary diagnostic center.
Objectives: The present study investigates the impact of generalizing this model to a larger network of integrated primary care clinics located in the eastern region of our state with a largely rural and underserved catchment. This study extends previous work by providing data pre/post implementation of the streamlined model across a range of clinics, as opposed to comparing wait time reductions to local norms. This study also allowed us to study the impact of the embedded model when implemented by multiple clinicians across multiple primary care clinics that provide healthcare to rural and underserved communities.

Methods: Eighty children between the ages of 19 and 47 months old were seen across five different clinics. The participants were divided into four groups based on their status as primary care patients and whether they received an evaluation before or after implementation of the streamlined model. Data were collected via chart review from the electronic health record.

Results: Implementation of streamlined model resulted in a significant decrease in latency to diagnostic conclusion from a mean of 144.7 days to 49.9 days. Children were likely to experience a greater reduction in wait times if they were a primary care patient (mean reduction of 120.5 days) versus a non-primary care patient (mean reduction of 69.1 days). Lastly, data suggest that on average, diagnostic decisions were provided 1 month earlier in age post-implementation of streamlined model.

Conclusions: Results show significant reduction in wait times for ASD diagnostic decisions across both primary care and non-primary care patients. With implementation of the streamlined model, families had to wait an average of 95 days less than families not having access to the streamlined model. By reducing waits and identifying concerns more efficiently, we may increase the ability of families to access early intervention and support services as well as prepare them for the school-age transition at 3 years.

320 **176.320** Training Medical Providers to Care for Patients with ASD: Autism in 3-D

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Background: The social communication, restricted interests and repetitive behavior deficits that are core features of ASD may create challenges for patients, families and health care providers during routine and sick health visits as well as during emergent or acute medical care. In addition, ASD is often associated with medical and mental health co-morbidities and/or safety risks, which may further increase the need for medical visits beyond those of typically developing peers.

Objectives: To create multi-dimensional training and resources to improve the knowledge, comfort and effectiveness of medical providers in caring for patients with ASD in the medical setting.

Methods: Medical providers in a large health system were surveyed regarding their knowledge, comfort and concerns related to treatment of patients with ASD. Specific issues and scenarios were also solicited to help design training. Trainings were developed and implemented with varied audiences including primary care and acute care nurses, pediatric residents and pediatricians, inpatient multidisciplinary pediatric chronic illness management team, other service providers, and families. Resources developed included patient health and wellness passports, visual schedules, pictorial social narratives, and sensory toolkits.

Results: Baseline concerns included how to identify patients with ASD, handling communication and behavioral challenges, how to modify medical education for the patient, and coordination of care.

Five workshops were highlighted. For four of the five, training was provided by a multidisciplinary team which included psychologists, behavior analysts, parents, and nurse practitioners. The fifth workshop was provided by a psychologist. Participants reported improvements in knowledge and comfort in providing care, and improved ability to recognize individual/family strengths and challenges. The chronic illness management team successfully adapted their patient goals and training materials to better match patient skill level and learning style. One year follow up data for the nursing workshop will be reviewed to examine long-term impact. As a result of the trainings, one hospital initiated a system-wide process for identifying, preparing for and addressing needs of patients/families and staff.

Conclusions: Given the prevalence of ASD, nearly all medical providers involved in primary, specialty, emergent and acute care will be involved in caring for this population. Training that combined the perspectives and skills of families, health, and behavioral/mental health providers effectively improved knowledge and comfort of medical providers and helped arm them with strategies to implement in their respective medical homes.

Poster Session
177 - Social Cognition and Social Behavior
11:30 AM - 1:30 PM - Room: 710

321 **177.321** Real-World Joint Action and the Autism Spectrum: Separating Social Coordination from Motor Clumsiness

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Background:

"Joint action"—the ability to coordinate actions with others—is critical for achieving individual and interpersonal goals (Sebanz, 2006), and for our collective success as a species (Tomasello, 2009). Joint actions require accurate and rapid inferences about others' thoughts, intentions, and feelings (Pesquita, Whitwell, & Enns, 2017); skills that are thought to be impaired in ASD (Baron-Cohen, 2005). To date, research has not investigated joint action abilities in ASD during real-world social interactions.

Objectives:

1) To determine if there are joint action differences in children with ASD relative to typically developing (TD) children.

2) To determine if joint action differences in ASD are due to motor clumsiness or differences in cooperation abilities.

3) To determine how joint action differences in ASD are manifested with respect to correlates with behavioral and clinical measures.

Methods:

Participants were children with ASD (n = 26) and TD children (n = 31), 6-12 years old, matched on age and Full-scale IQ (ASD mean = 102.64, TD mean = 109.50). Parents completed continuous measures of ASD traits, alexithymia, and social competence (Table 1).

Participants moved tables through an S-Shaped maze of stationary tables (obstacles) in three different conditions: "Child-Only" (child moved table by him/herself), "Child-Child" (two children moved table together), and "Child-Adult" (child moved table with adult researcher).

Joint action was measured using an iPhone attached to each table installed with a customized App that quantified table movement in three dimensions (greater table movement indicated less coordination).

The table moves were video-recorded so that we could subsequently code behavioral indices of interpersonal synchrony—operationalized as the percentage of time participants stepped synchronously versus asynchronously.

Results:

Children with ASD exhibited less table movement than TD children in the child-only condition, but significantly more table movement than TD children in the child-child condition (all *p*s < .05). This pattern suggests the TD children benefitted more from the aid of a peer than the ASD children (we termed difference scores between child-only and child-child, "cooperation benefit") (Figure 1).

The calculated cooperation benefit was associated with higher verbal IQ (r = .402), higher social competence (r = .290), fewer autistic traits (r = -.302) and less alexithymia (r = -.230) across groups.

Children with ASD spent a significantly lower percentage of time stepping synchronously with their peer during the child-child condition, $t(50.35) = 2.894$, $p = .006$, but this ASD disadvantage was not evident when moving the table with an adult researcher in the child-researcher condition, $t(48) = 0.47$, $p = .934$.

Conclusions:

Children with ASD were less likely to step synchronously with their peer when moving tables collaboratively, and they benefited less than TD

children from the aid of a peer in completing the table-moving tasks. This lower "cooperation benefit" was associated with lower intelligence and social skills and higher alexithymia and autistic traits. The data suggest that joint action is a highly adaptive social process that may be impaired in ASD and not simply explained by motor clumsiness.

322 **177.322** Self-Report of "Camouflaging" Behaviors in Women Is Related to Autism Symptoms and Mental Health but Not Executive Functioning

J. S. Beck[1], *R. A. Lundwall*[2], *T. P. Gabrielsen*[3], *J. Cox*[4], *A. M. Dixon*[1], *M. Ekins*[1], *M. Farmer*[1], *T. DeMordaunt*[1], *L. Peacock*[1], *K. Christensen*[1], *S. Kamhout*[1], *L. Ekins*[1] *and M. South*[2], *(1)Psychology, Brigham Young University, Provo, UT, (2)Psychology & Neuroscience, Brigham Young University, Provo, UT, (3)Counseling & Special Education, Brigham Young University, Provo, UT, (4)Counseling and Career Center, Brigham Young University, Provo, UT*

Background: Autistic women may "camouflage" their differences to appear more typical during social interactions and formal assessments such as the *ADOS-2*. Camouflaging may cause some to be overlooked for diagnosis of autism or misdiagnosed, delaying access to appropriate interventions. To improve diagnostic accuracy, others (e.g., Lai et al., 2016) have attempted to quantify camouflaging and explore clinical correlates and potential mechanisms, such as executive functioning (EF) skills which allow the individual to inhibit autistic tendencies and switch to typical behaviors. A new self-report measure of camouflaging, the Camouflaging Autistic Traits Questionnaire (*CAT-Q*; Hull et al., 2018), was only recently published.

Objectives: We sought to explore the camouflaging phenomenon in the diagnostic "gray zone," where camouflaging can mean the difference between receiving a diagnosis of ASD and not. Accordingly, we investigated a sample that included high-functioning women with ASD as well as undiagnosed (potentially camouflaged) women with the broader autism phenotype. To examine the clinical significance and potential mechanisms of camouflaging, we assessed and explored associations between camouflaging and autism symptoms, indicators of mental health, and EF (inhibition and switching).

Methods: Our sample includes women without intellectual impairment (*N*=51; age *M*=24 years; IQ *M*=114; 15 had a previous autism diagnosis) who reported impairing symptoms associated with ASD per elevated scores on the *BAPQ* (total score>3). Participants were recruited through local clinics, a university counseling center, and social media. We administered measures through an online survey platform and in-person visits. Measures included the *CAT-Q*, *BAPQ, ADOS-2*, *WASI-II* (IQ), *DASS-21* (psychological distress), *TSCS-2* (self-concept), *Suicidal Behaviors Questionnaire*, and *D-KEFS Trail-Making* and *Color-Word Interference* (EF). Before analyses, outliers were Winsorized to 2**SD* above/below the mean. Pearson and Spearman (non-normal variables) correlation coefficients were calculated.

Results: A majority of participants (53%; *n*=27), including a majority of participants with a previous ASD diagnosis (53%; *n*=8), had *CAT-Q* total scores higher than the average score of the ASD group in the *CAT-Q* validation sample (our sample: *M*=4.72*; SD*=0.83; ASD validation sample: *M*=4.79*; SD*=0.99*)*. Similar to findings in the validation sample, our sample showed significant associations between *CAT-Q* total scores and *BAPQ* total scores (*r*=0.28, *p*<0.05) and indicators of mental health (*DASS-21*: *r*=0.27, *p*=0.05; *TSCS-2*: *r*=-0.39, *p*<0.01). *CAT-Q* total scores were *not* associated with suicidal behavior (ρ=0.09, *p*=0.52), EF (*Trails* Condition 4: ρ=-0.1, *p*=0.47; *Color-Word* Condition 4: ρ=-0.15, *p*=0.31), or IQ (*r*=-0.03, *p*=0.81).

Conclusions: Our findings provide support for the validity of the *CAT-Q* and reinforce the clinical relevance of the camouflaging construct. The lack of association between self-reported camouflaging and suicidal behaviors speaks to the complexity of factors influencing suicidality. The lack of hypothesized association between camouflaging and EF leaves open the question of which cognitive abilities allow some individuals to camouflage while others seem unable to do so. Future directions include investigating alternate potential mechanisms of camouflaging behavior, as well as exploring the temporal relationship between camouflaging and psychological distress since distress may motivate and/or result from camouflaging.

323 **177.323** Sex Differences in Social-Communication Function in Children with Autism Spectrum Disorder and Attention-Deficit Hyperactivity Disorder: Data from the Pond Network

T. Mahendiran[1], *A. Dupuis*[2], *J. A. Brian*[3], *X. Liu*[4], *E. Kelley*[5], *S. Georgiades*[6], *R. Nicolson*[7], *J. Crosbie*[8], *R. Schachar*[9] *and E. Anagnostou*[3], *(1)Institute of Medical Science, University of Toronto, Toronto, ON, Canada, (2)Biostatistics, University of Toronto, Dalla Lana School of Public Health, Toronto, ON, Canada, (3)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (4)Psychiatry, Queen's University, Kingston, ON, Canada, (5)Queen's University, Kingston, ON, Canada, (6)McMaster University, Hamilton, ON, Canada, (7)University of Western Ontario, London, ON, Canada, (8)Psychology, The Hospital for Sick Children, Toronto, ON, Canada, (9)Psychiatry, The Hospital for Sick Children, Toronto, ON, Canada*

Background: There is a strong male prevalence in ASD and ADHD. Even though social-communicative deficits are observed in both ASD and ADHD, to date research examining sex differences in social and communication function in these disorders remains limited and findings are mixed.

Objectives: This study examined potential sex differences in social and communication function in ASD and ADHD.

Methods: 115 youth with ASD, 172 youth with ADHD and 63 typically developing controls (age range 8-12 years, 75% males) were recruited from the Province of Ontario Neurodevelopmental Disorder (POND) Network. Social and communication function were assessed using the communication, leisure and social skill areas of the Adaptive Behaviour Assessment Scale-Second Edition (ABAS-II). To test for sex differences, a logistic regression was performed on the proportion of positive items for each skill area (i.e., communication, leisure and social), controlling for age and sex.

Results: Significant sex by age interactions were seen within ASD on the communication (p=0.005), leisure (p=0.003) and social skill areas (p<0.0001). In all three areas, lower scores were found in females compared to males at the age of 12, despite females performing better than males at the age of 8. There were significant sex by age interactions in the social (p=0.02) and leisure (p= 0.0005) domains between those with ASD and typically developing controls, with typically developing females showing better scores at older ages. Sex by age interactions were significant between ASD and ADHD on the social (p=0.009) and leisure domains (p<0.0001), as females with ADHD consistently scored higher on social skills than males across all ages, unlike those with ASD. Sex differences across age in the social domains for ADHD were similar to those in the typically developing group.

Conclusions: Sex differences in social and communication domains were observed between ASD and ADHD, and typically developing controls, with females with ASD performing worse than males at older ages, despite earlier advantages, potentially suggesting a female –specific phenotype in ASD. This has implications on development of treatments plans that target social function in females with ASD. Furthermore, these findings

reinforce the need to take a developmental/longitudinal approach to understanding sex differences.

324 **177.324** Sex Differences in Toy Preference in Children with Autism Spectrum Disorder and Typical Development

***L. W. Chan**, M. R. Altschuler, M. L. McNair, J. Wolf, E. Jarzabek, A. Naples, T. Winkelman and J. McPartland, Child Study Center, Yale University School of Medicine, New Haven, CT*

Background:
The social camouflage theory posits that girls with ASD more commonly and successfully camouflage their symptoms compared to boys with ASD (Lai et al., 2017). One method of camouflage for girls with ASD may include inhibiting self-soothing behaviors and outward responses to sensory overstimulation, with the goal of making their condition less obvious (Hull et al., 2017). Girls with ASD may also play with more female-typical toys compared to boys with ASD to more closely align with the social profile of typically developing (TD) girls (Harrop et al., 2017). Examining sex differences in toy preference and behavior during play may clarify how sex influences sensory behavior and engagement with toys. Moreover, exploring how ASD symptoms relate to toy preference may reveal whether behaviors during play are associated with individual differences in symptom severity, providing insight into clinically relevant sex differences and phenotypic heterogeneity in ASD.

Objectives:

To investigate sex differences in toy preference during play in TD children and children ASD and explore whether symptom severity predicts toy preference during play.

Methods:

Videos of the Autism Diagnostic Observation Schedule (ADOS-2), Module 3 were coded for toy play (the amount of time spent touching a toy) using ELAN software. Videos of children with ASD (n=17; 7 girls; mean age=12.7 years) were coded. Based on Harrop et al. (2017), toys were separated into categories (Vehicles, Figurines, Tools/Weapons, Domestic, Miscellaneous). Independent samples t-tests were conducted to determine sex differences for time spent playing with each category. Toys were categorized as either social (e.g., dinosaur, action figures) or non-social (e.g., wrench). Correlations between ADOS-2 Calibrated Severity Score (CSS) and play time with social and non-social toys, as well as total play time, were calculated. Behavioral coding is ongoing in a sample of available recordings from 60 TD children and 60 children with ASD.

Results:

Girls with ASD played with domestic toys more than boys with ASD (t(15)=2.44, p=.03). There were no categories for which boys showed more play time than girls. Across both sexes, higher CSS was associated with more play with non-social toys (r=.551, p=.013).

Conclusions:

Preliminary results align with Harrop et al. (2017) and indicate that girls with ASD play with domestic toys more than their male counterparts. In contrast, boys with ASD did not play with any category more than their female counterparts, suggesting that increased gender-stereotyped play may be specific to girls with ASD, consistent with the "camouflaging" account of gender roles and toy play. However, increased overall symptom severity was associated with less play with social toys and more play with non-social toys, suggesting that children with ASD, regardless of gender, may display reduced interest in social toys during play.

325 **177.325** Social Camouflaging in Adolescence: Are There Differences across Sex?

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Background: Social camouflaging is hypothesized to be used by individuals on the autism spectrum as means of masking or compensating for their autistic traits (Hull et al., 2017). Results from existing research suggest that autistic females may be more likely to engage in social camouflaging, and that it may have a negative impact on their mental health and well-being. However, much of this research is qualitative and few quantitative studies have sought to examine these hypotheses. In addition, few studies have included analysis of camouflaging in neurotypical (NT) populations.
Objectives: The aim of this pilot study is to compare levels of camouflaging and internalizing symptomology in autistic and NT adolescent males and females. The following research questions were addressed: Do autistic and NT males and females report different levels of camouflaging? Do autistic and NT males and females report different reasons for and consequences of camouflaging? Do autistic and NT males and females report different levels of internalizing symptoms?

Methods: 84 adolescents ages 13-18 years completed an online survey including the Camouflaging Autistic Traits Questionnaire (CAT-Q; Hull et al., 2018), Subthreshold Autism Traits Questionnaire (SAT-Q; Kanne et al., 2012), and Depression, Anxiety, and Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995). Twenty-five participants were on the autism spectrum (14 females and 11 males) and 59 were NT (34 females and 25 males). In addition, 9 adolescents on the autism spectrum and 8 NT adolescents completed follow-up interviews. The interviews were conducted to obtain richer information about participant motivations for and consequences of camouflaging.

Results: Autistic females report the highest levels of camouflaging (M=87.23, SD=21.58), followed by NT females (M=76.75, SD=21.23). Autistic males (M=70.91, SD=20.99l) and NT males (M=70.91, SD=22.95) report the same level of camouflaging. Trends have also emerged in the subscales of the CAT-Q. Autistic females report the highest levels of anxiety, while autistic males report the highest levels of depression and stress. Trends are also emerging in the interview data, with most participants describing camouflaging to some degree, but females on the autism spectrum reporting it to be more necessary, difficult, and exhausting than other participants.

Conclusions: The preliminary results of this study support and add to the existing literature. Females on the autism spectrum report the highest levels of camouflaging and the most detrimental effects. While camouflaging may be beneficial for all groups in some social situations, the negative effects these behaviors can have on well-being suggest that they may also be problematic. Further analyses of this data will (a) examine whether scores on the CAT-Q are associated with scores on the DASS-21 and (b) compare participant groups on subscales of the CAT-Q (compensation, masking, and assimilation).

326 **177.326** Social Camouflaging in the Presentation of Suspected Autism Spectrum Disorder in Toddler Girls

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Background: Autism spectrum disorder (ASD) is more frequently diagnosed in males than in females, with ratios varying from 2:1 to 12:1 (e.g., Frazier & Harden, 2016; Whiteley et al., 2010). This imbalance could stem, in part, from a heightened tendency for girls with ASD to engage in "social camouflaging," or compensatory behaviors that mask their symptoms relative to their male counterparts (Kreiser & White, 2013), including staying close to peers, jointly engaging with peers, and weaving in and out of peer groups (Dean, Harwood, & Kasari, 2017). Girls with ASD may also engage more than their male peers in social initiation behaviors that conceal complex difficulties forming and maintaining relationships, such as making eye contact, appropriately production of facial expressions, initiating social interactions, and making requests (Harrop et al., 2015; Oien et al., 2016; Spies et al., 2011). Limited research, however, has compared these discrete social communication behaviors between boys and girls using validated ASD assessment measures.
Objectives: The current study investigated sex differences in social communication behaviors assessed by the ADOS-2 Toddler Module. We hypothesized that toddler girls referred for an ASD evaluation would exhibit better and more frequent social initiation behaviors (eye contact, facial expression, social overtures, and requesting) than would their male counterparts.

Methods: We tested hypotheses using data from a diverse sample of toddlers (n=214; 26% female, Mean age=25 months, 47% White) referred for an ASD evaluation at an outpatient autism center where research-reliable clinicians administered the ADOS-2 Toddler Module (Lord et al., 2012).

Results: As predicted, girls initiated significantly more social overtures with parents than did boys in both univariate ($t = -2.66$; $p < .01$) and multivariate analyses ($F = 7.09$, $p < .01$). However, no significant sex differences were evident for eye contact, facial expressions, or requesting.

Conclusions: Findings suggest that among the ADOS-2 Toddler Module social communication items, it may primarily be those measuring the tendency to extend social overtures that differentiate girls referred for an ASD evaluation from boys. Other behaviors that prior research has shown to differ between girls and boys with ASD (eye contact, facial expressions, requesting) did not show sex differences in the present study. Girls with ASD often engage in "social camouflaging" behaviors, which may reflect gendered socialization patterns (Dean et al., 2017). For instance, girls with ASD more often situate themselves near peer groups and report wanting to be socially involved with others than do boys (Attwood, 2006). However, once girls initiate social interactions, they may have difficulties sustaining them, much like their male peers (Cridland et al., 2014). These findings raise the possibility that the social overture item may not be an optimal indicator of ASD in toddler girls. Thus, identifying specific items, such as social overtures toward parents/caregivers, where girls and boys differ, may suggest areas of sex-specific strengths or weaknesses that could facilitate early diagnosis.

327 **177.327** Social Judgements and Reactions to Social Rejection in Young Adults with Autism

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Background: Autistic individuals are at substantial risk for peer rejection, alongside more frequent experiences of loneliness, isolation and bullying. Such experiences likely contribute to heightened rates of mental ill-health, including increased rates of anxiety, depression and suicide (Jackson et al., 2017). Research has shown that autistic individuals are less accurate in predicting how others would perceive their personality, and less accurate at judging others' faces in terms of social approach characteristics (e.g. trustworthiness and kindness). However, it is less known how autistic individuals perceive and respond to social rejection from others and this may be crucial for shaping social experiences.
Objectives: The primary objective of the current study was to provide the first insights into combined behavioural and psychophysiological markers of social rejection in autistic adults. A secondary objective was to relate these markers to self-reports of depression, anxiety, and stress.

Methods: 20 autistic university students (11 males, mean age =23.58) and 40 neurotypical students (21 males, mean age =22.83) participated. Participants were asked to provide a 'profile picture' to be shown to other students. In the experiment, participants were shown photos of adult faces and told these were students from their university. For the social judgement task (SJT) participants were asked to evaluate whether the students in the pictures would have 'liked' the participant from their profile picture, then subsequently given feedback on whether their evaluations were correct or incorrect. In reality, the feedback was randomly created by the computer programme such that there were 50% 'YES' and 50% 'NO' (rejection) trials. In the age judgement task (AJT), participants estimated the age of the person in the picture and were given feedback on their evaluations. Behavioural responses and psychophysiological cardiac reactivity (inter-beat intervals; IBIs) were measured. Participants completed the Autism Quotient (AQ; Baron-Cohen et al. 2001), Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) and Depression Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond 1995).

Results: Between-group behavioural and psychophysiological analyses were conducted. Autistic participants predicted they would be rejected on 56% of trials compared to 48% for the neurotypical group. Importantly, the psychophysiological results showed a significant difference between groups. The neurotypical participants had longer inter-beat intervals following social rejection trials indicating transient cardiac slowing. However, the autistic participants did not show cardiac slowing to the same trials (see Figure 1 panels A and B). These results were not due to generalised negative feedback effects, as the pattern was absent from the age judgement task. Finally, there were significant correlations between negative self-bias and AQ (r=.335, p=.009), LSAS (r=.505, p<.001), and DASS-21 scores (r=.296, p=.02).

Conclusions: Autistic adult participants showed atypical cardiac responsivity to social rejection within a social judgement task. It may be hypothesized that experience of social rejection in autistic adults has a down-regulation effect on psychophysiological responses as a potential compensatory mechanism.

328 **177.328** Social Monitoring of Conversation Partners in Young Children with ASD

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Background: Attenuated attention to ostensive social bids (e.g., gaze cues, speech) appears to be a prodromal and early syndromal feature of ASD (Charwarska et al., 2012; Shic et al., 2014). These early differences in social monitoring may compromise the uptake of foundational social

communicative inputs and contribute to difficulties in language and social competency. Recent work suggests that simplified humanoid figures not only facilitates attention to faces (Tsang et al., 2018), but may also support learning when used in ASD interventions (Scassellati et al., 2018). However, it is unclear whether simplified humanoid figures (e.g., puppets) are regarded as equivalent social agents to people, and whether children with ASD are receptive to their social communicative bids. This will critically inform the application of simplified social figures as tools to increase social learning opportunities in ASD.

Objectives: (1) Examine how children with ASD monitor a conversation between a puppet and person, and (2) its association with social communicative competence. Simpler humanoid figures (e.g., puppets) may facilitate attention to relevant social information for children with ASD, relative to their typically developing (TD) and developmentally delayed (DD) peers, which may provide supported social learning opportunities.

Methods: 81 participants (ASD: N=29, Mean=46.25(SD=14.76) months; DD: N=25, Mean=51.29(SD=17.39) months; TD: N=27, Mean=39.83(SD=10.94) months) were eye-tracked while they freely viewed a video depicting a puppet and person engaged in an animated conversation (Figure 1). Participants were characterized using the ADOS-2 and a cognitive test (e.g., Mullen or DAS). Eye-tracking data were analyzed under two conditions: 1) Puppet-Speaking/Person-Listening and 2) Person-Speaking/Puppet-Listening. For each condition, we measured overall percent looking at the scene (%Valid), percent of valid looking directed at faces (%Face_Speaker, %Face_Listener), and a composite ratio of relative attention to the speaker versus listener within the dyad (i.e., time spent looking at the speaker divided by looking to either speaker or listener). Attention to faces was analyzed using a 3 (Diagnosis) x 2 (Condition) x 2 (Social Agent: puppet vs. person) repeated-measure ANCOVA, covarying for age. Associations between the composite ratio metric and clinical features were evaluated.

Results: The ASD group had lower %Valid in Puppet-Speaking/Person-Listening (F(2,80)=3.984,p=.022) and Person-Speaking/Puppet-Listening conditions (F(2,80)=7.033,p=.002) than TD and DD groups. There was a significant 3-way interaction (F(2,77)=5.34, p<.001, partial eta2=.12)—children with ASD had lower %Face_Speaker-Person, but not %Face_Listener-Puppet, in the Person-Speaking condition; all diagnostic groups showed similar patterns of %Face_Speaker-Puppet and %Face_Listener-Person in the Puppet-Speaking condition (Figure 2). In the ASD group, a higher puppet-speaker to person-listener ratio was moderately associated with higher ADOS scores (r=.47,p=.06). Conversely, a higher person-speaker to puppet-listener ratio was associated with lower symptom severity (r=-.41,p=.03), and higher verbal (r=.46,p=.01) and nonverbal (r=.59,p=.001) cognitive skills.

Conclusions: Overall, children attend to the speaker in a conversational dyad. While children with ASD attended less to the social scene than their TD and DD peers, the presence of the puppet effectively engaged children with ASD to socially monitor conversational partners. Perceptually salient, humanoid forms may serve as alternative routes for social learning especially in lower functioning and cognitively/verbally challenged children with ASD.

329 **177.329** Social Motivation By Self- and Parent-Report: Reporter Correspondence and Social Correlates

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Background: According to several theoretical models, deficits in social motivation underlie the core social deficits observed in autism spectrum disorder (ASD), supported by evidence from behavioral, neuroimaging, and physiological studies. However, social motivation is rarely investigated as a multi-dimensional construct that can vary across social contexts. Also absent from most research of social motivation are subjective reports from individuals with ASD, despite the unique insight they may provide.

Objectives: To investigate social motivation in children with and without ASD, with attention to social context and reporter. Specifically, we examine (1) concordance between self- and parent-report of social motivation; (2) group differences in social motivation by reporter and social context; and (3) associations between social motivation and other social outcomes by reporter and social context.

Methods: A total of 56 verbally fluent children (20 ASD, 36 non-ASD) from 8 to 13 years of age (mean = 10.2 years, *SD*=1.4, range=8.0-12.9) and their parents completed the self-report and parent-report versions of the Dimensions of Mastery Questionnaire (DMQ), respectively. The DMQ yielded two indices of social motivation – Social Persistence with Adults, and Social Persistence with Children – which reflect a child's typical effort toward and enjoyment of social interactions and relationships with adults and same-age peers, respectively. Social skills were assessed via parent-report using the Vineland Adaptive Behavior Scales, 2nd Edition (Vineland-2) Socialization standard score and the Child Behavior Checklist (CBCL) Social Problems *T*-score. All children with ASD met clinical cut-offs on ADOS-2, ADI-R, and DSM-5 criteria.

Results: Concordance between children's self-report and that of their parents varied by social context. WIthin each group, motivation with adults was significantly correlated across reporters (ASD: *r*=.53, *p*=.03; non-ASD: *r*=.55, *p*=.001) but motivation with peers was not (ASD: *r*=.03, *p*=.9; non-ASD: *r*=.32, *p*=.06). Group comparisons indicated that parents rated children with ASD as lower than non-ASD children in motivation with both adults (*t*=2.77, *p*=.008) and with peers (*t*=4.33, *p*<.001), whereas children's self-report indicated lower motivation in the ASD group with peers (*t*=3.07, *p*=.003) but not adults (*t*=1.5, *p*=.14). Finally, within the ASD group, self-reported motivation with peers was negatively correlated with Social Problems on the CBCL (*r*=-.68, *p*=.002), and motivation with peers (*r*=.49, *p*=.04) and adults (*r*=.54, *p*=.02) was positively correlated with social skills on the Vineland-2, whereas parent-reported social motivation was not significantly correlated with either measure (*r*s<.025, *p*s>.29). Within the non-ASD group, neither children's self-report ratings nor parents' ratings of social motivation were significantly correlated with social skills on the CBCL or Vineland-2, likely due to restricted range on these measures for children without ASD.

Conclusions: Although children with ASD do report decreased social motivation relative to peers, social motivation may not be a unitary construct and may instead vary across social contexts and reporters. While parents' and children's reports provide some overlapping information regarding social motivation, children with ASD provide an under-appreciated perspective that carries unique statistical value in understanding their social skills and experiences. Results underscore the need for multi-context and multi-reporter assessment of complex processes such as social motivation.

330 **177.330** The Influence of Autism Spectrum Disorder and Attention Deficit Hyperactivity Disorder Symptom Severity on the Facial Emotion Recognition Skills of Adolescents

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Background: Autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) have a high degree of comorbidity but differential etiology (Leitner, 2014). Previous studies reported deficits in facial emotion recognition (FER) associated with poorer social functioning (Høyland et al., 2017; Kats-Gold, 2007) in both ASD (Lozier et al., 2014) and ADHD (Da Fonseca, 2009) populations. When examined categorically, diagnoses of ASD and ADHD have been associated with differential deficits in FER (Buitelaar et al., 1999; Berrgren et al., 2016); however, despite the disorders' frequent co-occurrence, no work has examined the relative influence of ADHD and ASD symptom severity on FER within the context of ASD diagnosis (Webb, Neuhaus, & Faja, 2017; Miller et al., 2011).

Objectives: To determine the unique influence of ASD and ADHD symptom severity on FER abilities in adolescents with and without ASD.

Methods: Using a standardized assessment of FER (DANVA-2; Nowicki, 2004), data were collected from 86 adolescents with and without ASD (Table 1). ADOS-2 (Lord et al., 2012) Comparison Score was used to measure ASD symptom severity. Parents of participants reported adolescent's ADHD (Combined Type) symptom severity via the CASI-5 (Gadow and Sprafkin, 2013). A One-Way ANOVA determined if FER and symptom severity differed between diagnostic groups. Pearson correlations assessed relationships between ASD and ADHD symptom severity and FER in each group.

Results: FER performance did not differ as a function of ASD diagnosis ($F(1,84) = 1.48$, $p = .23$). For the ASD group, ASD symptom severity was associated with greater FER errors ($r(38) = .45$, $p < .01$; Figure 1), with the relationship driven primarily by errors for happy ($r(38) = .40$, $p = .01$) and fearful facial expressions ($r(38) = .52$, $p < .01$). For non-ASD participants, ADHD symptom severity corresponded with greater FER errors ($r(44) = .38$, $p < .01$; Figure 1), with the relationship driven primarily by errors for high-intensity ($r(44) = .50$, $p < .001$) and sad expressions ($r(44) = .34$, $p = .02$).

Conclusions: These results support previous findings of disorder-specific FER deficits associated with ASD and ADHD. For individuals with ASD, FER errors were associated with ASD, but not ADHD symptom severity. FER errors for happy (Berrgren et al., 2016) and fearful (Ashwin et al., 2006) expressions were particularly associated with more severe ASD symptom presentation. Conversely, for non-ASD participants, FER errors were associated with ADHD symptom severity but not ASD symptom severity. This finding is particularly interesting given that the ASD group demonstrated greater overall levels of ADHD symptom severity relative to the non-ASD group. Additionally, in the non-ASD group, participants with greater ADHD symptom severity made more FER errors for high-intensity emotions, indicating greater relative impairments on less difficult FER trials. Overall, these findings suggest that once ASD symptoms reach a threshold of clinical significance for diagnosis, they may be more influential in contributing to deficits in FER than ADHD symptoms for adolescents.

331 **177.331** Spontaneous Mentalizing in Children with and without ASD

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Background:

A deficit in Theory of Mind (ToM) or mentalizing has been argued to play a causal role in the development of social difficulties in individuals with autism spectrum disorder (ASD). However, findings are inconclusive as many individuals with ASD pass standard mentalizing tasks, in which they are required to explicitly reason about the beliefs of another agent. It has been argued that they succeed by using compensatory strategies, but still encounter difficulties in daily life because individuals with ASD suffer from a specific impairment in spontaneous mentalizing. There is initial support for this hypothesis, however, studies are scarce and are mainly based on adult research.

Objectives:

Our main objective was to investigate spontaneous mentalizing in children with ASD. We expected that children with ASD would show less spontaneous mentalizing compared to neurotypical children. Additionally, we aimed to investigate if mentalizing abilities are related to ASD symptom severity.

Methods:

The current study is still ongoing and includes at this point 44 children between 7 and 13 years old, of which 23 children with a formal ASD diagnosis and 21 neurotypical children. We aim to eventually include 35 children in each group. Participants carried out a spontaneous mentalizing paradigm based on the ball detection task developed by Kovàcs, Téglás and Endress (2010). This is a false belief task that consists out of two phases: the belief formation phase and the outcome phase. In the first phase, an agent and the participant form a false or true belief about the location of a ball. In the outcome phase they have to detect if the ball is present or not. The ball was present in 50% of the trials, independent of what happened during the clip. This paradigm allows us to investigate how reaction times to the ball are affected by their own belief and by the belief of an agent, hence giving us an implicit measure of mentalizing. ASD symptomatology was measured by two questionnaires namely the Social Responsiveness Scale 2 (SRS-2) and the Social Communication Questionnaire (SCQ) as well as by the ADOS-2.

Results:

Ball detection time of neurotypical children is influenced by the belief of the agent, being faster when the agent believed the ball was behind the occluder, indicating that they spontaneously take into account the belief of the agent. Conform our hypothesis, this effect was absent in children with ASD, suggesting impaired spontaneous mentalizing. This effect was negatively correlated with ASD symptoms. Children with more severe ASD symptomatology showed stronger impairment in spontaneous mentalizing.

Conclusions:

Our findings indicate that neurotypical children do spontaneously take into account the belief of another agent, while children with ASD show a lack of spontaneous mentalizing. This impairment was associated with reported social difficulties in daily life. This deficit in spontaneous mentalizing may explain their persistent social difficulties, in which often fast spontaneous mentalizing is required. As studies are scarce, replication is warranted, also applying other implicit mentalizing tasks.

332 **177.332** The Association of Early Theory of Mind to Two-Year-Later Pretend Play Performance in Children with Autism Spectrum Disorder

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Background: Theory of mind (ToM) deficit and poor pretend play are two characteristics of children with autism spectrum disorder (ASD). ToM is a social cognitive ability to infer the mental states of self and others and thereby to make appropriate replies. Via ToM, children can impute others' beliefs to usual presentations and then can generate new ways to pretend. Therefore, children's ToM ability may benefit the generation of pretend play. However, the association of early ToM development to later pretend play performance has not been examined.
Objectives: The main purpose of this study was to clarify how early ToM ability is related to two-year-later pretend play in children with ASD.

Methods: A total of 83 children with ASD aged 5-12 years were included for two evaluations. In the first evaluation, the Theory of Mind Task Battery (ToMTB), Verbal Comprehension Index of the Weschler Intelligence Scale for Children, Fourth Edition, (VCI, WISC-IV), and Childhood Autism Rating Scale (CARS) were respectively administered to assess ToM, verbal ability, and symptom severity. Two years later, in the second evaluation, the Child-Initiated Pretend Play Assessment (ChiPPA) was administered to evaluate children's pretend play in two sessions: conventional imaginative play and symbolic play. In these two sessions, the percentage of elaborate pretend play actions (PEPA), number of object substitutions (NOS), and number of imitated actions (NIA) were respectively scored as measures of the quality, quantity, and creativity of pretend play. Pearson's product-moment correlation coefficients and linear regression models were used for data analysis.

Results: The children's mean age was 71.98 months (SD = 19.82) at the first evaluation. The earlier ToMTB scores (r=.256, p=.019; r=.217, p=.049; r=-.220, p=.046) had positive associations with the PEPA-conventional imaginative play and total scores, as well as negative association with the NIA-symbolic play scores The earlier VCI (r=.240, p=.029; r=.275, p=.012; r=.300, p=.006) had positive associations with the PEPA-conventional imaginative play, symbolic play and total scores. The earlier CARS scores had positive associations (r=.264, p=.016) with only the NOS-conventional imaginative play scores. The results of the regression models showed that in addition to the earlier VCI and CARS scores, the earlier ToMTB scores could not additionally predict the PEPA-symbolic play scores. Other models were not significant.

Conclusions: Children with ASD who have better early ToM ability are likely to have better quality and creativity of pretend play. However, despite considering early VCI and symptom severity, the early ToM ability could not further predict pretend play. Verbal ability seemed to be the more important predictor of pretend play in children with ASD. ToM ability is known to have close developmental coexistence with verbal ability. Therefore, ToM ability may be associated with pretend play via the mediation of verbal ability in children with ASD. The association of early ToM, verbal ability, and symptom severity to pretend play in children with ASD will require further research with larger sample sizes to provide more solid evidence.

333 **177.333** The Discriminant Power of the Combination of Oculometric and Pupillometric Parameters during the Exploration of Objects and Faces between Autism Spectrum Disorders and Typical Development

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Background: Autism Spectrum Disorders (ASD) are characterized by impairments in social communication and atypical social interactions. These impairments could be related to an alteration of face and social stimuli processing. Many studies have used eye-tracking in order to identify key parameters specific to ASD visual exploration, particularly of faces and social situations. However, if several parameters have been identified (e.g. time spent on the eyes region during face observation, preference for non-biological over biological movement), none of them allow to distinguish between ASD and Typical Development (TD) subjects with more than 70-80% discrimination power.
Objectives: The aim of this study was to explore how the combination of several eye-tracking parameters could improve the discrimination between ASD and TD children compared to each parameter individually.

Methods: Eye position and pupil diameter were recorded with an eye-tracking system (FaceLAB®) in 87 ASD and 96 typical children (3-12 years old) during a passive observation paradigm in which images of objects and faces were presented. These stimuli were interleaved with grey images containing a black cross (baseline). At the beginning of the paradigm, black and white images were also presented in order to elicit a pupillary light reflex.

A total of 18 parameters were extracted from the different conditions (baseline, objects, faces, black/white images) and the two measurements: pupil (diameter, speed) and gaze (total tracking time, time spent on the screen or the stimulus, fixation duration, number of fixations, latency to the first fixation).

A Receiver Operating Curve (ROC) analysis was conducted in order to determine the discrimination power of individual parameters, estimated by the Area Under a Receiver Operating Curve (AUC). We then used a data-mining approach combining all oculometric and pupillometric parameters using a logistic regression model. A ROC analysis was conducted to estimate the discrimination power of the model.

Results: The analysis required to determine the 18 parameters for all the subjects without any missing data. In total, 18 ASD children and 33 TD children were included in the analysis.

Some individual parameters reached a discrimination power between the ASD and TD groups of about 80%, e.g. the time spent on faces for children older than 8 years-old.

The combination of the 18 parameters reached a >95% discrimination power for children under 8 years-old (with a sensitivity and a specificity of >95%). The results stayed really good when the 9 and 10 years-old were also included (AUC 93%, sensitivity 85%, specificity 88%), and lowered to 82% when the 11 and 12 years-old were added.

Conclusions: These results suggest that eye-tracking parameters are very effective to discriminate ASD and TD children when combined, particularly for younger children. Analyses still have to be pursued in order to determine which parameters are crucial to describe the evolution of the exploration strategies with age, both in ASD and TD children. These results will need to be replicated with a new and large group of patients, but are very promising to help the clinical diagnosis and follow the evolution of individual patients.

334 **177.334** The Effect of Autism Knowledge and Diagnostic Labels on Stigma Towards Autism

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Background: Although neurotypical (NT) adults evaluate peers with autism more favorably when they are made aware of their diagnosis, this pattern does not occur for NTs harboring high stigma about autism (Morrison et al., under review).
Objectives: The current study examines whether stigma-related attitudes in NTs are activated differently depending upon how an autism diagnosis is presented.

Methods: Neurotypical college students (n=266) (mean age = 21.55; SD = 4.61) completed six surveys answering questions in regard to one of eight labels, four referring to autism (Autistic, Autism, Autism Spectrum Disorder, Asperger's), and four comparison labels (Schizophrenia, Schizophrenic, Clinical Disorder, Clinical Diagnosis). The Prejudice Scale (Hori et al., 2011) and the Social Distance Scale (SDS; Gillespie-Lynch et al., 2015) measured the raters' stigma and willingness to interact with individuals with each label. The Attributes and Reactions Scale (AAR; Angermeyer & Matschinger, 2003) evaluated the perceived negative attributes (danger, dependency on others) and emotional reactions (fear, pity, anger) ascribed to different labels. The General Knowledge Questionnaire (Jensen et al., 2016) was used to assess raters' beliefs about the prognosis and level of intelligence of people with each label, while the Autism Awareness Survey (AAS; Gillespie-Lynch et al., 2015) assessed autism knowledge.

Results: For the four autism labels, greater autism knowledge among NTs was associated with less evoked fear (R^2= -.273; p=.001), less perception of danger (R^2= -.401, p< .001), and reduced belief that autism requires dependency on others (R^2= -.288, p=.001). NTs with greater autism knowledge also endorsed a more positive prognosis (R^2 = .401, p<.001) and perceived greater functioning within relationships (R^2=.218, p=.01) for individuals with autism. Autism knowledge also correlated with social distance (R^2=.207, p=.015): NTs with higher autism knowledge were more willing to interact with autistic individuals.

For stigma, levels of social distance and endorsements of fear and pity differed across labels (ps<.01). The schizophrenic label evoked more fear than the autistic, autism, and clinical diagnosis labels (ps<.01), but no label comparisons survived the correction for social distance (*ps*>.052) and pity (*ps*>.09).

NTs provided different intelligence and prognosis ratings across labels (*ps*<.004). The label Asperger's was associated with more intelligence than the schizophrenia, schizophrenic, and generic clinical disorder labels (*ps*<.04), and raters endorsed more positive life outcomes for individuals with autism and Asperger's compared to the generic clinical diagnosis label.

Conclusions: Levels of stigma did not differ across the four autism labels, suggesting that how autism is described does not induce distinct stigma-related attitudes. However, the label Asperger's produced higher ratings of intelligence, and both autism and Asperger's were rated as having better prognoses, suggesting each may be associated with perceptions of higher functioning. Additionally, higher autism knowledge was associated with better perceptions and decreased stigma of autism. Autism also was perceived more favorably than schizophrenia or a general clinical diagnosis. Although autism may therefore be viewed more favorably than some other conditions, results suggest that efforts to increase autism knowledge among NTs may help to further reduce stigma and prejudice.

335 **177.335** Social and Object Attention in Autism Is Modulated By Biological Sex and Gender-Typicality of Objects

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Background: Decreased attention to social stimuli is a consistently replicated feature of Autism Spectrum Disorder (ASD). Due to the sex imbalance in ASD diagnoses, previous eye-tracking studies consist largely of males. However, recent literature suggests that females with ASD differ from males, with ASD girls appearing more socially motivated than ASD boys (Sedgewick et al., 2016). Emerging evidence suggests that ASD girls may also differ in social attention, with some attentional patterns similar to TD girls (Harrop et al., 2018a, 2018b). Therefore, a naturalistic eye-tracking paradigm may reveal differences in social attention and motivation in ASD girls.
Objectives: The aim of this current study was to understand the impact and interplay between biological sex and gender on social attention in ASD.

Methods: 79 children (ages 6-10) participated: 46 ASD (21 female); 33 typically developing (TD; 17 female). Subjects completed a dynamic eye-tracking paradigm with 18 silent videos of child actor pairs playing independently (Solo Condition), together (Joint Condition) or in parallel. Pairs played with toys that were either gender-typically *male* (Lego, action hero, science kit) or gender-typically *female* (My Little Pony, Barbie, cooking set). Actor sex was manipulated, so that the effect of gender/sex congruence between toy and actor could be explored. Dependent variables included percent of time attending to faces and hands with toys across conditions.

Results: In the joint play condition, children with ASD spent proportionally less time attending to faces compared to TD children, $F = 2.8$; $p = .05$. In the solo play condition, there was a marginal group*sex effect, where ASD males allocated proportionally less time to faces, $F = 3.7$; $p = .059$. No significant effects were found for overall attention to hands with toys. However, sex differences were found when the gender of the toy was taken into account, with females spending proportionally more time attending to hands with toys when a *female* toy was presented, $F = 4.45$; $p= .02$. Children showed an attentional preference for gender/sex congruent play, with females allocating proportionally more attention to *female* toys matched with a female actor, $F = 5.7$; $p = .02$ and males spending proportionally more time attending to *male* toys matched with a male actor, $F = 3.97$; $p= .05$.

Conclusions: Our data support previous findings of a disjointed attentional profile among ASD females. ASD females attended more to female-oriented stimuli than ASD males, with attention patterns comparable to TD females. This extends previous findings of more female-typical interests among ASD females (Harrop et al., 2018a, Sutherland et al., 2017). Our findings largely replicate previous findings of reduced social attention in ASD. However, when the scene was socially *lean* (children playing alone), ASD females attended to faces to the same degree as both TD males and females. This aligns with previous findings, which suggest that ASD females share features with both TD girls and ASD boys (Harrop et al., 2018b). These findings highlight the importance of considering the gender-typicality of objects when developing stimuli for children with ASD.

336 **177.336** The Interaction of Autism Traits and Psychosis Traits on Mentalizing in a Clinical-Community Sample

L. E. Bradstreet[1,2], *P. I. Paragas*[1], *F. Zhang*[2], *M. E. Calkins*[3], *P. J. Moberg*[3], *B. P. Daly*[2], *M. T. Schultheis*[2] *and D. L. Robins*[1], *(1)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (2)Psychology, Drexel University, Philadelphia, PA, (3)University of Pennsylvania, Philadelphia, PA*

Background: Previous research suggests dimensional traits that characterize autism spectrum disorder (ASD) and psychotic spectrum disorders (PSDs) are useful for understanding variations in social cognition. Notably, in individuals without clinical diagnoses, concurrent high levels of both sets of traits are associated with better performance on social cognitive tasks relative to discordant levels of traits (i.e., high on one set of traits, low on the second set of traits; Abu-Akel et al., 2015). The current study extends previous work on this "normalizing effect" by examining effects of autism traits, psychosis traits, and their interaction on mentalizing in a combined clinical-community sample of individuals with and without ASD.
Objectives: The current study examines 1) main effects of autism traits, 2) main effects of psychosis traits, and 3) interaction effects of autism and psychosis traits on mentalizing accuracy (forced-choice task) and spontaneous mentalizing levels (open-ended task).

Methods: Seventy-six adolescents and adults (M_{age}=22.18 years, *SD*=4.51 years; 19 females) completed the Wechsler Abbreviated Scale of Intelligence, 2nd Edition (WASI-II), Autism Spectrum Quotient (AQ; autism traits), Schizotypal Personality Questionnaire, Factor 1 Cognitive-Perceptual (SPQ-Cognitive; psychosis traits), Social Attribution Task-Multiple Choice (SAT-MC; mentalizing accuracy), and the Dynamic Interactive Shape Clips Task (DISC; mentalizing levels). Thirty-two individuals (eight females) had ASD diagnoses confirmed by record review. We conducted multiple linear regression analyses to evaluate main effects and interaction effects of mean-centered autism traits and psychosis traits on SAT-MC mentalizing accuracy and DISC mentalizing levels with WASI-II Vocabulary scores as a covariate. When data distributions violated assumptions of analytic procedures, we evaluated the significance of results by generating p-values and confidence intervals using bootstrapping based on 5,000 samples. We used the PROCESS macro for SPSS and, specifically, the Johnson-Neyman Technique to probe significant interactions.

Results: Bivariate correlations showed that AQ scores had significant relationships with SPQ-Cognitive ($\rho(76)$=.26, p=.02) and SAT-MC scores ($\rho(76)$=-.26, p=.02). SAT-MC and DISC scores were positively related ($\rho(75)$=.37, p=.001). In the regression models, AQ scores were significantly negatively related to SAT-MC scores, $F(2,73)$=14.67, p<.001, R^2=.29, ΔR^2=.07, β=-.26,p=.01, but not DISC (*ps*>.05). SPQ-Cognitive was not related to SAT-MC or DISC scores (*ps*>.05). The interaction term, AQ x SPQ-Cognitive, was significantly negatively related to SAT-MC scores (R^2=.33, $F(4,71)$=8.65, p<.001, ΔR^2=.04, β=-.20,p=.03) and DISC scores (R^2=.18, $F(4,70)$=3.72, p=.008, ΔR^2=.05,β=-.23,p=.04), such that higher levels of both autism and psychosis traits related to the poorest performance on mentalizing tasks.

Conclusions: We found an enhancing negative effect of autism traits and psychosis traits on mentalizing accuracy and levels in a combined sample of individuals with and without ASD. Specifically, individuals with concurrent high levels of these traits performed *less accurately* on a forced-choice mentalizing task and made the *fewest, least complex* mental state attributions during an open-ended mentalizing task compared to individuals with discordant levels of traits. Our results suggest that relative levels of these traits exert an enhancing negative effect on some forms of social cognition and behavior. The normalizing effect documented in a previous study may not be present for all social cognitive skills or when traits reach clinically significant levels.

337 **177.337** The Relationship between Social Knowledge, Social Behavior, and Peer Victimization in Adolescents with ASD

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Background: Individuals with autism spectrum disorder (ASD) are at greater risk for peer victimization than typically developing (TD) adolescents (Maïano, Normand, Salvas, Moullec, & Aimé, 2016) and more susceptible to the negative outcomes associated with peer victimization (Adams, Taylor, Duncan, & Bishop, 2016). Social skills deficits are pathognomonic to ASD and have also been linked to increased victimization in non-ASD youth (Ung et al., 2016). Two components of social skills are social knowledge, the ability to explicitly identify appropriate social behavior in context, and social behavior, the performance of socially appropriate actions. However, no study has examined the relative relationship of social knowledge vs. behavior with peer victimization. Clarification of this association could inform interventions to support social development in youth with ASD at risk for peer victimization.
Objectives: Examine the relationship between social behavior, social knowledge, and peer victimization in adolescents with and without ASD. Determine the relative role of social behavior versus social knowledge in predicting victimization.

Methods: Fifty adolescents with ASD (M_{age}=12.69, SD_{age}=1.97; 39 male) and 57 TD adolescents (M_{age}=13.41, SD_{age}=1.74; 34 male) participated. All participants had an IQ≥70 (M_{ASD}=101.94, SD_{ASD}=16.58; M_{TD}=107.96, SD_{TD}=13.04). ASD diagnosis was confirmed via ADOS-2 (Lord, Rutter, DiLavore, & Risi, 2012). Participants completed the Olweus Bully Victim Questionnaire (OBVQ; Solberg & Olweus, 2003), a measure of peer victimization; the Social Skills Improvement System (SSIS; Elliott & Gresham, 2013), a measure of social behavior; and the Children's Assertive Behavior Scales (CABS; Michelson & Wood, 1982), a measure of social knowledge. Associations between social knowledge and behavior and victimization were assessed via bivariate correlations. Specificity of significant correlations by diagnosis were probed using moderation models with z-transformed variables. The relative contribution of social knowledge vs. behavior in predicting peer victimization was evaluated using a multiple linear regression.

Results: Higher OBVQ ratings of peer victimization was positively correlated with CABS scores, indicating poorer social knowledge (r=.223, p<.05). Higher OBVQ scores were negatively correlated with social behavior on the SSIS (r=-.299, p<.01). Moderation analyses indicated that the relationship between social knowledge and peer victimization was moderated by ASD diagnosis (β =.460, p=.030), such that poorer social knowledge related to increased victimization only in the ASD group (β =.365, p=.002; Figure 1A). Similarly, the relationship between social behavior and peer victimization was moderated by ASD diagnosis (β =-.404, p=.050), such that it was present only in the ASD group (β =-.473, p=.001; Figure 1B). In the ASD group, multiple linear regression indicated that social behavior (β=-.497, p<.01), but not social knowledge (β =.096, p>.05), significantly predicts victimization.

Conclusions: This study suggests that social knowledge and social behavior deficits are related to increased peer victimization in adolescents with ASD, but not TD adolescents. Furthermore, within ASD, self-perception of social behavior, as opposed to social knowledge, more strongly predicts level of peer victimization. Youth with ASD who view themselves as less socially capable are particularly susceptible to instances of peer victimization, above and beyond any risk conferred by not explicitly knowing how to behave appropriately in a given social context.

338 **177.338** Third-Party Sociomoral Evaluations in Children with Autism Spectrum Disorder

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Background:
Individuals with ASD have shown preserved abilities in several aspects of moral evaluations (e.g., Blair, 1996; Kretschmer, Lampmann, & Altgassen, 2014), despite their impairments in Theory of Mind (ToM). However, previous findings on moral reasoning in ASD have all built on explicit verbal evaluations of morally-laden scenarios, while the implicit processing underlying them remains undiscovered.

Objectives:

The current study investigates both implicit and explicit processes of third-party moral transgressions using eye tracking in children with ASD and typically developing (TD) controls. We aim to provide new evidence for implicit and explicit moral reasoning in children with ASD in terms of their understanding and sensitivity to the perpetrator's intention, as well as atypical patterns of responses, especially for scenarios involving intentional damage to objects.

Methods:

We modified the moral reasoning task from that created by Decety and colleagues (2012). The paradigm included four experimental conditions and one control condition. A total of four scenarios for the experimental conditions were depicted as follows: (a) a person (perpetrator, the initiator of the action) damaging an object intentionally (object-intentional, OI); (b) a person damaging an object accidentally (object-accidental, OA); (c) a person (perpetrator) hurting another person (victim) intentionally (person-intentional, PI); and (d) a person damaging another person accidentally (person-accidental, PA).The control condition depicted people's daily activities without any pain or damage involved. Each condition consisted of five trials, and each trial consisted of three pictures presented successively to imply actions.

Twenty 4- to 7-year-old children with ASD and nineteen typically-developing controls were shown dynamic visual stimuli depicting intentional or accidental harm to persons or damage to objects. Their eye-movements and pupil dilations were recorded by a Tobii Pro X60 eye tracker. They were asked four questions to evaluate the wrongness of the harmful behavior and the perpetrator performing the actions in each trial, using five-point rating scales.

We defined the fixation durations on the perpetrator and on the victim, with manually drawn areas of interest (AOIs). Children's verbal evaluation, fixation durations and pupil dilations were compared across group and condition using mixed-design ANOVAs.

Results:

We found that (a) children with ASD show implicit processing and autonomic responses to the third-party harms in their eye movements and pupil dilation; (b) children with ASD demonstrated a spared ability to process the intentionality of the perpetrator, reflected by both their explicit evaluations and implicit reactions; and (c) children with ASD showed some abnormal patterns of moral evaluation, especially for the scenarios involving intentional damage to objects.

Conclusions:

Our study indicate a preserved capacity to understand the mental states of perpetrators and an implicit moral sensitivity to the third-party harms in children with ASD. Nonetheless, children with ASD show specific sensitivity and emotional arousal when viewing damage to objects. These findings contribute to the understanding of the underlying mechanisms of moral reasoning in ASD, and its possible association with the autistic symptoms.

339 **177.339** Toward a Cross-Species Measure of Social Motivation: Social Attention during Object Engagement in Autism and Williams Syndrome

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Background: Autism Spectrum Disorder (ASD) is characterized by social deficits including reduced social orienting. According to the social motivation hypothesis of autism, this may be due to children with ASD finding social stimuli and interactions less inherently rewarding than typically developing individuals. Conversely, children with the genetic disorder Williams Syndrome (WS) are often hypersocial, suggesting they may find social interaction more rewarding than their typically developing peers. In a recent study examining the social motivation of domesticated dogs as compared to wolves, attentional bias to social stimuli was quantified by presenting animals with a highly engaging object and coding for looks toward the experimenter (vonHoldt et al. 2017). Interestingly, the greater social attention in dogs was associated with structural variants in several genes implicated in WS (vonHoldt et al. 2017), suggesting that attention to social vs. nonsocial stimuli represents a conserved aspect of social motivation across species. Therefore, measurement of this behavior in humans could serve as an informative correlate for future genetic studies of social motivation and its role in the development of ASD.
Objectives: Here we have developed a novel method to assess social motivation in children with ASD and WS, by quantifying their social attention while the child plays with a high-value toy, a competing non-social stimulus.

Methods: We analyzed video clips from the free play section of the Autism Diagnostic Observation Schedule (ADOS), a standardized, semi-structured, play-based interview often used to diagnose ASD. Specifically, we focused on brief segments when the child was actively engaged with a high-value object (an interactive musical toy), and coded the frequency and duration of the child's gaze toward the object, the examiner, and the caregiver. Inter-rater reliability was high (ICC > 0.9). Videos were coded for three groups: a typically developing group, a group with ASD, and a group with WS.

Results: In a small pilot sample (n=6 per group), we found that toddlers with ASD spent significantly less time looking at social partners (caregiver and examiner) compared to typically developing children during periods of engagement with the high-value toy (see figure). While typically developing children frequently alternated their gaze between the toy and social partners, children with ASD looked toward the adults much less frequently. Children with WS were more variable in their social attention, with some behaving more like children with ASD and others more like typically developing children. There was no significant difference in duration of play with the high-value toy across groups, suggesting that it was consistently engaging for all children.

Conclusions: We are currently replicating these findings in a larger dataset which includes both high-risk and low-risk typically developing children, as well as additional ASD and WS participants. Our pilot analyses suggest that a brief behavioral measure pitting a high-value toy against the innate draw of social engagement could serve as a rapid, feasible measure of social motivation, with implications for enhanced clinical

assessment and behavioral phenotyping for genetic research in ASD and WS.

340 **177.340** Turner Syndrome: A New Research Model for ASD in Girls?

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Background: Autism Spectrum Disorders (ASD) are rarely diagnosed in high-functioning females with normal/high verbal IQ. Consequently, there have been few studies on this female phenotype across the life-span.
Turner Syndrome (45,X; TS) is a relatively common sex chromosome aneuploidy (4:10,000 live births). Affected females often experience social interaction difficulties that resemble those of idiopathic ASD. Yet most have normal-range verbal intelligence and they typically possess good formal language skills.

Objectives: We compared and contrasted the phenotypic profiles of TS females (5-18 years of age) with an age/VIQ matched sample of females diagnosed with idiopathic ASD.

Methods: Participants with TS (N=70) were recruited nationally from support groups and paediatric clinics. They were participants in the Social Skills and Relationships in Turner Syndrome study (SOAR), but they were not selected because of any previously diagnosed social communication disorder. Participants with idiopathic ASD (N=35) were recruited from the National Centre for High Functioning Autism (NCHFA-London, UK). The idiopathic-ASD and TS groups were matched for chronological age (t(54)=-0.71, p=0.48) and mental age (t(50)=-0.38, p=0.7). All had verbal IQ in the normal range. ASD was diagnosed in all cases by clinicians, using standardized procedures applying DSM-5 criteria. Participants were also rated according to the Strengths and Difficulties Questionnaire (SDQ) and the Social Responsiveness Scale 2 (SRS-2).

Results: 22.6% of TS females were diagnosed with ASD in the course of the SOAR study. There were no significant group differences on SDQ total scores, a broad ranging measure of emotional and behavioural adjustment, but the ASD-TS group were rated as having greater peer difficulties than the idiopathic-ASD group (t(52)=-3.95, p<0.0001). There were no significant group differences on the SRS-2 total score; only 14% of the TS participants obtained a 'normal-range' score. Overall, the TS group with ASD were more impaired than the idiopathic ASD females, in terms of social awareness, social cognition, social communication and autistic mannerisms but they scored similarly for social motivation. Group differences were not statistically significant but effects sizes ranged from small to medium.

Conclusions: 86% of a large and putatively representative sample of TS females, recruited from paediatric endocrinology clinics, experienced autistic-like social interaction difficulties of considerable severity, likely to impact their everyday life. One in five met DSM-5 criteria for an ASD. Phenotypic comparisons with females matched for age and IQ showed a similar range and severity of symptomatology. We provide preliminary evidence indicating females with TS are at high risk of ASD despite normal verbal intelligence. They represent a suitable model syndrome for interventions aimed at remediating social interaction difficulties in females with high-functioning ASD.

341 **177.341** Using Social Stories to Promote Behavior Change for Individuals with Autism Spectrum Disorders: A Scoping Review

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Background: Social stories are a popular choice of intervention for many professionals to use when working with individuals with Autism Spectrum Disorders (ASD). Social stories have been used in a variety of settings and for a number of purposes, including helping children understand group situations, perceive how others behave or respond, develop self-care skills, academic abilities, and coping skills, and as a behavioral strategy. There have been a number of reviews exploring the quality and efficacy of social story interventions. However, the results of previous publications have highlighted the disparate outcomes of social story research.
Objectives: The objective of this scoping review is to identify, evaluate, and synthesize studies utilizing social story interventions targeting behavior change in individuals with Autism Spectrum Disorders (ASD).

Methods: A search of five databases (PsycINFO, Cochrane Systematic Database, PubMed, CINAHL, ERIC) targeting social stories was conducted. Articles with population term- [(Autis* OR ASD OR Asperger*)] AND intervention term- [("Social Stories" OR "Social Story" OR Social Narrative)] were considered. Inclusion criteria: 1) individuals with Autism, Asperger, PDD-NOS, or Autism Spectrum Disorders; 2) published before February 2018; 3) social story/social narrative as intervention. Exclusion criteria: 1) literature reviews; 2) case studies without intervention; 3) qualitative understanding of user experience; 4) no control or alternate condition; or 5) comparisons of delivery modes (i.e., iPad vs. paper). Article titles, abstracts, and full-texts were independently reviewed by two reviewers; a third reviewer assisted during conflicts until consensus was met.

Results: Results of the systematic search produced 450 abstracts across five databases. After 136 duplicates were removed, 314 original titles and abstracts were screened, and 150 full-texts were evaluated for inclusion. Eighty-eight articles met criteria and were included in the qualitative synthesis. Primary outcomes of each study were identified and sorted into one of two macro-categories based on their aim: *Reduce Disruptive Behaviors* (RDB) (37.5%) and *Increase Desired Behaviors*(IDB) (62.5%). Gray's Social Story fidelity criteria were used to assess intervention strength, and were met in 35% of the articles. The subcategories yielding effective results consistently across multiple studies targeted the following behaviors: aggressive actions, fear/anxiety, verbal protests, identifying emotions, executive functioning, and following directions. Since 2013, the focus of social story interventions has moved from reducing disruptive behaviors toward increasing desired behaviors, at a ratio of 2:5. The overwhelming majority of the articles (92%) are from the U.S, two are from Turkey, and one each from Japan, New Zealand, Thailand, United Arab Emirates and the United Kingdom.

Conclusions: This scoping review highlights how social story interventions are used to promote behavior change for individuals with ASD. The studies included in this review provide support for the use of social stories to improve social engagement through the development and enhancement of a pro-social skills such as recognizing emotions, initiating social contact, and learning how to utilize positive verbal and non-verbal communication abilities. Thus, the findings from this scoping review provide evidence supporting social story interventions as effective in facilitating positive social interactions, promoting regulation, and eliciting behavior change for children with ASD.

342 **177.342** Using Thin Slice Ratings to Measure Social Communication in Children with Autism Spectrum Disorder

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Background: Behavioral observations are an important source of information regarding social communication behaviors in young children with ASD. The Brief Observation of Communication Change measure (BOSCC; Grzadzinski et al., 2016) was developed as a standardized observational coding system of social communication skills that can be used across intervention trials. Thin slice ratings (TSR), in which very short observations are rated by multiple untrained raters, have been shown to predict a variety of behaviors in children and adults (Baker et al., 2010; Murphy, 2005; Tackett et al., 2016). Recently, they have been used to rate social communication and autism symptomatology in young children with ASD (Hampton et al., 2018; Walton & Ingersoll, 2016), suggesting their potential as an alternative to more time intensive coding systems.
Objectives: The aim of the current study is to examine whether TSR of social communication skills during a parent-child interaction are psychometrically sound and capture similar information to the BOSCC for young children with ASD. We predicted that TSR would be highly correlated with BOSCC scores for the same observation and would show similar relationships to other measures of social communication and demographic variables.

Methods: TSR for 71 children with ASD were completed by 173 undergraduate college students from a psychology research pool. Fourteen groups of 11-15 raters viewed 2-minute clips of a 10-minute parent-child interaction for 4 to 7 different children. Raters used a 5-point likert-type scale to rate each clip on 7 items that were derived from the social communication items of the BOSCC (SC). Each group's item-level ratings for an individual child were averaged to produce TSR for each item. All items were then averaged to produce an overall TSR for each child. Cronbach's alpha based on the average item-level ratings was used to examine internal consistency of the coding scheme. Intraclass correlations (ICCs) based on overall TSR were examined to evaluate inter-rater reliability. Separate one-way random average measures ICCs were run for each group, given groups had different numbers of randomly-selected raters. Bivariate correlations were run to examine concurrent and discriminant validity between overall TSR and the BOSCC-SC, and other measures of social communication and demographic variables.

Results: Cronbach's alpha for the TSR was 0.92. ICCs ranged from 0.75 to 0.98. Overall TSR were significantly correlated with BOSCC-SC ($r = -.69$, $p < 0.01$). In addition, overall TSR and BOSCC-SC scores showed similar relationships to other measures of social communication (i.e. MCDI words produced, VABS-2 communication and socialization age equivalents, and MSEL verbal age equivalents; $p < 0.01$), but not child sex or parent education.

Conclusions: Thin slice ratings of young children with ASD during a parent-child interaction using modified BOSCC-SC items are internally consistent and show a similar pattern of relationships with other measures. Findings suggest TSR may be used to measure child social communication as an alternative to more resource-intensive coding measures. Future studies should investigate whether TSR capture other aspects of autism symptomatology (e.g. restricted and repetitive behaviors) and are sensitive to change.

343 **177.343** Web-Based Measure of SEL Skills Associated with Parent-Reported Social Behavior in Youth with Autism Spectrum Disorders

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Background: Social emotional learning (SEL) skills are essential for competent social functioning across youth populations (Crick & Dodge, 1994). While youth with autism spectrum disorders (ASD) often exhibit challenges in aspects of SEL (e.g., emotion recognition, theory of mind; Lozier et al., 2014; Baron-Cohen, 2000), it is unclear how these challenges relate to social functioning as observed by parents. To assess this relationship comprehensively, a tool is needed that evaluates multiple aspects of SEL in the same child. A web-based, modular, self-administered SEL assessment called SELweb has been developed, validated, and normed in general education-placed youth (McKown et al., 2015); effectively measures emotion recognition, theory of mind, social problem solving (SPS), and self-control (McKown, 2018); and is a promising candidate for unraveling the association between SEL and social functioning in ASD.
Objectives: To explore the relationship between SELweb performance and parent-reported social behaviors among youth with ASD.

Methods: Fifty-two verbal children between 6 and 10 years of age (M_{age}= 8.66, SD_{age}=1.38; 40 male; IQ≥85 per KBIT-2; Kaufman & Kaufman, 2004) who met diagnostic criteria on the ADOS-2 (Lord et al., 2012) completed SELweb (Table 1), which yielded standard scores for emotion recognition, theory of mind, SPS, self-control, and an overall SEL composite score (Table 2). A parent completed the Social Skills Improvement System (SSIS; Gresham & Elliott, 2008) for each participant. Using multiple regression analyses, SELweb results were compared to scores on the SSIS, controlling for age and IQ.

Results: The SEL composite score on SELweb predicted the overall SSIS Social Skills score (β=.351, p<.05). This association was largely attributable to the relationship with SSIS responsibility and empathy subscales (both β>.463, p<.01). These associations were, in turn, driven by SELweb's SPS module (β =.372, p<.01; β=.385, p<.01, respectively) and its subcategories of solution preference (β=.332, p<.05; β=.339, p<.05), goal selection (β=.309, p<.05; β=.366, p<.01), and hostile attribution bias (β=.391, p<.01; β=.354, p<.05). Scores on the SPS module and its subcategories were also associated with other SSIS scores, including the autism spectrum scale (all β<-.288, all p<.05).

Conclusions: Results suggest that SELweb performance in youth with ASD is related to several social behaviors as reported by parents, with particularly robust associations with responsibility and empathy. In turn, this effect was driven by SPS abilities, which were also associated with parent-reported ASD symptoms. When considering all aspects of SEL and controlling for age and IQ, it may be the ability to effectively and accurately plan responses to social situations (but not more widely-studied perspective-taking or emotion recognition) that most relates to parent-observed social abilities in youth with ASD, particularly in terms of being well-behaved and showing concern for others. While youth with ASD, then, may exhibit challenges in other aspects of SEL, they may be less directly related to the functional social outcomes ultimately targeted in interventions. The specificity of this finding arises from the use of an assessment tool that permits evaluation of multiple aspects of SEL in the same child – an approach that warrants study in future research.

344 **177.344** Yoga Practice Among Adolescents with Autism Spectrum Disorder: Exploring the Effect on Social Behaviors in Classroom.

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Background:
Adolescents with Autism Spectrum Disorder (ASD) may present some difficulties that can be explain by a diagnosis associated with there condition (ex: anxiety disorder, attention deficit and hyperactivity disorder (ADHD), mood disorder) (Simonoff and al., 2008). The percentage estimates of adolescents with ASD meeting the diagnosis criteria of ADHD is about 28% (Simonoff and al., 2008). New avenues are explored to help adolescents with ASD deal with there difficulties, such as yoga therapy, that had demonstrated it efficacity among children with ASD (Kenny, 2002; Koenig and al., 2012; Rosenblatt and al., 2011).

Objectives:

The aim of this study is to explore the efficacity of yoga practice on social behaviors of high school students with ASD.

Methods:

Two groups of six students (n=12) with ASD in two special classrooms frequenting an ordinary Montreal high school, their teachers and the classroom special educator participated to one yoga session per week for 8 weeks. The yoga sessions were animated by a yoga teacher certificated in yoga therapy. Before and after each session, an observation of the student's social behaviors was made. The social behavior referred to the attentive response of the students to a task that the teacher was asking them to do in the classroom. The students evaluated their difficulties with the Behavior Assessment System for Children, second edition, self-reported questionnaire (BASC-2).

Results:

The results indicate that 48 % of the student perceived that they present attention problems. Non-parametric analyses indicate that the social behavior frequencies of those students are significantly higher after the yoga sessions compared to before the yoga sessions, $p < .05$. Of all the students that have participated, 52 % do not report presenting attention problems. For those students, there social behavior frequencies after yoga sessions are significantly higher then before yoga sessions, $p < .05$.

Conclusions:

These findings indicate that yoga can be an effective practice among adolescents with ASD. The effect of the yoga was shown regardless of the attention difficulties perceived by the participants. The results of this study support the findings of Kenny (2002), Koenig and collaborators (2012) as well as Rosenblatt and collaborators (2011) by demonstrating that yoga is a practice that can help improving social behaviors of adolescents with ASD. This research show that integrated yoga sessions in school setting can be an effective way to reinforce the concentration of the students when doing an academic task. Next steps would be to increase the participants and to add a measurement of anxiety before and after the yoga sessions.

Poster Session
178 - Statistical Genetics
11:30 AM - 1:30 PM - Room: 710

345 **178.345** Deletion Impact on General Intelligence Is Similar in Autistic Than in Other Neurodevelopmental Disorders and General Population.

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Background: Copy number variants (CNVs) classified as pathogenic are identified in 10 to 15 % of patients referred for neurodevelopmental disorders (examples: intellectual disability, autism, ...). However, their effect-sizes on cognitive traits measured as a continuum remain mostly unknown because the vast majority of them are too rare to be studied individually using association studies. In a previous study, we developed a model to predict the effect-size of any deletion on intelligence quotient (IQ). This model was based on data from two general population cohorts. We validated this model by assessing the concordance between our predictions with literature for 15 recurrent CNVs and we estimated that our model has 75% of accuracy.
Objectives: We aim to extend this model to neurodevelopmental disorders, especially autistic populations to better handle the rare and non-recurrent deletions that may explain the low IQ measured in some patients.

Methods: We called CNVs ≥50Kb from genotyping data from 5 general population cohorts (n=17,449) as well as two disease cohorts, the Simons Simplex Collection of autism (n=2,574) and a neurodevelopmental disorder family cohort from CHU Sainte Justine (n=239). General intelligence was measured using different IQ scales or general factor (g-factor) which was computed using principal components analysis of different cognitive scores. Linear and non-linear models investigated functional annotations of genes included in CNVs to identify features explaining their effect-size on IQ. Then, we meta-analysed the results obtained for each cohort. Validation was performed using intra-class correlation comparing IQ predicted by the model to empirical data.

Results: We investigated a total of > 80,000 CNVs covering > 5,000 genes. Effect-size of deletions in disease cohort, including an autistic cohort, is similar to the one we observed in general population. Among 10 functional annotations, constraint scores (in particular the probability of being intolerant to haploinsufficiency-pLI) best explain the effect of deletions on non-verbal IQ with a decrease of 0.17 points Z-score per unit of pLI (CI 95%: [-0.22;-0.13]). The same effect-size was observed for the normalized g-factor with -0.20 Z-score (CI 95%: [-0.26;-0.14]). Effect-size of CNVs was similar across all methods used to measure general intelligence and across general population disease cohorts and complex comorbid clinical cases (neurodevelopmental disorders and/or autism). The concordance between this new prediction and the decrease of general intelligence computed in previous studies on recurrent CNVs is >75%. We did not identify any interactions or non-linear genetic effects on general intelligence.

Conclusions: The effect-size of deletions on general intelligence can be reliably estimated across the genome and is independent of participants' status. Results suggest omnigenic effects of haploinsufficiency and overexpression on general intelligence. This represents a framework to study variants too rare to perform individual association studies and we provide a new online tool for clinicians to estimate the contribution of undocumented CNVs to patient's cognitive deficits in the neurodevelopmental clinic. We hope that the characterization of rare variants will help to better understand the heterogeneity of autism disorder.

347 **178.347** Social and Non-Social Autistic Traits and Autism Domains Are Genetically Dissociable

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Background: There is some evidence to suggest that the two core domains of autism – social and communication difficulties, and unusually repetitive and restricted behaviour, interests and activities – are dissociable. Autism has traditionally been regarded as a 'syndrome' meaning that these two domains co-occur. The idea that these symptom domains might be independent of one another should not be surprising, given that they seem to entail very different cognitive processes. To date, there is limited molecular genetic evidence in support of the dissociability hypothesis, primarily due to the lack of well-powered molecular genetic studies that investigate the social and non-social domains of autism separately.

Objectives: To investigate if social and non-social autistic traits measured in the typical population and autism domains measured in autistic individuals are genetically dissociable.

Methods: Genetic correlations of autistic traits (systemizing, empathy, social relationship satisfaction, and scores on the Social and Communication Disorders Checklist (5,421 < N < 139,604)), and of RBS-R and ADOS social and communication subscales in 2989 autistic individuals.

Results: Systemizing is positively genetically correlated with autism ($r_g = 0.26 \pm 0.06$; $P = 3.35 \times 10^{-5}$), whilst SCDC, self-reported empathy, friendship and family relationship satisfaction are negatively genetically correlated with autism ($-0.39 < r_g < 0.26$, all $P < 5 \times 10^{-4}$). There is limited shared heritability between the social traits (empathy, friendship and family relationship satisfaction) and systemizing. Clustering analyses of 15 phenotypes that are genetically correlated with autism identified a social cluster with the social phenotypes clustering with each other, measures of intelligence clustering close to each, and neuropsychiatric conditions clustering close to each other. Systemizing did not cluster with any of the phenotypes, and was genetically correlated only with autism and measures of intelligence **(Figure 1A)**. Investigating genetic correlations between friendship satisfaction, empathy, and systemizing among 9 psychiatric conditions, only autism had the combination of negative genetic correlations with both empathy and friendship satisfaction, and positive genetic correlation with systemizing, mirroring the DSM-5 and ICD-11 criteria for autism (**Figure 1B**). Polygenic scores for systemizing are associated with RBS-R scores (Beta = 0.047±0.018, P = 0.010) , but not with ADOS social and communication subscale (Beta = -0.008±0.016, P = 0.60). Genetic correlation between RBS-R scores and ADOS social and communication score is low (r_g = 0.15±0.46, P = 0.74) and significantly lower than 1 (P = 0.034).

Conclusions: Our findings strongly suggest that the two core domains of autism are genetically dissociable, and point at how to fractionate the genetics of autism. We strongly suggest the need to collect deeper phenotypic information and understand potential neural and cognitive convergence of these domains to understand the underlying heterogeneity in and biology of autism.

348 **178.348** Autism Polygenic Scores Are Associated with Trauma and Self-Harm

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Background:

Autistic individuals experience significantly elevated rates of childhood trauma, and self-harm and suicidal behaviour and ideation (SSBI). It is unclear if polygenic scores for autism are associated the likelihood of experiencing these adverse mental health outcomes, and variables that may mediate and moderate this.

Objectives:

To investigate if polygenic scores for autism are associated childhood trauma and SSBI and identify variables that mediate and moderate these effects.

Methods: Using data from the UK Biobank (105,222 < N < 105,638), we applied polygenic scores for autism, and tested for association with childhood traumatic events and SSBI. The exposure variables were polygenic scores for autism, derived from an independent GWAS of autism. Sex and childhood trauma were moderators. Depression and anxiety symptoms, social relationships and job satisfaction were mediators. The main outcomes were childhood trauma scores, self-harm ideation scores, and self-harm scores.

Results: Polygenic scores for autism were significantly associated with childhood trauma scores (max R^2 = 0.083%, $P < 2 \times 10^{-16}$), and self-harm ideation scores (max R^2 = 0.098%, $P < 2 \times 10^{-16}$), and self-harm scores (max R^2 = 0.12%, $P < 2 \times 10^{-16}$). Male sex significantly negatively moderated the effect of polygenic scores on childhood trauma scores (Beta = -0.025±0.005, $P = 1.59 \times 10^{-5}$) and self-harm scores (Beta = -0.015±0.005, P = 0.007). Childhood trauma scores significantly positively moderated the effect of polygenic scores on self-harm ideation scores (Beta = 0.007±0.002; P = 0.008). Depressive symptoms, and quality and frequency of social interactions were significant mediators of the effect of polygenic scores on autism, with the proportion of effect mediated ranging from 0.23 (95% CI: 0.34 – 0.12) for depression to 0.02 (95% CI: 0.03 – 0.01) for frequency of social interaction.

Conclusions: Our results suggest the risk for SSBI and childhood trauma is partly associated with polygenic scores for autism and point to significant gene-by-environment interactions, with sex and childhood traumatic experiences moderating the effects of SSBI. Finally, our results also identify significant mediators of the effect of polygenic scores on SSBI.

Oral Session - 7A
Early Development (< 48 months)
180 - Screening
1:30 PM - 2:25 PM - Room: 517C

1:30 **180.001** Screening for Autism Spectrum Disorder in 9-Month-Old Infant Siblings

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Background: Most children with autism spectrum disorder (ASD) remain undiagnosed until age 4 or later (Daniels & Mandell, 2013; Public Health Agency of Canada, 2018). Therefore, identifying and treating children prior to diagnosis to improve lifelong outcomes and lessen financial burden have been emphasized. One method to capture early signs of ASD is through parent report. One such assessment, the 'Autism Parent Screen for Infants' (APSI; Sacrey et al., 2018), was developed as a parent-report analogue of the Autism Observation Scale for Infants (AOSI; Bryson et al., 2008), an observational assessment designed to elicit ASD-related behaviors up to age 18 months.
Objectives: This study examined whether the APSI, administered at 9 months of age, could differentiate high-risk (HR; have an older sibling diagnosed with ASD) infants subsequently diagnosed with ASD from other HR and low-risk (LR; no family history of ASD) infants not diagnosed with ASD.

Methods: *Participants*: Children were grouped based on 3-year diagnostic outcomes: (1) HR infants diagnosed with ASD (HR-ASD; n = 34), (2) HR infants not diagnosed with ASD (HR-N; n=82), and (3) LR infants not diagnosed with ASD (n=62).
Assessments: The APSI is a 26-item parent-report questionnaire that queries early signs of ASD in infants between ages 6 and 18 months. It covers pre-diagnostic behavioral symptoms, including impairments in eye contact, visual tracking, responding to name, imitation, language, social development, joint attention, gestures, play, visual examination of objects, and emotional regulation. Parents completed the APSI when their children were 9 months of age. Clinical best-estimate diagnoses were completed at 3 years of age, using the Autism Diagnostic Observation Scale and the Autism Diagnostic Interview-Revised, by clinicians who were blind to previous assessments. *Statistical Analyses*: Performance on the APSI was compared using a one-way ANOVA with diagnostic group as the independent measure and total score as well as item-level scores as the dependent measures. Group effects for total score and individual items were explored using Benjamini and Hochberg (1995) corrections.

Results: A group effect was seen for total APSI score ($F(2,175)=16.37$, $p<.001$), with the HR-ASD group having higher scores than both the HR-N and LR groups ($ps<.001$; $ds=.74$ and .96, respectively), who did not differ ($p=.12$,$d=.33$). Significant group differences were observed for 16 of 26 APSI items ($ps<.05$), as displayed in Table 1. Importantly, the eight items that distinguished between HR-ASD and the other two groups (who did not differ) were: responding to name, anticipating a social response, eye contact, reactivity, showing interest and pleasure, use of hands/holding objects, unusual repetitive behaviors, and unusual sensory interests.

Conclusions: These results suggest that the APSI may be a viable screening option to identify, among children at familial high risk as early as 9 months of age, those who may require additional follow-up and referrals to specialized services. Utility in LR children in the community remains to be determined.

1:42 **180.002** Leveraging Developmental Trajectories of Broadband Screening to Detect Autism Risk in Primary Care

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Background: The gap between the typical onset of autism symptoms and the average age of diagnosis remains wide, demonstrating the need for novel screening methods that detect ASD more reliably and at younger ages. Infant-sibling studies suggest that many children later diagnosed with ASD show developmental deceleration in the first two years of life, sometimes before clear autism symptoms emerge. However, this has not yet been demonstrated in low-risk samples so its screening value is unknown. This study leveraged routine developmental screening in primary care to examine whether developmental deceleration is an early indicator of ASD that can contribute to universal screening.
Objectives: Test the hypotheses that (1) developmental deceleration can be detected in a subset of low-risk primary care patients and (2) this pattern confers elevated risk for ASD.

Methods: The Children's Hospital of Philadelphia has conducted universal screening for 10+ years across 31 primary care sites. The Survey of Well-Being in Children (SWYC) Milestones (Sheldrick & Perrin, 2013) is administered at 9, 18, and 24-30 months, according to American Academy of Pediatrics (AAP) guidelines. All patients with at least one SWYC screening and follow-up diagnostic data at ≥4 years were included in this epidemiological cohort, identified from electronic health records (N=32,280). The ASD prevalence rate in this cohort was 2.4%.

Results: Growth mixture models identified distinct developmental trajectories of SWYC scores from 9-30 months; a four-class model provided the best fit. Class 1 (67% of the cohort) had 9-month scores that met age expectations and significantly increased from 9-30 months. This class (average posterior probability [APP]=.92) had a lower probability of a later ASD diagnosis (0.5%) compared to the entire cohort (2.4%). Class 2 (19%, APP=.78) also met age expectations at 9 months, but showed a more modest increase from 9-30 months; the rate of ASD in this class was 1.6%.

In contrast, Class 3 (10%, APP=.81) showed developmental deceleration from 9-30 months and had an elevated rate of ASD (7.1%). Class 4 (4%, APP=.89) had lower 9-month scores and more significant developmental deceleration, with a very elevated rate of ASD (27.0%). Two-thirds of children with ASD were classified into Class 3 or 4 (i.e., sensitivity=74%). Specificity of these developmental profiles was 88%, positive predictive was 13%, and negative predictive value was 99%. Additional analyses will combine SWYC developmental trajectories and M-CHAT/F results to determine if the combination yields more accurate screening than either alone.

Conclusions: These data demonstrate that clear developmental deceleration is detectable through routine developmental screenings, and when this pattern is present, it confers elevated risk for ASD. As such, screening for developmental deceleration in the first two years of life may

improve the status quo of universal screening in primary care. One important benefit of this approach is that it leverages tools pediatricians are already administering as a part of routine clinical care. Though this study used screenings from 9-30 months (given guidelines for screening at these ages), developmental deceleration may be detectable even earlier than 24-30 months with more repeated developmental screenings.

1:54 **180.003** Neonatal and Early Infant Developmental Profiles of High-Risk Siblings of Children with ASD

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Background: In an effort to improve early identification of ASD, prospective longitudinal studies of infant siblings of children with ASD have delineated early development profiles of high-risk infants. These profiles characterize infant development from 12-36 and even 6-36 months of age, identifying cognitive, motor, and language deficits for infants who go on to develop ASD (e.g., Barbaro and Dissanayake, 2012; Landa et al., 2012). Yet, little to no research has examined developmental profiles of high-risk infants in the neonatal and early infant period, from birth to 6 months. An understanding of key developmental differences during this early period, including neurological functioning and cognitive and motor development, will contribute to a mechanistic understanding of the emergence of ASD, ultimately leading to the development of targeted interventions.

Objectives: The current study examines neonatal neurobehavioral functioning and subsequent longitudinal developmental profiles from birth to 6 months of age for high-risk infant siblings of children with ASD (HR) compared to low-risk infant siblings of typically developing children (LR).

Methods: In a prospective, longitudinal design, HR (N=51) and LR (N=49) infants were administered the *NICU Network Neurobehavioral Scales* (NNNS) at 1-month and the *Bayley Scales of Infant and Toddler Development* (Bayley) at monthly intervals between 1 week and 6 months of age. Neurobehavioral functioning at 1 month of age was compared between HR and LR infants using independent sample t-tests. Specifically, measures of attention, regulation, arousal, excitability, and lethargy were examined. Linear mixed models were then used to examine trajectories of cognitive, fine motor, and gross motor development between 1-6 months across HR and LR infants.

Results: Neonatal neurobehavioral functioning was largely comparable across the groups, with the exception of regulation for which LR infants outperformed HR infants ($t(65) = -2.70$, $p = < .01$). Linear mixed models indicated a significant main effect of risk for trajectories of cognitive development ($F(1,341)=3.98$, $p<.05$) and a marginally significant main effect of risk for trajectories of fine motor skills ($F(1,338)=3.80$, $p=.052$). Gross motor development was not different between HR and LR groups ($F(1,338)=0.05$, $p=.829$).

Conclusions: These findings suggest that that infants who are at an increased genetic risk for developing ASD may experience very early developmental vulnerabilities, present as early as 1 month of age, prior to the emergence of social-communication deficits. Regulation abilities, which refer to the capacity to organize motor activity and physiological reactivity, were found to be significantly lower for 1-month-old HR infants. Subsequently, HR infants were found to achieve cognitive and fine motor milestones later than LR infants through the first 6 months of life. Additional research is needed to investigate the possibility that lower regulation abilities contribute to these later delays. Indeed, regulation capacities afford increased opportunity for controlled, organized exploration of the environment, which may foster the emergence and refinement of cognitive and fine motor skills. Overall, this research highlights very early vulnerabilities, possibly grounded in disrupted neurological functioning from birth, that should be further investigated as biomarkers of later-emerging social-communication deficits.

2:06 **180.004** Parental Reports of ASD Proband Functioning Are Associated with Outcomes at 24 Months in Infant Siblings

J. B. Girault[1], *M. R. Swanson*[2], *R. L. Grzadzinski*[3], *M. D. Shen*[1], *S. S. Meera*[4], *J. Pandey*[5], *T. St. John*[6], *A. Estes*[6], *L. Zwaigenbaum*[7], *K. Botteron*[8], *H. C. Hazlett*[1], *S. R. Dager*[6], *R. T. Schultz*[5], *J. N. Constantino*[8] *and J. Piven*[9], *(1)University of North Carolina, Chapel Hill, NC, (2)University of North Carolina at Chapel Hill, Chapel Hill, NC, (3)University of North Carolina Chapel Hill, Chapel Hill, NC, (4)Carolina Institute of Developmental Disabilities, University of North Carolina at Chapel Hill, Carrboro, NC, (5)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (6)University of Washington, Seattle, WA, (7)University of Alberta, Edmonton, AB, Canada, (8)Washington University School of Medicine, St. Louis, MO, (9)*Co-Senior Authors, IBIS Network, University of North Carolina, Chapel Hill, NC*

Background: ASD is heritable and infant siblings of children with ASD are at greater risk for receiving a diagnosis, though it remains unclear whether functioning of the proband is related to dimensional outcomes of the infant siblings.

Objectives: To determine if dimensional parent report measures of developmental functioning and autism symptom severity in probands are related to infant sibling outcomes at 24 months.

Methods:

Participants: Participants were recruited as part of the Infant Brain Imaging Study (IBIS), a longitudinal, multi-site study of brain and behavioral development in children at high-familial risk (HR) for ASD. Data from 406 proband and HR infant sibling pairs were included, in which 92 HR infant siblings were diagnosed with ASD at 24 months (HR-ASD) and 314 were negative for ASD (HR-Neg).

Measures:Parental reports of proband ASD severity were evaluated using the Autism Diagnostic Interview – Revised (ADI-R) and the Social Communication Questionnaire (SCQ), and reports of dimensional adaptive behaviors were collected with the Vineland Adaptive Behavior Scales (VABS). Infant measures of interest included examiner-based language and motor performance on the Mullen Scales of Early Learning (MSEL), Autism Diagnostic Observation Schedule (ADOS) scores, and parental reports from the VABS at 24 months.

Analysis:(1) To determine if proband functioning and severity differed between HR-ASD and HR-Neg groups, an ANCOVA testing for main effects of sibling diagnostic group were employed, adjusting for proband and sibling sex and age at measurement. (2) Robust linear regression was used to predict sibling outcomes at 24 months from proband parental reports adjusting for diagnostic group of the sibling, proband and sibling sex and age at measurement, and interacting effects of proband scores and sibling diagnostic group.

Results: Probands of HR-ASD infants were significantly more impaired than those of HR-Neg infants on the SCQ ($F_{1,356}=5.98$, p=0.016, Cohen's d=0.30)and measures of daily living skills ($F_{1,338}=7.21$, p=0.008,d=-0.31), socialization ($F_{1,337}=5.17$, p=0.024d=-0.23), and communication ($F_{1,337}=5.26$, p=0.023, d=-0.26) on the VABS (**Figure 1**). Across the HR sample, there were significant associations between proband SCQ scores and sibling Adaptive Behavior Composite (ABC) scores from the VABS (b=-0.27, p=0.032), between proband and sibling VABS ABC scores (b=0.34, p=0.004), socialization scale scores (b=0.34, p=0.023), and communication scale scores (b=0.47, p<0.0001). Proband parental reports of language from the

VABS were significantly associated with examiner-based assessments of infant sibling MSEL expressive (b=0.32, p<0.01) and receptive language (b=0.76, p<0.001), as well as parental reports of these measures from the VABS (expressive: b=0.39, p<0.001, receptive:b=0.52, p<0.0001; **Figure 2**). Significant interactions for infant diagnostic group and proband score were found when predicting infant communication (b=-0.36, p<0.01) and receptive language (from VABS: b= -0.29, p=0.021, from MSEL: = -0.74, p<0.001;**Figure 2B,C**). No significant associations were found between proband ADI-R and infant sibling outcomes, proband measures and infant ADOS scores, or proband and infant motor skills.

Conclusions: This study demonstrates that parent reports of proband functioning are associated with categorical diagnostic outcomes and both parent reports and examiner-based clinical assessments of dimensional outcomes in infant siblings.

Oral Session - 7B
Diagnostic, Behavioral, Sensory and Intellectual Screening and Assessment
181 - Diagnosis
2:30 PM - 3:25 PM - Room: 517C

2:30 **181.001** Testing the Efficacy of the Get SET Early Model As a Mechanism to Reduce the Mean Age of ASD Detection and Treatment Referral

K. Pierce[1], *S. James*[2], *E. Bacon*[1], *E. Skepnek*[2], *E. Leuthe*[2], *C. Barnes*[1], *D. Cha*[1], *L. Outhier*[2], *L. Lopez*[1], *S. Nalabolu*[1], *C. Pham*[1], *V. Gazestani*[3], *A. Cheng*[1], *A. Moore*[1], *E. Courchesne*[3] *and C. J. Smith*[2], *(1)Neurosciences, University of California, San Diego, La Jolla, CA, (2)Southwest Autism Research & Resource Center, Phoenix, AZ, (3)Neurosciences, Univeristy of California, San Diego, La Jolla, CA*

Background: Because many children with ASD begin to show observable signs within the first year, there is an ethical demand for early detection and intervention. While we and other University-based studies have shown that ASD can be detected as early as 12-18 months using parent report screens at well-baby check-ups, surprisingly, the mean age of ASD detection in the US is several years later, around 4 years. CDC studies report this age as even later at 56 months in Phoenix. To address this gap, we created a standardized early detection program within the University of California, San Diego, named *Get SET Early,* which expands on our previous work. Our approach incorporates new elements including a triple screen at 12, 18, and 24 month well-baby visits, and tracking of pediatrician diagnostic impression and referral habits (Figure 1). The goal of the model is to reduce the mean age of ASD detection and treatment referral to be between 12-24 months as standard of care.
Objectives: (1) To determine the feasibility of instituting the *Get SET Early* model, initially created within a University setting, within in a community center in Phoenix; (2) to examine program metrics such as mean age of first comprehensive evaluation in Phoenix in comparison to CDC statistics, and in comparison to our university-based program in San Diego.

Methods: A community–based center in Phoenix (i.e., SARRC) was selected to implement the *Get SET Early* model. The program was established in 2014 by creating an early ASD diagnostic center within SARRC, establishing a network of 109 pediatricians and training them to use a screening tool, the CSBS, and by providing San Diego-established *GET SET Early* program materials and data collection mechanisms. Once a toddler was referred to the program, he/she participated in an evaluation that included the ADOS, Vineland, and Mullen and referred for immediate treatment as appropriate. Program metrics included number of screens administered, age at first diagnostic evaluation, number of toddlers identified with ASD and other delays, and age at last (most recent) diagnosis.

Results: Within just 4 years, 45,289 screens were administered at 12, 18, and 24 month well baby visits. Within toddlers screened at 12 months, the mean age of dx evaluation and treatment referral was 14.78 months. Overall, 520 screen-detected (Figure 2), and an additional 65 toddlers that fell outside validated screen age were evaluated. Within this final sample (N=585), 251 toddlers were diagnosed as ASD, 96 as ASD Features, 71 as LD, 106 as DD, and 61 as false positive (i.e., TD) at their last evaluation. The overall age at first evaluation was 21.8 months, which is similar to program results in San Diego, and is 3 years lower than the CDC reported age of 56 months.

Conclusions: The *Get SET Early* model can be easily implemented in regions with late detection ages. Although the program was established in Phoenix just 4 years ago, it has had a major impact on lowering the first age of diagnosis and treatment engagement by around 3 years.

2:42 **181.002** Validation of a Novel Assessment Instrument for Identifying Autism Spectrum Disorder (ASD) in Children with Visual Impairment

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Background: Children with profound or severe visual impairment (VI) are at high risk of developing difficulties in social communication and interaction (prevalence of ASD ~30% in several studies). The administration or coding of existing diagnostic tools depend on vision-dependent items and are therefore inappropriate for this clinical population. A novel observational schedule (the Visual Impairment Social Communication Observational Schedule - VISCOS), drawing on elements of ADOS with novel items and methods which do not require vision function, has been developed and validated for the first time.
Objectives: To investigate the performance of the VISCOS in reliably differentiating children with VI at high risk of ASD from those at low risk according to independent expert clinician formulation. Additional investigations aimed to establish concurrent validity by correlating the VISCOS scores with parent-report questionnaires that address social responses in children.

Methods: Four-to-seven-years-olds (M=5.4 years, SD=10.5 months; range 4.0 years to 7 years 9 months; 59% males), with profound VI (n=15; light perception at best), to severe VI (n=67, M=.98 logMAR) participated. The children engaged in social interaction and play including symbolic play, conversation, auditory story and non-visual theory of mind materials with a trained psychologist assessor, using standard presses designed specifically for children with very low or no vision (VISCOS). Parents filled out the Social Responsiveness Scale (SRS-2) and completed an interview consisting of the Development And Wellbeing Assessment (DAWBA) tool. Items which were heavily vision dependent were removed and scoring adjusted. Presented are preliminary data from 67 children, who were rated by the assessor using VISCOS coding schedule. A paediatrician, expert

in VI and ASD, independently scored children using the video assessments and the parent-reported DAWBA to reach diagnostic formulation (Low Risk of ASD, Borderline, ASD) according to DSM-5 criteria.

Results: The internal consistency of VISCOS-Total items was good (α=.87). Inter-rater reliability was excellent (ICC=.95, p=.0001). Significant positive associations were found between VISCOS-Total and the parent-rated questionnaire SRS-2 suggesting good criterion validity. Clinician formulation showed: Low Risk ASD=65.7%; Borderline=19.4%, and ASD=13.4%. A ROC analysis revealed excellent predictive discriminant validity (AUC=0.92) with a sensitivity/specificity of 0.86 for clinician ratings and identified a VISCOS threshold score for *High Risk for ASD* (≥13.5) or *Low Risk for ASD* (<13.5). Correlations revealed the *High Risk* group had significantly higher reported difficulties than the *Low Risk* group on SRS-2 subscales (p=.005, η^2=.122).

Conclusions: The VISCOS has been designed as the first visual impairment-specific assessment tool for children to support the identification and diagnosis of ASD and social communication difficulties. Results suggest a reliable instrument depicting strong internal coherence, construct validity, inter-rater reliability and predictive discriminant validity. Good criterion/construct validity was demonstrated using the results of the SRS-2 questionnaire. The results of the clinician formulation showed that about 32% of the children were classified as being at high risk of ASD (ASD plus borderline), a percentage similar to that found in other studies. A more accurate diagnostic algorithm is being developed. The profiles of ASD in the context of VI are discussed, providing new insights into non-visual ASD.

2:54 **181.003** DSM-5 Autism Spectrum Disorder Symptom Expression in Toddlers

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Background: Diagnosing autism spectrum disorder (ASD) in toddlers requires careful interpretation of how the diagnostic criteria are manifested in toddlerhood. An established, widely-used parent interview, the ADI-R, has been shown to sometimes under-diagnose children below 24 months chronological or 18 months mental age (Lord et al., 1993). While toddler-specific algorithms have been published (Kim & Lord, 2012), sensitivity in some samples is as low as 67-70%, with specificity from 82-86% (Kim et al., 2013). In addition, administration of the entire interview is lengthy, placing a significant burden on clinicians, parents, and researchers. Based on the clinical experience of multiple expert clinicians, we developed a briefer interview comprising symptoms and behaviors often observed in toddlers with ASD, and accompanying scoring algorithms aligned with DSM-5 diagnostic criteria, for use during evaluations with young children age 12-36 months.

Objectives: Our aim was to determine which of these toddler-specific questions within each DSM-5 symptom domain most clearly differentiate very young children with ASD from those with other disorders or typical development, and which symptoms are unlikely to be manifested at this age.

Methods: Semi-structured interviews with parents attending a diagnostic evaluation for their child were analyzed to determine which questions within each DSM-5 domain best discriminated children who received an ASD diagnosis from those with another diagnosis or no diagnosis. Participants were parents of 284 toddlers between age 12-36 months (M=19.3) who screened positive on a developmental screening questionnaire and received a developmental/diagnostic evaluation. Seventy-eight children were diagnosed with ASD; 117 received a diagnosis of language delay or global developmental delay, and 89 were typically developing. Fisher's Exact Test was used to determine group differences on each of 45 interview questions. An adjusted alpha value of a=.001 was used to account for multiple comparisons.

Results: **Responses to most interview questions were significantly different** between the ASD, other diagnosis, and typically developing groups. Table 1 lists the items with the largest effect size. In the social domain (DSM-5 criterion A), questions about **initiating joint attention, gaze shifting, and responses to other children** most strongly distinguished diagnostic groups. In the Restricted, Repetitive domain (criterion B), questions addressing **unusual whole-body movements, distress in response to change in routines, presence of restricted interests, and sensory seeking** (vs. hyper- or hypo sensitivity) showed the largest differences. Items that were not different among diagnostic groups included how children respond to their name (though frequency of response to name *was* significant), immediate and delayed echolalia, and distress to minor changes in the environment. We suggest that many young children do not yet have enough language to be echolalic, and their cognitive development may not be sufficient to notice small changes in the environment.

Conclusions: Focusing on how the DSM-5 ASD symptoms are expressed in toddlers can help to optimize evaluation efficiency and shed light on how the core symptoms appear early in development in children who screen positive for developmental disorders.

3:06 **181.004** Improving Parent-Provider Communication and Shared Decision-Making for the Early Identification of ASD: A Qualitative Study

E. Posner[1], *L. V. Ibanez*[1], *J. Locke*[2], *P. Carpentier*[1], *L. Frederick*[2] *and W. L. Stone*[3], *(1)UW READi Lab, Seattle, WA, (2)Speech & Hearing Sciences, University of Washington, Seattle, WA, (3)Psychology, University of Washington, Seattle, WA*

Background:

There is an average delay of two years between first concerns for Autism Spectrum Disorder (ASD) and diagnosis (Sansoti, Lavik, & Sansosti, 2012). As a diagnosis is necessary to access ASD specialized interventions, many children fail to receive these services before the age of three, when it would be most beneficial to their development (Dawson et al., 2010). Disjointed and inefficient communication between parents and health/service providers could be a contributor to this delay, as many parents report being afraid to express concerns due to fearing judgement, while providers are unsure about how to appropriately bring up or respond to ASD concerns (Ryan & Salisbury, 2012). The principles of shared-decision making can mitigate these issues, but past studies have found the use of such models is difficult due to a lack of clear materials and supports (Shields et al., 2012).

Objectives:

Our aim was to characterize the challenges and facilitators for effective communication between parents and providers about early ASD concerns in order to develop tools to promote shared-decision making.

Methods:

Twenty-three parents of young children diagnosed with ASD participated in 3 focus groups, 2 conducted in English and 1 in Spanish. Participants answered a series of pre-determined, open-ended questions and prompts related to the diagnostic process and obstacles they encountered accessing services. Focus groups were audio-recorded, transcribed, and coded using the grounded theory approach to find common themes among the participants' responses. Two independent coders reviewed the transcriptions and inter-coder reliability was reached.

Results:

Eight themes were found (underlined; see Table 1). Child characteristics that generated parental concerns included those related to core ASD deficits (e.g., poor eye contact, social interactions) and developmental delays (e.g., language delay). When parents raised the concerns to others (e.g. providers, spouses), their responses ranged from dismissive to disbelieving to affirming. If ASD concerns were raised by others, the delivery was usually gentle, but sometimes poor and unwelcome. Parental reactions when others raised concerns ranged from fear to anger to relief, but all parents generally took action once their providers made recommendations/referrals. Parents' lacked in-depth prior knowledge of ASD and would use the internet and library to seek information on ASD, which, at times, led to them feeling overwhelmed. Barriers to acting on concerns included providers' dismissal of concerns, parental hesitation, language and cultural barriers, and issues with the service delivery system (e.g., long diagnostic waitlists), while appropriate referrals, resources, and support/validation from the child's providers acted as facilitators to acting on concerns. Parents' recommendations to providers included increased training in ASD, increased sensitivity and responsiveness to parental concerns, and concise, informative written materials about ASD, the diagnostic process, and interventions.

Conclusions:

These findings highlight the role that shared decision-making principles may play in improving the early detection of ASD. Results have immediate implications for strategies providers can use in discussing ASD concerns and possible next steps and for the development of shared decision-making materials.

Oral Session - 8A
Biomarkers (molecular, phenotypic, neurophysiological, etc)
182 - Biomarkers 3
1:30 PM - 2:25 PM - Room: 517A

1:30 **182.001** Investigating Brain Response to Speech in 6- and 7-Month-Old Infants: Evidence for Atypical Statistical Learning in Infants at High Risk for ASD

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Background: Statistical learning is a mechanism of language acquisition that may be atypical in ASD (Romberg & Saffran, 2011). Previous studies have investigated statistical learning by measuring changes in brain activity across trials as infants listen to repeated stimuli. When listening to repeated patterned speech, typically developing (TD) neonates exhibit increased brain activity overtime (Gervain et al., 2008). By 3-months, TD infants exhibit suppressed brain activity overtime, but infants at high risk for ASD do not exhibit changes in brain activity overtime (Edwards et al., 2017). It is however unknown whether these high risk infants continue to exhibit atypical statistical learning as they age, and whether this is early brain activity predicts language abilities later in development.
Objectives: The present study investigated whether 6- and 7-month-old infants at low and high risk for ASD exhibit neural evidence of statistical learning when listening to patterned versus non-patterned speech, and explored whether early brain response predicts receptive language abilities at 24-months.

Methods: 26 (14M, 12F) low risk control (LRC) and 12 (6M, 6F) high risk for ASD infants (HRA-), ages 6 months;5 days to 7 months;28 days, listened to two syllable sequence types, patterned (ABB; "ba-ga-ga") and non-patterned (ABC; "ba-ga-lo") speech, while wearing a fNIRS cap. HRA- infants had an older sibling with ASD, but no ASD diagnosis by 24-months. All infants provided data from 16+ trials. Change in oxyhemoglobin concentration (OxyHb) over the 16-second trial period was extracted and averaged across the first four trials and last four trials (trial blocks) after motion artifact correction. This process was repeated for two regions of interest (ROIs), left anterior and right anterior (Figure 1.b), and for both syllable sequence types. At 24-months, infants returned to complete the Mullen Scales of Early Learning to assess language.

Results: Results of a 2x2x2x2 mixed factorial ANOVA revealed a significant interaction effect between ROI, time, and group ($F(1,36)=4.277$, $p=.046$). Collapsing across both syllable sequence types, LRC infants had greater OxyHb response ($M=.121x10^{-3}$) than HRA- infants ($M=-.013x10^{-3}$) during the first trial block within the left anterior ROI (Figure 1.a). LRC infants had decreased OxyHb in response to speech during the last trial block ($M=.010x10^{-3}$) versus the first trial block ($M=.121x10^{-3}$) within the left anterior ROI. There were no significant differences in OxyHb response during the first trial block ($M=-.013x10^{-3}$) versus the last trial block ($M=.084x10^{-3}$) for HRA- infants within either ROI. Additionally, OxyHb response to patterned speech during the first trial block within the left anterior ROI was significantly correlated with Mullen receptive language scores at 24-months ($r(30)=.438$, $p=.016$; Figure 2).

Conclusions: 6- and 7-month-old TD infants exhibited left-lateralized suppression of brain activity as they listened to repeated stimuli, which may reflect successful stimulus encoding of both patterned and non-patterned speech (Issard & Gervain, 2018). In contrast, HRA- infants did not exhibit changes in brain activity overtime, which may indicate atypical statistical learning within the broader ASD phenotype. Future studies should continue to investigate whether early brain response to speech predicts later language abilities in high risk populations.

1:42 **182.002** Changes in Amygdala and Hippocampus Volumes Among Adolescents with Autism Spectrum Disorder over the Course of the PEERS® Social Skills Intervention

A. Arias[1], *A. Barrington*[2], *A. J. McVey*[1], *H. K. Schiltz*[1], *A. D. Haendel*[3], *B. Yund*[4], *A. V. Van Hecke*[5], *W. Krueger*[6] *and M. Carlson*[7], *(1)Marquette University, Milwaukee, WI, (2)Biomedical Engineering, Marquette University, Milwaukee, WI, (3)Speech-Language Pathology, Concordia University Wisconsin, Mequon, WI, (4)Psychology, University of Wisconsin Milwaukee, Milwaukee, WI, (5)Psychology, Marquette University, Milwaukee, WI, (6)Speech Pathology and Audiology, Marquette University, Milwaukee, WI, (7)Education, Marquette University, Milwaukee, WI*

Background: Amygdala and hippocampus volume comparisons between adolescents with and without autism spectrum disorder (ASD) have been mixed (e.g., Groen et al., 2010; Schumann et al., 2004). Further study is needed to better understand these findings. Additionally, adolescents with ASD who receive a well-validated social skills intervention have demonstrated neurological changes, via EEG, coinciding with improvements in social behavior (Van Hecke et al., 2013). No known study, has examined volumetric change of brain structures in ASD over the course of such an intervention.

Objectives: 1) Compare amygdala and hippocampus volumes for groups of adolescents with and without ASD before intervention. 2) Examine changes in these regions across the Program for the Education and Enrichment of Relational Skills (PEERS; Laugeson & Frankel, 2010) using a randomized controlled trial (RCT).

Methods: Thirty-two male adolescents (23 ASD, 9 typically developing (TD)) aged 11-16 participated. See Table 1 for descriptive statistics and volume means. An RCT (experimental (EXP) vs. waitlist control (WL)) of PEERS® was conducted for the ASD group. Structural MRI scans were collected twice (before and after PEERS® for the EXP group) using a GE 3T scanner. Freesurfer Autorecon Processing (Fischl et al., 2002) was used for whole brain structural segmentation. MATLAB (The Mathworks, Inc, 2018) was employed to extract bilateral amygdala and hippocampus volumes.

Results: One-way ANOVAs revealed no significant difference between groups on amygdala or hippocampus volumes before intervention. Repeated measures MANOVAs for Time (pretest vs. posttest) by Group (EXP vs. WL vs. TD), revealed a Time by Group interaction for amygdala volume (Wilks' Lambda = .48, $F(8,72) = 3.95$, $p < .001$). Univariate follow-up showed that the interaction effect was upheld for right and left amygdala volumes. Paired sample *t* tests demonstrated a decrease in right ($t(15) = 2.97$, $p = .010$) and left ($t(15) = 4.43$, $p < .001$) amygdala volumes in the EXP group across intervention; no significant changes were found for the WL group. Conversely, left amygdala volume increased for the TD group ($t(8) = -3.31$, $p = .011$) across time. No significant effects were found for hippocampus volumes. Table 2 shows the descriptive statistics, *F* values, and significance levels for the univariate follow-ups.

Conclusions: Significant decreases were uncovered for bilateral amygdala volumes for the adolescents with ASD who received the intervention, whilst no significant changes were found for those who did not. The PEERS® intervention, shown to improve social behavior (Laugeson et al., 2009), may contribute to changes in amygdala volume. Furthermore, these changes in brain structure and behavior may dynamically and transactionally contribute to maintained overall outcomes observed after PEERS® for adolescents with ASD. Significant increases uncovered in the left amygdala volume for the TD adolescents are likely due to a maturation effect, as left amygdala volume has shown increases in TD males during adolescence (Neufang et al., 2009). No significant changes were found for bilateral hippocampus volumes, thus social behaviors targeted by PEERS® may be centered in the amygdala.

1:54 **182.003** Social Gestures Are Differentially Related to Brain GABA Levels between Children with Autism and Typically Developing Children

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Background: Autism Spectrum Disorder (ASD) is characterized by impairments in social cognition, communication, and repetitive behaviors. Motor abnormalities are common in ASD and have been linked to social and communicative features of the disorder. Praxis - the performance of complex gestures with a communicative or functional purpose, has been shown to be impaired in ASD and has a large impact on quality of life. The inhibitory neurotransmitter GABA plays an important role in regulating motor behaviors and is implicated in ASD pathophysiology, but the link between GABA and autism-related dyspraxia is unclear.

Objectives:Here, we assessed praxis and measured GABA levels in the sensorimotor cortex of typically developing children and children with ASD using edited Magnetic Resonance Spectroscopy. We hypothesize that children with ASD show worse praxis, and that better praxis performance is correlated with higher sensorimotor GABA levels.

Methods: Data were acquired in 24 children with ASD (10.52 ± 1.25 years, 6F) and 26 TDC (10.11 ± 1.38 years; 8F). Subject and parental consent were obtained under local IRB approval. Diagnosis was confirmed using the ADOS-2. *Praxis:* A pediatric version of the Florida Apraxia Battery was used to examine performance of skilled gestures, known to robustly discriminate children with ASD and TDC. Total percent correct and total error scores were used. *MRI:* GABA-edited MR spectra were acquired from $(3\ cm)^3$ voxels over the right primary sensorimotor cortex using MEGA-PRESS on a Philips 3T 'Achieva' (TE/TR 68/2000 ms, 320 transients; 10 min) and analyzed in Gannet.

Results: Mean praxis percentage correct (ASD; 52.1 ± 15.21, TDC; 75.93 ± 10.94, $p < 0.001$) and errors (ASD; 42.3 ± 15.95, TDC 20.57 ± 9.87, $p < 0.001$) differed significantly. GABA values were significantly lower in ASD, as previously shown. TDC showed a negative correlation with praxis percentage correct (-0.62, p = < 0.01), whereas there was trend towards a positive correlation in ASD (0.21, p = 0.12; *Figure 1A*). TDC showed a positive correlation between GABA and praxis errors (R – 0.6, $p < 0.001$; *Figure 1B*). Children with ASD showed a negative trend (R = -0.25). The correlations were significantly different between cohorts (Fisher r-to-z, $p < 0.01$). We explored whether an inverted u-shape (quadratic fit) fit the data across all participants, but significance did not reach alpha of 0.05 ($R^2 = 0.078$, p =0.06; *Figure 1C*). There were no significant differences in data quality.

Conclusions: GABA is differentially related to praxis performance in children with ASD and TDC. It is not quite clear how to interpret this finding, but the correlations are robust in TDC. Additional resting-state-fMRI, or left-hemisphere GABA levels, might elucidate this relationship. Within TDC, increased GABA levels may reduce gesture performance by suppressing SMA/PMC function to properly plan and execute movements, whereas in ASD, pathologically-reduced GABA may hinder efficient encoding of motor commands and ultimately impair the performance of complex gestures with a communicative or functional purpose, contributing to the autistic phenotype. Understanding the GABA system in ASD is important for developing future novel targets for patient-specific treatment.

2:06 **182.004** EEG Coherence Changes Related to the PEERS® Intervention: Evidence of Neuroplasticity

A. D. Haendel[1], *A. Barrington*[2], *B. Magnus*[3], *A. J. McVey*[4], *B. Dolan*[5], *K. Willar*[6], *A. Carson*[7], *A. Arias*[4], *N. Johnson*[8], *M. Jones Moyle*[9] *and A. V. Van Hecke*[3], *(1)Speech-Language Pathology, Concordia University Wisconsin, Mequon, WI, (2)Biomedical Engineering, Marquette University, Milwaukee, WI,*

(3)Psychology, Marquette University, Milwaukee, WI, (4)Marquette University, Milwaukee, WI, (5)Medical College of Wisconsin, Milwaukee, WI, (6)Stanford University, Stanford, CA, (7)Pediatrics, Autism Center, Baylor College of Medicine/Texas Children's Hospital, Houston, TX, (8)Nursing, Marquette University, Milwaukee, WI, (9)Speech-Language Pathology & Audiology, Marquette University, Milwaukee, WI

Background: There is consensus that neurological differences present in people with autism. Furthermore, theories emphasize the mixture of hypo- and hyper-connectivity as a neuropathology in autism spectrum disorder (ASD) (O'Reilly, Lewis, & Elsabbagh, 2017). Literature examining changes in neurological connectivity as a result of a well-validated social skills intervention, however, is limited.
Objectives: The current study examined changes in EEG coherence across the Program for Education and Enrichment of Relational Skills (PEERS®) for adolescents with ASD with the following aims: 1) to examine changes in neural connectivity among adolescents with ASD who received PEERS® (experimental group; EXP) versus those who did not (waitlist control group; WL), 2) to evaluate whether changes in EEG coherence were related to behavioral changes.

Methods: One-hundred ten adolescents with ASD ages 11-16 years, with an IQ ≥ 70, participated in a randomized controlled trial of the PEERS® intervention. Autism diagnosis was confirmed via the ADOS-G (Lord et al., 2001). Electroencephalogram (EEG) data were collected using a 3-minute eyes-open resting state paradigm at two timepoints (pre- and post-intervention for the EXP group). At both timepoints, adolescents completed the Test of Adolescent Social Skills Knowledge(TASSK) and Quality of Socialization Questionnaire(QSQ-A); caregivers completed the Social Responsiveness Scale(SRS) and Social Skills Improvement System(SSIS). EEG data from eight regions of interest: frontal, temporal, parietal, and occipital lobes, in each hemisphere, were calculated and averaged (see Figure 1). Magnitude Squared Coherence was calculated using MATLAB MVDR method for all of the possible pairings (28) in the alpha band (pre and post). Path Analyses were used to investigate correlated outcomes and covariates.

Results: Significant differences were found between the EXP and WL groups at post in OL-TL coherence (β = 0.20, p < .01), controlling for Time 1. Significant effects of Income were found on EEG coherences at post in OR-FR (β = -0.13, p < .005), OR-PL (β = -.29, p < .01), OR-TL (β = -0.27, p < .003), OR-FL (β = -0.14, p < .001), and OL-OR (β = -0.30, p < .005). ADOS-G Total score was a predictor of EEG coherences at post in TR-PR (β = -0.27, p < .01), OR-TR (β = -0.25, p < .009), OL-TL (β = -0.27, p < .006). The residualized post score in the FR-PR coherence pair was significantly related to the Social Skills subscale of the *SSIS* at post (β = .30, p < .002). Significant effects of OL-PL (β = .32, p < .002), and OR-TR residualized coherence (β = .36, p < .008) were found on QSQ-A scores at post.

Conclusions: Results indicated that adolescents with ASD exhibiting more severe symptoms of autism, showed less coherence in "short-range" EEG pairings in social brain areas. After receiving PEERS®, those adolescents exhibited changes in an exemplar "short-range" coherence pair in left occipital-temporal regions that was linked to changes in their social knowledge and behavior. The study's results provide neural evidence for the initial brain differences in ASD being affected by the PEERS® social intervention; therefore, supporting the theory of neuroplasticity.

Oral Session - 8B
Neurophysiology/Electrophysiology
183 - Brain EEG
2:30 PM - 3:25 PM - Room: 517A

2:30 **183.001** Relationships between Auditory ERP Responses and Caregiver-Reported Sensory Behaviours in Young Children with Autism Spectrum Development

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Background: Sensory processing differences in Autism Spectrum Development (ASD) are related to quality of life (Lin & Huang, 2017). These sensory processing differences are heterogeneous, and there have been calls to explore this heterogeneity multimodally (Uljarević et al., 2017). Previous multimodal investigations of sensory processing in ASD using both questionnaires and ERPs have generally included broad age ranges or used smaller sample sizes.
Objectives: The present study aims to explore relationships between auditory ERP responses and caregiver-reported sensory behaviours in a large sample. To allow exploration of loudness-dependency in ERP responses, stimuli were delivered at multiple loudness levels.

Methods: ERPs to auditory stimuli were investigated in 108 young participants with ASD (90 male, M_{Age} = 38.80mos, SD_{Age} = 6.17mos). While watching a quiet video, participants heard, via headphones, brief tones randomly varying in loudness of 50, 60, 70 or 80 dB SPL (200-300 trials/intensity) at an ISI randomly varying between 1-2s. 61-channel EEG was sampled at 1000 Hz. The global field power (GFP) was used as an index of neural response strength. Participants' caregivers completed all seven Short Sensory Profile (SSP) subscales. Time-wise one-way ANCOVAs were conducted on ERP global field power with loudness as a factor and (separately) SSP total and subscale scores as covariates. Only effects with a p-value ≤ 0.01 sustained for ≥20ms are reported; main effects of loudness are not reported. Correlations between SSP scores and GFP in different loudness conditions were used to probe significant effects. Scores on items from subscales on which effects were found were then run as covariates.

Results: An interaction emerged between SSP total scores and loudness (105 – 133ms); less typical sensory behaviours were associated with higher GFP amplitudes in the 70 dB condition (r = -.28, p = .005). In a partially overlapping window, an interaction emerged between the SSP Auditory Filtering subscale and loudness (76 – 131ms); auditory filtering problems were associated with higher GFP amplitudes in the 80 dB (r = -.24, p = .01) condition. Interactions also emerged between loudness and scores on two items on the subscale, specifically those relating to distraction and trouble functioning (72 – 135ms) and difficulty working (81 – 130ms) amid background noise. Correlations yielded similar results to those observed on the complete subscale. Finally, an interaction emerged between Visual/Auditory Sensitivity and loudness (298 – 336ms); greater sensory sensitivity was associated with lower GFP amplitudes in the 80 dB condition (r = .29, p = .003). No other time-wise ANCOVA effects survived outlier removal.

Conclusions: The presence of loudness x SSP interactions emphasizes the importance of considering how sensory response patterns may be affected by the loudness of sensory stimuli. Early in processing (~75-135ms), difficulty with background noise appeared to be related to a stronger response to louder sounds, which could reflect difficulty inhibiting responses to these sounds. Surprisingly, later in processing (~300ms),

visual/auditory sensory sensitivity was associated with a weaker neural response to louder sounds.

2:42 **183.002** Individual Differences in Neural Response to Own Name Heard in Noise across Minimally Verbal and Verbally Fluent Adolescents with Autism

S. Schwartz[1], *L. Wang*[2], *B. Shinn-Cunningham*[3] *and H. Tager-Flusberg*[4], *(1)Graduate Program for Neuroscience, Boston University, Boston, MA, (2)Biomedical Engineering, Boston University, Boston, MA, (3)Carnegie Mellon University, Pittsburgh, PA, (4)Psychological and Brain Sciences, Boston University, Boston, MA*

Background: Failure to effectively process salient speech in noisy settings could be both a significant contributor to and a reflection of communication and auditory filtering processing issues observed in many individuals with autism. However, research on these issues has been limited by a lack of neuroimaging research on individuals at the minimally verbal end of the spectrum.
Objectives: We sought to measure, across the entire autism spectrum, neural EEG response to one of the most salient speech sounds – one's own name – when presented in multispeaker noise. For those on the autism spectrum, how does atypical response to own name in noise vary with the individual's communication abilities? How do responses correlate with phenotypic descriptions of the individual's success in filtering speech from noise in everyday settings?

Methods: 38 adolescents with autism (26 M), ages 13 to 22 years, with a range of communication abilities from minimally verbal to verbally fluent, participated. Autism diagnoses were confirmed with the ADOS-2 or Adapted ADOS (Lord et al., 2012; Hus et al., 2011). We additionally collected the Vineland-3 Receptive Communication Subscale and Short Sensory Profile Auditory Filtering Subscale (Sparrow et al., 2016; Tomcheck & Dunn, 2007). 22 typically developing (TD), age-matched adolescents (14 M) served as a reference group to determine the spatial and temporal regions of interest for our autism-specific EEG analyses. For the EEG experiment, each participant heard their own name and two other participants' names as a part of an 8 dB signal to noise multispeaker scene. For analyses, we compared differential response to own name relative to one other name. Peripheral hearing was confirmed as intact using an auditory brainstem measure.

Results: TD participants had a negative differential response from 100 to 300 ms post stimulus along fronto-central electrodes and a positive differential response in a similar time window along left temporal electrodes. They also had a positive differential response from 500 to 600 ms along parietal-occipital electrodes. When we examined this neural response within these reference-defined spatial and temporal components in our autism group, we found that more typical neural response corresponded with better receptive communication and auditory filtering skills. Early fronto-central differential response negatively correlated with receptive communication ($p=0.02$), early left temporal differential response positively correlated with receptive communication ($p=0.01$), and late parietal-occipital response positively correlated with auditory filtering ability ($p<0.001$). Results were not significantly influenced by number of accepted EEG trials.

Conclusions: This study is the first to demonstrate reduced early stage encoding of salient speech and diminished late stage attentional orienting to salient speech in individuals on the autism spectrum who have been characterized phenotypically as having poor communication skills and auditory filtering abilities. This work lays a foundation for uncovering the neural underpinnings of communication and auditory filtering processing issues in autism. Our results highlight the importance of capturing brain-behavior interactions through the measurement of individual differences within a heterogeneous sample of people with autism.

2:54 **183.003** Distinct but Effective Neural Networks for Facial Emotion Recognition in Individuals with Autism : A Deep Learning Approach

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Background: Individuals with Autism Spectrum Disorder (ASD) evince deficits in facial emotion recognition (FER; Lozier et al., 2014). However, it is unclear if these deficits result from a failure to encode FER, or to deploy correctly-encoded information in making FER judgements (Yang et. al 2018). Deep-learning methodologies, such as Deep Convolutional Neural Networks (Deep ConvNets), utilize a data-driven approach to isolate neural networks involved in encoding emotional faces using single-trial electroencephalography-based (EEG) classification in typically-developing (TD) individuals (Schirrmeister et. al 2017). However, the extent to which Deep ConvNets can determine whether individuals with ASD correctly-encode FER using similar neural networks to their TD peers remains unclear.
Objectives: (1) Examine accuracy of a Deep ConvNet classifier in classifying neural responses to four different emotions (*happy, sad, angry* and *fear*), and (2) detect differences in neural networks involved in FER in individuals with and without ASD.

Methods: Thirty-six TD, and twenty-nine ASD individuals (M_{age}=13.48, SD_{age}=1.894, 44 male; ADOS-2-confirmed; Lord et. al 2012) completed an EEG FER task (DANVA-2; Nowicki 2004). Each participant viewed 48 faces x 752 samples x 30 channels. Trials were segmented 0-1500ms post-stimuli and pre-processed using the PREP (Bigdely-Shamlo et. al 2015) and ADJUST (Mognon et. al 2011) pipelines. A ZCA whitening normalization (Coates & Ng, 2012) was applied constructing a 752x30 image/trial. The Deep ConvNet received images composed of 2 conv-pool layers: (1) a convolutional layer (kernel size: 100x10, filters: 32) and a pooling layer (size: 5x2; 2 stride), and (2) a convolutional layer (kernel size: 20x5; filters: 64) and a pooling layer (size: 2x2; 2 stride). The final fully-connected layer (1024units) was flattened to 4 softmax-derived probabilities-one/class. Accuracy of classifying FER neural responses using the Deep ConvNet was calculated by grouping all the true-positives from the confusion matrix/48 faces. To determine which channels are needed to accurately classify FER, occlusion analyses were used (Zeiler & Fergus, 2014) resulting in 19 possible spatial combinations spanning 5 time-ranges.

Results: Individuals with ASD performed worse on the FER task ($p's<0.05$). The Deep ConvNet classifier successfully distinguished FER neural responses with high accuracy (>0.85; Figure 1,A;B) in both groups, indicating successful encoding occurred. Encoding of FER measured by the Deep ConvNet performance was higher than behavioral FER performance in ASD ($p's<0.001$, Figure 1.C). Occlusion analyses indicated the importance of fronto-temporal regions for TD (Figure 1.D), but left-temporal region for ASD (Figure 1.E), suggesting distinct network engagement in FER in ASD.

Conclusions: The Deep ConvNet was a robust EEG single-trial classifier obtaining high accuracies in classifying correctly-encoded neural responses to FER in ASD. Results suggest that individuals with ASD successfully encode FER using left-temporal networks, which are distinct networks from their TD peers. However, despite accurate encoding, individuals with ASD experience difficulties deploying the correctly-encoded information

needed to accurately perform FER tasks behaviorally. Such findings emphasize that individuals with ASD can indeed encode FER, but do not reliably use this information to perform FER tasks.

3:06 **183.004** Increased Phase-Amplitude Coupling in Children with Autism at 18, 24, and 36 Months

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Background: Phase-Amplitude Coupling (PAC), the modulation of higher frequency activity by the phase of lower frequency activity, can be derived from the nested oscillations seen in electroencephalography recordings. PAC may serve as a mechanism for the processing of information as well as for functional connectivity in the brain[1]. Greater PAC has been demonstrated in children with autism spectrum disorder (ASD) with an average age of 9.5 years[2].

Objectives: Here we examine if and when differences in PAC emerge through infancy and early childhood among children at high familial risk who develop ASD, as compared to those who develop typically.

Methods: Baseline electroencephalography (EEG) data was collected in infants at 3, 6, 9, 12, 18, 24, and 36 months of age as a part of a prospective, longitudinal investigation (n=108; not all participants provided useable data at each time point). Participants were at a high risk for autism (HRA) by virtue of having an older sibling with ASD. We measured PAC across multiple frequency combinations for each individual at each time point. Diagnosis of ASD(+) or lack thereof(-) was determined at 24-36 months using the Autism Diagnostic Observation Schedule (ADOS) and best clinical estimate (HRA+: n = 35; HRA-: n = 73).

Results: The HRA+ group shows greater PAC ($p < .05$, independent samples Mann-Whitney U test) than the HRA- group at 18, 24, and 36 months. Differences were not significant in the 3, 6, 9, and 12 month age groups.

Conclusions: We find increased PAC in children later diagnosed with ASD, beginning at around 18 months. We find children later diagnosed with ASD are not born with, but develop, increased PAC. Notably, the timing at which PAC becomes excessive in the HRA+ group is similar to the timing at which symptoms of ASD tend to become more prominent.

Oral Session - 9A
Interventions - Non-pharmacologic - Infant, Toddler, and Preschool
184 - Early Intervention
1:30 PM - 2:25 PM - Room: 516ABC

1:30 **184.001** Parent and Toddler Outcomes from a Wide-Scale Community Implementation of the Social ABCs Parent-Mediated Intervention

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Background: Advances in early detection of ASD in the first years of life have motivated development of early intervention models directly targeted to the developmental needs of the toddler years. Several such models have demonstrated efficacy based on randomized control trials in controlled research settings. Next steps involve scaling up and wide-scale implementation.
Objectives: To evaluate the effectiveness of a parent-mediated intervention for toddlers with confirmed or suspected ASD in a large-scale community implementation.

Methods: Social ABCs parent-mediated intervention is one of four evidence-based models included in a government-funded pilot demonstration initiative currently underway in four regions of Ontario, Canada. The Social ABCs developers ("expert team") trained 5 front-line staff ("coaches") to deliver the Social ABCs parent coaching through the Ron Joyce Children's Health Centre, the regional autism intervention service-provider in Hamilton Ontario (population ~750,000). Coaches attained fidelity of implementation and coaching, and 90 families have completed the 12-week coaching program to date (n > 120 anticipated by April 2019, for presentation at INSAR). To date, 159 toddlers have been enrolled (111 boys, 48 girls); age range: 15-34 months (*M* age = 25.4 months, *SD* = 4.16). Data were analyzed for those children who had completed week 12 (n = 90), including video-coded indices (parent implementation fidelity and child's rate of responding to parent-provided language opportunities; "responsivity") and standardized measures (Vineland Adaptive Behavior Scales (VABS) and Autism Diagnostic Observation Schedule-2; ADOS-2). Detailed information about the implementation process (i.e., training, referral/service delivery model, uptake, satisfaction, and acceptability, and other factors related to implementation are described in a linked submission: "Community Implementation of Social ABCs"). All parents received 12 weeks of one-on-one coaching, supported by the Social ABCs parent manual. Data were collected at baseline and weeks 1, 8, 12 (and 24 when available).

Results: Parents achieved implementation fidelity at a mean rate of 68% by week 4, and 80% by week 8, with significant gains compared to baseline (both *p*'s < .001); for the sub-set who have now completed their week 24 evaluation (n = 59), fidelity remained high (*M* = 73.76%). By week 8-12, 92.6% of families had achieved the pre-established target rate of 75% fidelity. Child Responsivity increased significantly from week 1 to week 12 ($t = 13.32$, $p < .001$). ADOS-2 scores pre-versus post-intervention revealed significant decreases in symptoms in the Social Affect domain (*M* = 14.3 vs. 11.8; $t = 4.89$, $p < .001$), but not the Restricted and Repetitive Behavior domain ($p = .15$). Standard scores for the VABS Communication domain (but no other domain) increased significantly from baseline (*M* = 71.0 to 73.4; $t = 2.44$, $p = .02$).

Conclusions: Findings demonstrate the successful implementation of the Social ABCs in a large, diverse community setting. Parents learned the techniques and toddlers made gains based on video-coded indices, direct assessment, and parent-reported function. These findings support the effectiveness of parent-mediated intervention for toddlers with confirmed or suspected ASD, and highlight both the scalability and portability of the Social ABCs for implementation within a community service-delivery model.

1:42 **184.002** Indirect Effect of Impact Intervention on Expressive Communication in Infant Siblings of Children with ASD

P. Yoder[1], *W. L. Stone*[2], *C. Bush*[3] *and K. Ragsdale*[2], *(1)Department of Special Education, Vanderbilt University, Nashville, TN, (2)Psychology, University of Washington, Seattle, WA, (3)Special Education, Vanderbilt University, Nashville, TN*

Background: Infant siblings of children with ASD are at 40% risk of developing a communication disorder due to ASD or language delay. The ImPACT (Improving Parents As Communication Teachers) intervention may be one way to mitigate the risk of communication disorder. One goal of ImPACT is to teach parents to model language related to the child's focus of attention with the goal of facilitating the transition from pre-linguistic to linguistic communication. Using a weighted frequency of intentional communication enables showing growth in expressive communication during this transitional developmental period. Measuring changes in measurement contexts that differ on multiple dimensions from the treatment sessions provides a strong basis for inferring that the treatment produced generalized change.
Objectives: To test whether ImPACT's effect on weighted frequency of intentional communication is due to its effect on parents' language modeling.

Methods: We randomly assigned 53 parent-child dyads to either the ImPACT or a business-as-usual control group. See Table for participant description at study entry. Coders and examiners were blind to treatment assignment. Overall attrition was 10%; three from ImPACT, two from Control, respectively. Equivalency of groups at Time 1 was assessed on 15 relevant variables, which were controlled when indicated. There were two sites, but no site effects. Three measurement periods were separated by 3 months (pretest, immediate posttest, and 3-mo follow-up).

Parents were trained by an ImPACT-certified speech-language pathologist (SLP) or someone trained by the certified SLP. Mean percent adherence to ImPACT protocol for staff teaching parents was 91% (*SD* = 3%). Treatment sessions occur in the home. Twenty-four sessions occurred across 3 months between pre- and immediate post-tests.

Parents' language modeling (utterances that verbally mapped the child's focus of attention) was assessed at pre- and immediately post-treatment during a 15-minute parent-child free play activity that occurred in the lab. The number of 5-s intervals with parental language modeling was the putative mediator.

Weighted (nonverbal = 1 point, single word = 2 points, multiword = 3 points) frequency of intentional communication was measured at pretest and 3-mo follow-up during the Communication and Symbolic Behavior Scales (CSBS), an examiner-led structured communication sample. The CSBS used a different person, materials, activity and interaction style than that used in parent-implement ImPACT sessions, which was considered a strong test of generalization.

Results: As predicted, greater gains occurred in the ImPACT group than in the Control group for parents' language modeling ($p < .001$, $d = 1.0$) and for children's weighted frequency of intentional communication ($p = .05$; $d = .46$). As predicted, the indirect effect was significant. That is, the product of the effects of treatment on parental language modeling (the *a* path) and parental language modeling on child communication controlling for the treatment (the *b* path) had a confidence interval that did not include zero. See Figure.

Conclusions: Using ImPACT facilitated the transition from pre-linguistic to linguistic communication by increasing parents' modeling of language. Ultimately, ImPACT may be one method to mitigate the risk of communication disorder in infant siblings of children with ASD.

1:54 **184.003** A Multi-Component Communication Intervention for Preverbal Preschoolers with Autism: Outcomes from an RCT

E. Fuller[1], *L. H. Hampton*[2] *and A. P. Kaiser*[1], *(1)Special Education, Vanderbilt University, Nashville, TN, (2)Northwestern University, Evanston, IL*

Background: Half of children with autism at age 33-months are preverbal (Eaves & Ho, 2004) and are at high risk for remaining in the 30% of children with autism who are persistently minimally verbal (DeMeyer et al., 1973, Tager-Flusberg & Kasari, 2013). Targeting foundational skills for spoken language in the preverbal ASD population, including imitation, receptive language, and joint attention (Weismer, Lord, & Esler, 2010, Paul, Campbell, Gilbert, & Tsiouri, 2013), may be crucial for reducing the prevalence of children who remain minimally verbal. The purpose of this study was to test a multi-component intervention that combined direct teaching of foundational skills with a naturalistic communication intervention, parent training, and a speech generating device (SGD) for preverbal preschoolers with ASD.
Objectives:

- Do children receiving a multi-component communication intervention show greater improvements in communication skills compared to children in a control group?
- Do caregivers who are trained in the intervention use more language facilitative strategies than parents who are in a control group?

Methods: Preschool-aged children with autism (N= 68; mean age= 43 months) who used fewer than 20 words in a naturalistic language sample (NLS) were randomly assigned to receive a multi-component communication intervention or to the control group. Both of the groups received an SGD programmed specifically based on the child's communicative abilities for use for the duration of the study.

The intervention group received 36 60-minute sessions comprised of four evidenced-based components: (a) direct teaching of foundational skills, (b) training to use an SGD; (c) a naturalistic communication intervention (J-EMT); (d) parent training in communication-support strategies.

Children and their caregivers were assessed before intervention, immediately after the 4-month intervention, and 4-months following intervention. Language and communication was assessed on: the Preschool Language Scales (PLS, Zimmerman), the Early Social Communication Scales (ESCS; Mundy, 2003), a 20-minute NLS with an assessor blind to group assignment, and a 10-minute caregiver-child interaction (CCX). The number of socially communicative utterances (SCU) was coded from the language sample and CCX. Parent use of strategies was coded from the CCX.

Results: Children in the intervention group made greater gains than children in the control group across all communication outcomes, however the significant differences between groups were observed only for the number of initiations of joint attention at posttest (b=0.644, SE=0.270 p=0.017) and SCU in the CCX at follow-up (b=0.838 SE=.425, p=.049). Object interest and frequency of escape behaviors moderated the effects of intervention on initiating joint attention, such that children in the intervention group with lower frequency play behaviors and higher frequency escape behaviors at pretest demonstrated significantly more joint attention at posttest. Caregivers in the intervention group used significantly more language facilitation strategies following intervention.

Conclusions: A brief multi-component communication intervention improved joint attention skills in preverbal children with ASD immediately

following intervention and increased social communicative utterances with their trained caregivers 4 months after intervention. Future research should examine mediators of treatment to better identify how this treatment approach is effective. Longer term follow-up of children's communication outcomes is needed.

2:06 **184.004** Barriers to Participation in a Parent-Mediated Intervention for 12-Month-Old Infant Siblings of Children with ASD

A. Trumbull[1], *J. Bradshaw*[2], *C. A. Saulnier*[3,4], *J. L. Stapel-Wax*[5], *A. Klin*[6] *and A. Wetherby*[7], *(1)Marcus Autism Center, Children's Healthcare of Atlanta, Atlanta, GA, (2)Department of Psychology, University of South Carolina, Columbia, SC, (3)Neurodevelopmental Assessment & Consulting Services, Decatur, GA, (4)Department of Pediatrics, Emory University School of Medicine, Atlanta, GA, (5)Emory University School of Medicine, Atl, GA, (6)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (7)Florida State University Autism Institute, Tallahassee, FL*

Background: As more evidence emerges that optimal developmental outcomes for individuals with autism spectrum disorder (ASD) are associated with the earliest possible onset of intervention in the infant and toddler years (Rogers et al., 2012), it is essential to identify barriers to parent participation in very early intervention programs. Despite the strong evidence for parent-mediated early interventions for ASD (e.g., Bradshaw, Koegel, & Koegel, 2017; Carter, et al., 2011), caregivers may sometimes elect not to take advantage of treatment services that are available to them.

Objectives: The current study aims to describe barriers to enrollment into an early parent-mediated intervention trial as part of a longitudinal investigation of infant siblings of children with ASD.

Methods: As part of a prospective longitudinal design, 23112-month-old infants were given an assessment of social-communication skills (Communication Symbolic Behavior Scales – Behavior Sample) and autism symptomology (Home and Clinic Systematic Observation of Red Flags for ASD (SORF) and ESAC). Infants who exhibited early signs of ASD and delays in social-communication during the 12-month assessment based on the study's eligibility criteria (i.e., scoring above the screening threshold for 2 out of the four measures) (N=47) were offered enrollment into a randomized controlled trial of a parent-mediated early intervention for ASD. Of these 47 infants, 29 (62%) caregivers enrolled into the treatment study and 18 caregivers (38%) declined treatment. We compare infant clinical characteristics, family demographics, and older sibling autism symptom severity across families who agreed to treatment and those who did not in an effort to identify those variables that may serve as barriers to accessing caregiver-mediated intervention.

Results: Results revealed significant differences in several demographic characteristics of the caregivers who elected not to enroll in the treatment study. Specifically, participants who declined treatment were characterized by greater maternal full-time employment ($p < .01$), higher level of education ($p < .05$), and living further from the clinic ($p < .01$). Child birth order also had an impact on enrollment statistics, with families who had more than two children (including the infant and older child with ASD) being less likely to enroll than families with only two children. Surprisingly, there were no significant differences in clinical presentation across infants who enrolled into treatment compared to those who did not.

Conclusions: In summary, findings highlight a number of barriers to enrollment into early intervention strategies for children at high risk for autism spectrum disorder, most of which are related to caregiver resources. In this study, one component of the treatment required parents to come to the clinic once per week with their infant, potentially leading to families with limited time (full-time work and/or more than two children) to decline participation. These data suggest that in-home treatment for young siblings of children with ASD may be critical in broad dissemination of infant interventions. Knowledge of such barriers by professionals may contribute to the use of additional techniques for increasing enrollment into important intervention strategies and improving outcomes for young children with social communication deficits.

Oral Session - 9B
Service Delivery/Systems of Care
185 - Intervention 2
2:30 PM - 3:25 PM - Room: 516ABC

2:30 **185.001** Does Adding Mindfulness Based Stress Reduction to Early Intervention Improve Caregiver Functioning?: A Randomized Controlled Trial

A. S. Weitlauf[1], *N. Broderick*[2], *A. Stainbrook*[3], *J. L. Taylor*[3], *C. G. Herrington*[2], *A. Nicholson*[4], *M. Santulli*[5], *E. Dykens*[6], *P. Juárez*[2] *and Z. Warren*[2], *(1)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, Nashville, TN, (2)Vanderbilt University Medical Center, Nashville, TN, (3)Vanderbilt Kennedy Center, Nashville, TN, (4)Vanderbilt University, Pleasant View, TN, (5)Department of Pediatrics, Vanderbilt University Medical Center/Vanderbilt Kennedy Center, Nashville, TN, (6)Vanderbilt University, Nashville, TN*

Background: Systems of care increasingly emphasize parent-delivered early intervention for young children with autism spectrum disorder (ASD). Multiple studies have documented high levels of psychological distress within parents of children on the autism spectrum. However, few studies have examined how to support caregiver wellbeing directly as part of early behavioral intervention.

Objectives: This randomized controlled trial compared caregivers who completed 12 sessions of the Parent-implemented Early Start Denver Model (P-ESDM; n = 31) to caregivers who completed P-ESDM in addition to six concurrent individual sessions of Mindfulness Based Stress Reduction (MBSR; n = 30).

Methods: Caregivers (53 mothers, 8 fathers) and their child with ASD (mean age = 2.37 years, sd = .46; mean ADOS-2 Calibrated Severity Score = 8.11, sd = 1.63) participated in 12 weekly P-ESDM sessions. Half of caregivers were randomized to also receive six individual MBSR sessions. Caregivers completed the Beck Depression Inventory, Beck Anxiety Inventory, Parenting Stress Index, and Five Facet Mindfulness Questionnaire at baseline, 6 weeks, 12 weeks (treatment end) and 1-, 3-, and 6-months post treatment. Groups were similar at baseline on all outcome variables and demographic characteristics (caregiver sex, annual income, caregiver educational level, racial/ethnic background). Attrition was similar across groups and caregiver demographics.

Results: Multilevel models with discontinuous slopes (active treatment slope, change in slope post-treatment) were used to test for group

differences in change in outcomes over time. When considering the whole sample, resulting coefficients [standard errors] revealed significant (p < .001) average improvement during active treatment in all sub-domains of parent stress: parental distress (-1.32 [.28]), parent-child dysfunctional interaction (-1.18 [.26]), and difficult child (-.90 [.23]). These scores all significantly increased again post-treatment (ps < .01). During treatment, overall scores also decreased for depression (-.65 [.23]; p < .05) and anxiety (-.81 [.30]; p < .05). Depression scores significantly increased again post-treatment (.76 [.26]; p <.01), but improvements in anxiety were maintained (no significant change). Whole group analyses did not reveal changes in mindfulness. Considering groups separately, caregivers who received MBSR had greater improvements in parental distress (-1.69 [.47]; p < .01) and parent-child dysfunctional interactions (-1.12 [.45]; p < .05). Parental distress increased again post-treatment (1.46 [.69]; p < .05). Caregivers who received MBSR also improved in mindfulness (2.83 [1.36]; p < .05), whereas caregivers in only P-ESDM reported lower mindfulness scores over time. Treatment group did not significantly predict slopes (during active treatment or post-treatment) for depression or anxiety. Differential response trajectories emerged for male caregivers and caregivers of younger children, but no significant effects were found for child autism severity nor caregiver educational attainment.

Conclusions: Providing MBSR training as part of parent-mediated early behavioral intervention for very young, newly diagnosed children resulted in greater improvements in caregiver-reported levels of parenting stress relative to behavioral intervention alone. Results suggest that systems of care can offer caregivers manualized, low intensity training in stress reduction strategies that may have long-term impacts on how they interact with their children.

2:42 **185.002** Quality Matters: Application of Intervention Fidelity Benchmarks to Community Paraprofessional Delivered Social Communication Intervention for Toddlers with Autism

S. Y. Shire[1], *W. I. Shih*[2], *S. Bracaglia*[3], *M. Kodjoe*[3] *and C. Kasari*[2], *(1)University of Oregon, Eugene, OR, (2)University of California, Los Angeles, Los Angeles, CA, (3)New York Center for Child Development, New York, NY*

Background: Community Partnered Participatory Research can support the adoption of research-based practices in real world settings. The transfer of intervention protocols into community practice can be challenging, but deployment trials have demonstrated success sharing strategies with caregivers (Green et al., 2010; Kasari et al., 2014) and community educators (Chang et al., 2016). Although achieving 80% fidelity is a typical research standard, it is not as clear what constitutes "good enough" fidelity by which a minimum standard for program implementation may lead to empirical change in children's target outcomes.

Objectives: To explore whether implementation benchmarks previously published (Shire, Shih, & Kasari, 2018) for caregiver-mediated Joint Attention, Symbolic Play, Engagement, and Regulation (JASPER: Kasari et al., 2008; 2014) intervention would also differentiate children's outcomes when: (a) delivered by paraprofessional teaching assistants' (TAs) and (b) when adapted for small group instruction (referred to as jasPEER).

Methods: Forty-eight TAs and 113 toddlers (mean age=32.28 months) across four classrooms were randomized to JASPER with a peer (jasPEER) or one-to-one JASPER waitlist control. Children had received outside diagnoses of autism (*n*=1 with Down Syndrome). All but two TAs, and two children were members of an ethnic minority group.

Intervention. Significant effects of JASPER over treatment as usual on joint engagement, joint attention gestures, play skills, and language were demonstrated with this center in a prior trial (Shire et al., 2018). Building upon TAs' knowledge of one-to-one JASPER, they were provided with two weeks of in-vivo training and ongoing video feedback from the research team to learn the jasPEER adaptation. Children in waitlist classrooms received JASPER for 30 minutes a day for 11 weeks, while children in immediate jasPEER received the adapted peer version during this time.

Measures. Ten-minute video recorded TA-child interactions at entry, exit, and one month follow up were coded for children's play level (number of 1-minute intervals in simple, combination, pre-symbolic, and symbolic play) and TAs' implementation (total strategy implementation score).

Results: Examining TA's implementation fidelity at exit, 34 children received sessions at 75% or greater fidelity ("high fidelity"). The number of children receiving high fidelity sessions did not significantly differ between JASPER and jasPEER. Significant growth in children's pre-symbolic play (t(244)=2.39, p=0.017) was found for children in the high fidelity group, while gains were not significant for children in the lower fidelity group. Concurrent to this shift to higher level play was a significant decrease in combination play for the high fidelity group only (t(244)=-2.59, p=0.010). Simple and symbolic play occurred too infrequently to model.

Conclusions: Findings replicate differential outcomes for children when either intervention model was delivered with at least 75% implementation fidelity than below 75%. Considering the age and developmental heterogeneity of this diverse community sample of toddlers with ASD, gains in pre-symbolic play where children move beyond combining objects to extend acts to self and agents are clinically significant.

2:54 **185.003** A Multi-Site Randomized Control Trial of Family Navigation's Effect on Diagnostic Ascertainment Among Children at Risk for Autism: A Dbpnet Study

E. Feinberg[1,2], ***S. Broder-Fingert***[2,3], *A. Bennett*[4], *C. Weitzman*[5], *A. Chu*[1], *J. Eilenberg*[6], *M. Abraham*[4], *M. Credle*[5], *H. Cabral*[1], *M. Augustyn*[2,3], *G. Patts*[1], *J. Guevara*[4], *A. Fenick*[5] *and N. Blum*[4], *(1)Boston University School of Public Health, Boston, MA, (2)Boston University School of Medicine, Boston, MA, (3)Boston Medical Center, Boston, MA, (4)The Children's Hospital of Philadelphia, Philadelphia, PA, (5)Yale University, New Haven, CT, (6)Boston University, Boston, MA*

Background: Significant racial, ethnic, and socioeconomic disparities exist in access to diagnostic and evidence-based treatment services for children with autism spectrum disorder (ASD). Barriers to timely ASD diagnostic and treatment services can result from various factors including the availability of services, patient-provider miscommunication, parental stress, and culturally biased care. Family navigation (FN) is a care management strategy designed to reduce disparities in access to care, through provision of intensive, individually tailored, care coordination and family support.

Objectives: The purpose of this study was to test the effectiveness of FN to reduce time to diagnosis and increase access to treatment services for children at risk for ASD.

Methods: In this large, multi-site randomized comparative effectiveness trial, families of children at risk for ASD were recruited from urban clinics in Massachusetts (*n* = 6 clinics), Connecticut (*n* = 2), and Pennsylvania (*n* = 2). Eligible children were between the ages of 15-27 months (*n* = 250), who screened positive for ASD at a primary care visit. Families were randomized to receive either FN or enhanced usual care (eUC). FN families worked with a bilingual, bicultural navigator trained in motivational interviewing, who met with families in the community, conducted outreach to

service agencies as needed, and reminded families about upcoming appointments. eUC families received access to a clinic-based care manager, who addressed parent and provider concerns but did not actively reach out to families. Families received FN or eUC throughout their child's developmental assessment and for 100 days post-diagnosis.

Results: The trial successfully enrolled the desired target population: young, low-income, racially diverse children. The average age of enrolled children was 21.7 months. 12.4% of children in the study were white, 54.8% were black/African-American, 6.4% were Asian, and 5.2% were mixed-race. 29.0% were Hispanic and 82.4% were covered by public insurance. Children scored an average of 8.6 (SD=3.1) on the Modified Checklist for Autism in Toddlers, Revised, with Follow-Up (MCHAT-R/F) at time of enrollment in the study, with no significant differences reported between the FN or eUC groups. Approximately 60% of all children received an ASD diagnosis, with no significant differences between children who received FN versus eUC. By 90 days after enrollment, significantly more children in the FN group had achieved diagnostic resolution than those in the eUC group (55% versus 41%, p=0.022). By 1-year after enrollment, children who received FN had more than twice the odds of reaching diagnostic resolution as compared to children who received eUC, 86.6% vs 74.8%, respectively (Odds Ratio, 95% Confidence Interval, p-value; 2.18, 1.14-4.19, 0.019).

Conclusions: This study supports the effectiveness of FN to improve rates of ASD diagnostic resolution among urban minority, low-income children who are detected as "at-risk" for ASD in primary care. Because a formal medical ASD diagnosis is required in the majority of states to access early-intensive evidence-based ASD services, these findings support the use of FN to assure timely access to diagnosis, and ultimately services, for low-income, urban children.

3:06 **185.004** Screening and Linkage to Services for Autism (SaLSA): Randomized Controlled Trial of Family Navigation

C. DiGuiseppi[1], *S. Rosenberg*[2], *M. Tomcho*[3], *K. Colborn*[2], *K. Hightshoe*[2], *S. Gutiérrez-Raghunath*[3], *J. Cordova*[4], *J. Litfin*[5] *and C. Robinson Rosenberg*[6], *(1)Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO, (2)University of Colorado Anschutz Medical Campus, Aurora, CO, (3)Denver Health and Hospitals Authority, Denver, CO, (4)Bright Futures LLC, Denver, CO, (5)Rocky Mountain Human Services, Denver, CO, (6)University of Colorado / JFK Partners, Aurora, CO*

Background: Autism spectrum disorder (ASD) is under-diagnosed and under-treated in young children, particularly minority and disadvantaged children. Even with routine ASD screening, many screen-positive children fail to receive appropriate referral, evaluation, or services. Patient navigation, originally developed to address healthcare disparities, could facilitate referral, evaluation, and linkage to early intervention (EI) services.

Objectives: Evaluate the effect of family navigation for children with positive ASD screening on referral, evaluation and linkage to EI services.

Methods: Using a randomized controlled trial design, children aged 16-30 months seen for well care in a community health center network, who had an initial score ≥3 on the Modified Checklist for Autism in Toddlers-Revised with Follow-Up (M-CHAT-R/F), were randomly allocated to family navigation (if needed) or usual care. A bilingual, trained family navigator (FN) contacted intervention-group families if referral for evaluation was indicated (whether or not a referral had occurred) based on the M-CHAT-R/F: initial score ≥8 or initial score 3-7 with Follow-Up score ≥2. The FN offered care coordination, education, coaching, translation/interpretation, and psychosocial and practical support. The FN also assisted families of children with initial scores of 3-7 to obtain the indicated Follow-Up when not done, and offered navigation if the Follow-Up score was ≥2. Outcome data were obtained from electronic health and EI records. Generalized linear models with log links were used to compare outcomes between groups based on intention-to-treat.

Results: Families of 275 children were randomized to intervention (n=142) or control (n=133). Children were 62% male, 61% Hispanic, 44% non-White, and 93% insured by Medicaid (for low-income families); 30% lived in non-English-speaking households. Of intervention-group families, 52 were eligible for family navigation based on the need for referral; 22 families (42%) were successfully contacted and accepted FN assistance. Intervention children were significantly more likely than controls to complete the full two-step M-CHAT-R/F (68% vs. 54%, RR=1.25, 95%CI: 1.03, 1.52, p=0.02). There were no significant between-group differences in their likelihood of being referred for EI eligibility determination (45% vs. 45%, p=0.99), completing an evaluation for EI eligibility (25% vs. 23%, p=0.69), or initiating services (20% vs. 20%, p=0.86). However, intervention children were nearly three times as likely to undergo a diagnostic evaluation for ASD (11% vs 4%, RR=2.81 [1.05, 7.52], p=0.04). Twelve (8%) intervention and five (4%) control children were diagnosed with ASD (RR=2.25 [0.81, 6.21], p=0.12). Results were similar when limited to children who had received a referral for eligibility determination.

Conclusions: With family navigator assistance, young, minority, low-income children at risk for ASD were more likely to complete the full two-step M-CHAT-R/F and an ASD diagnostic evaluation. However, family navigation did not increase referral by healthcare providers, evaluation for EI eligibility or initiation of EI services. In both study groups, large proportions of referred children failed to complete evaluations for EI eligibility and for ASD. Even with trained, bilingual, Latina navigators, engaging families was difficult. Research is needed to identify effective methods to improve uptake of family navigation and to increase evaluation after a positive ASD screen in low-income, minority families.

Oral Session - 10A
Education
186 - Education
1:30 PM - 2:25 PM - Room: 524

1:30 **186.001** Profiles and Predictors of School Functioning Among Children with Autism Spectrum Disorders

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Background: Children with ASD demonstrate high variability in academic achievement; for many, academic achievement is lower than would be expected based on their IQ (Estes et al. 2011; Jones et al. 2009; Keen et al. 2015; Wei et al. 2013). In addition, children with ASD are less likely to enjoy or cooperate at school compared to typically developing peers (Jahromi et al. 2013), and often experience challenges in social interactions and relationships with classmates. Studies suggest that multiple competencies (both academic and social) work jointly to facilitate or undermine children's adjustment; thus, competencies should be examined by considering functioning across domains. There is limited knowledge regarding early predictors of educational outcomes among children with ASD.

Objectives: This study examined (1) patterns of academic and social school functioning among 10-11 year-old children with ASD; and (2) early behavioral and social communication indicators, measured around age 3, as predictors of children's school functioning profile membership.

Methods: The sample included 178 children from the Canadian *Pathways in ASD* study. Latent profile analysis (Vermunt & Magidson, 2013) was used to identify and describe profiles of children's school functioning (academic and social outcomes) when children were around 10-11 years old. Academic functioning outcomes included the composite standard score of the Wechsler Individual Achievement Test II (WIAT--II-A; Wechsler, 2001) and teacher reports of academic performance and school engagement (Teacher Report Form, Achenbach, 1991). Social functioning included parents' and teachers' report on adaptive socialization skills (VABS-II; Sparrow et al., 2005) and both pragmatic competence and children's social relations (CCC-2; Bishop, 1998). Early behavioral and social communication indicators at age 3 were examined as predictors of profile membership approximately 6 years later. Early predictors included autism severity (ADOS; Lord et al. 2000), behavior problems (Aberrant Behavior Checklist; Aman et al., 1985), imitation ability (Multidimensional Imitation Assessment; Lowe-Pearce & Smith, 2005), and initiating and responding to joint attention (Early Social Communication Scales; Mundy et al., 2007).

Results: A four-profile model of children's school functioning showed the best fit and was also the most parsimonious (Figure 1). Profile 1 (30%) was characterized by the highest scores on school functioning across both academic and social outcomes. Profile 2 (24%) had low outcomes on academic achievement and performance, with school engagement and social outcomes that were in the average range for the *Pathways* sample in this analysis. Profile 3 (21%) displayed above average academic achievement and performance, with social outcomes (i.e., pragmatic skills and social relations) that were relatively low. Finally, Profile 4 (24%) had the lowest level of school functioning across both academic and social outcomes. Three early behavioral and social communication indicators measured around age 3 significantly predicted profile membership; these included behavior problems (Wald = 15.07, $p < .01$), imitation (Wald=34.02, $p < .001$); and responding to joint attention (Wald = 25.13, $p < .001$).

Conclusions: School functioning is complex and variable in elementary-aged children with ASD. Professionals providing early intervention should focus on enhancing early social communication skills that may help to enhance future school functioning.

1:42 **186.002** Classroom Mathematical Learning Opportunities for Students with Autism Spectrum Disorder

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Background: Academic achievement is critical for educational and lifelong success (NICHD, 2000). Rich educational experiences have been associated with positive educational outcomes (Hiebert & Grouws, 2007), mental and physical well-being (Adams, 2002), and opportunities for employment (Duncan et al., 2007). Very few studies have examined the educational opportunities that students with Autism Spectrum Disorder (ASD) experience during mathematical lessons and how their experiences relate to participation and learning.

Objectives: The purpose of this study is to evaluate the nature and variability of mathematics instruction provided in preschool–3rd grade classrooms serving students with ASD. We utilized systematic observational methods in order to examine the amount and type of mathematics instruction that students receive as well as the degree of student participation and variability in teachers' language.

Methods: Participants included (n = 60) preschool–3rd grade students with ASD and their teachers (n = 36) who were recruited for a longitudinal study evaluating the efficacy of a classroom-based intervention and video-recorded in their classrooms at the beginning of the school year. We identified types of mathematics tasks students were presented with within the lesson across four categories:1) tasks focusing on recall and rote memorization (e.g., identifying numbers and reciting multiplication facts), 2) procedural tasks that highlight the learning of standard algorithms (e.g., writing out steps of addition), 3) tasks that tap into conceptual knowledge and content building, and 4) tasks that require problem-solving/mathematical reasoning. Next, trained observers coded student participation (amount of time that students attended to and appropriately utilized manipulatives and materials) as well as teachers' use of close-ended, open-ended, responsive, and directive language using Noldus Observer® Video-Pro Software. Interrater agreement between observers ranged between 80%–91%.

Results: Preliminary findings from 15 students and their teachers (n = 10) across 21 mathematics tasks indicated that students spent very little time engaged in mathematics instruction overall, with an average of 66% (SD = 18.70) of the lesson dedicated to mathematical content. A large percentage of the lesson focused on non-instructional activities, such as redirecting student behavior and attention or transitioning between materials. During mathematics tasks (M = 5:17 minutes, SD = 3:57), teachers most frequently provided opportunities for students to practice math facts (M = 57% of the tasks) and rehearse procedural steps of mathematical problems (M = 38%). Students spent very limited time on average (M = 00:09 seconds; SD = 00:06) interacting with relevant materials or looking at people. Finally, teachers used more directive language (e.g., "point to the number 5"; M = 43.00, SD = 38.60) and instructional comments (e.g., "this is the number 5"; M = 20.43, SD = 18.23) than all other language categories.

Conclusions: These data may have important implications for understanding the quality of instructional practices for students with ASD within mathematics lessons. Findings suggest that students with ASD may receive less than substantive learning opportunities in mathematics, which may have important educational consequences, and highlight salient instructional talk that might lead to improved participation in learning opportunities and deeper mathematical understandings.

1:54 **186.003** The Use of Recommended Practices for Children with ASD in Public Preschool and Elementary Schools

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Background: Outcomes for children with ASD in community service systems do not match those demonstrated in controlled trials (Nahmias et al., under review). It is important to understand what factors support best outcomes in usual care. As the educational system is the primary service children for children with ASD (Brookman-Frazee et al., 2009), studying intervention as it is delivered in the public education system can provide important insights which recommended practices have the potential to be most effective, given the resources available (Stahmer & Aarons, 2009). Evaluation of classroom quality measures that are specific to the instructional needs of students with ASD may specifically inform this goal.
Objectives:

- To examine predictors of use of recommended practices for children with ASD based on teacher and classrooms characteristics, and
- To examine the association of recommended practice use with student cognitive gains.

Methods:

Participants (45 teachers, 95.7% female; 68 students, 86.8% male) were part of the control arm of a randomized trial of an educational intervention for students with ASD in public preschool and elementary schools (mean student age = 68.0 months, *SD* = 22.1). Observers rated implementation of recommended practices for children with ASD using the Educational Program Review (EPR) in four classroom types: Mild/Moderate, Moderate/Severe, Autism, and Inclusion. Based on observation and teacher interview, raters coded skill indicators of Teaming, Classroom Structure, Classroom Environment, Curriculum and Instruction, Social/Peer Relationships, Challenging Behaviors Management, and Positive Instructional Climate. Teachers completed a demographic questionnaire. Children were assessed at the beginning and end of the school year with the same standardized cognitive assessment (either the Mullen Scale of Early Learning or the Differential Abilities Scales). Analyses included: (1) ANOVAs comparing EPR scores among classroom types, (2) Pearson correlations and ANOVAs examining associations between teacher characteristics and EPR scores, (3) a paired t-test assessing student cognitive gains over the school year, and (4) Generalized Estimating Equations examining the association between EPR domain scores on cognitive change scores.

Results:

EPR scores did not differ by classroom type, teacher years of experience in special education or with ASD, or teacher reported job-related stress (all *p*s > .08). Teachers with Bachelor's degrees had higher positive Instructional Climate scores than those with Master's degrees. Teachers with higher job satisfaction had higher Classroom Structure, Classroom Environment, Curriculum, and Social/Peer relationships scores (all *p*s < .03). Student cognitive scores increased by 4.7 points on average over the school year ($t(67) = 5.3$, $p < .0001$). Better implementation of recommended practices for Classroom Environment (e.g., low student-teacher ratio, use of natural/direct reinforcement, use of clear and meaningful instructions) was the unique significant predictor associated with cognitive gains ($B = 4.28$, $p = .03$) in adjusted analyses.

Conclusions:

Unlike in our previous research (Nahmias, 2017), the use of recommended practices for children with ASD did not differ by classroom type. The implementation of recommended practices for the classroom environment were particularly important for cognitive gains in students receiving publicly funded special education and offer strategies that may be beneficial for teachers in community settings to emulate.

2:06 **186.004** Changes in US Special Education Autism Eligibility Rates from 2010 to 2016

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Background: Current U.S. estimates of the prevalence of autism spectrum disorders (ASD) are 1 in 59 (i.e., 170/10,000) children (Baio et al., 2018). Public schools provide necessary services for children with ASD; however, many children with a medical diagnosis of ASD do not have corresponding special education eligibility in ASD (Pinborough-Zimmerman et al., 2012; Rubenstein et al., 2018). Further, ASD identification rates vary across racial groups, with some evidence that African American children are identified at lower rates and older ages than Caucasian children (Baio et al., 2018; Locke et al., 2017).
Objectives: We evaluated changes in ASD special education eligibility rates in the U.S. between 2010 and 2016. Patterns of ASD eligibility rates in relation to eligibility rates for speech and language impairments (SLI) and developmental delays (DD) were considered, as well as patterns across age and race (i.e., Caucasian, African American).

Methods: Publicly accessible U.S. Department of Education special education data from the 2010-11 and 2016-17 school years were used with corresponding years of U.S. Census Bureau State Datasets. Data from 48 states, excluding Iowa (a non-categorical eligibility system) and Wyoming (missing data), were analyzed. These analyses used overall numbers of children in special education and those with primary eligibilities in ASD, DD, or SLI.

Results: Between 2010 and 2016, the rate of ASD eligibility per 10,000 children increased from 40 to 56 for children ages 3 to 5, 81 to 105 for children 6 to 11, and 57 to 87 for children 12 to 18. The proportion of children eligible under ASD compared to all children eligible for special education increased between 1.7% and 3.3% across age ranges. Within the youngest age range (3-5 yrs) there was no correlation between ASD and DD rates ($r = -0.08$, $p = 0.62$) nor between ASD and SLI rates ($r = 0.11$, $p = 0.47$). The ratio of Caucasian to African American children ages 3 to 5 with eligibilities in the areas of ASD, DD, and SLI were 0.88 ($M = 0.90$, $SD = 0.3$), 0.87 ($M = 0.91$, $SD = 0.3$), and 1.42 ($M = 1.77$, $SD = 1.1$), respectively.

Conclusions: Special education ASD eligibility rates are one-third to two-thirds lower than ASD prevalence rates, though there is a trend toward greater identification between the years 2010 and 2016. Low rates of ASD eligibility rates for young children are consistent with past research but are troubling given the importance of early intervention (Baio et al., 2018; Zwaigenbaum et al., 2015). Given the lack of correlations between rates of ASD eligibility and rates of SLI and DD eligibility, we do not have evidence to suggest young children may be identified as having SLI or DD rather than ASD. However, differences in eligibilities were present across racial groups in young children. Specifically, Caucasian children were more likely to be identified with SLI, while African American children were more likely to be identified with ASD and DD, a finding which will be discussed in the context of literature.

Oral Session - 10B
Communication and Language
187 - Communication and Language
2:30 PM - 3:25 PM - Room: 524

2:30 **187.001** Parental Linguistic Alignment to Their Children Facilitates Language Acquisition, with Syntactic Alignment Being Particularly Relevant for Children with ASD

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Background: Parent language is a crucial factor in language acquisition in children with ASD and TD children alike, but its role as a scaffold for the child's linguistic production on a turn by turn basis is under-investigated. Here we focus on interactive alignment, that is, the tendency to re-use the child's lexical ("mommy, give me the *giraffe*", "is that a *giraffe*?"), syntactic ("*the giraffe has fallen*", "yes and *the elephant has gone* down to help her") and semantic (topic maintenance) choices. Besides supporting common ground and rapport, interactive alignment might facilitate language development by providing a rewarding parental response to children's productions, as well as contextualized linguistic input via elaboration.

Objectives: We investigate whether i) parental alignment to their children might affect language development beyond more traditional measures of parental input (total and unique words, Mean Length of Utterance, or MLU), and ii) this is modulated by the cognitive and clinical features of the children.

Methods: We analyzed spontaneous speech in 67 parent-child dyads from a longitudinal corpus (6 visits over 2 years), consisting of 30 minutes of play activities. We included 32 children diagnosed with ASD (mean age at recruitment: 32.76m) and 35 linguistically matched TD children (mean age at recruitment: 20.27m). Lexical alignment was based on lemmatized words, syntactic alignment on 2-grams of part-of-speech-tags, and semantic alignment on Word2Vec representations of the corpus. Alignment was calculated as cosine similarity between successive conversational turns (parent following child). To assess the effects of alignment at visit N on language learning at visit N+1, we relied on the best multilevel Poisson (total and unique words) and loglinear (MLU) models from our previous study on the role of parental input (Fusaroli et al 2019), and evaluated by Leave-One-Out-Information-Criteria whether including parental alignment improved these models.

Results: The full findings are presented in the accompanying table. The child's later MLU, unique and total words were positively affected by lexical and syntactic alignment. Parents' semantic alignment positively affected total amount of words, but negatively the number of unique words. Further, the effects of alignment were modulated by the children's features, in that children with lower previous production showed stronger effects of parental alignment on their own word use, compared with children with higher scores. Diagnosis provided independent modulation, in that children with ASD showed weaker effects on their own word use of parental lexical alignment, but stronger effects of syntactic alignment, than TD children. Finally, regardless of diagnosis, children exposed to less complex parental input (lower MLU) seemed to be more affected by the levels of parental lexical and syntactic alignment in their future word use, than those exposed to higher MLU.

Conclusions: Parental alignment differentially affected child language development. Parental lexical and syntactic alignment had positive effects on children's word types, tokens, and MLU; however, child features only modulated word use. Specifically, children with poorer production and less complex linguistic input benefited more from parental alignment of their own speech, and children with ASD in particular benefited from higher syntactic alignment.

2:42 **187.002** Reciprocal Influences between Child and Parent Language in Dyads Involving High- and Low-Risk Infants for Autism

ABSTRACT WITHDRAWN

Background:
The important role of parental linguistic input in children's language learning has been well documented in typical and atypical development (Bang & Nadig, 2015; Rowe, 2012). Yet, less research has explored how infants may impact parent language and shape their own environment (Fusaroli et al., 2019).

Objectives:

We conducted a longitudinal investigation of (1) infant language production; (2) parent language production; and (3) reciprocal associations between infant and parent language measures in dyads involving infants at high and low familial risk for autism spectrum disorder (ASD) at 12, 18, and 24 months.

Methods:

Eighty-nine mother-infant dyads were videotaped in the lab during a 10-minute interaction at 12, 18, and 24 months. Infants' and parents' language from each session was transcribed and analyzed for quantity and quality. The total number of words (word tokens) served as the measure of quantity. The total number of different words (word types) and linguistic complexity (mean length of utterance; MLU) served as the measures of quality. Infants' ASD outcomes were determined using Autism Diagnostic Observation Schedule (Lord et al., 2000) and clinical judgment at 18-36 months. Based on their risk and ASD outcomes, infants were classified into three groups: high-risk infants diagnosed with ASD (HRA+), high-risk infants not diagnosed (HRA-), and low-risk comparison infants not diagnosed (LRC).

Results:

(1) There was no significant group difference in infant language measures at 12 months. However, HRA+ infants produced significantly fewer word tokens than LRC infants at 18 months (z= -2.40, p= .02) and 24 months (z = -2.64, p= .01). Also, HRA+ infants produced significantly fewer word types than HRA- (z= -2.00; p = .05) and LRC infants (z= -2.65, p= .01) at 24 months, displaying lower quantity and quality of talk beginning within the second year of life.

(2)There was no significant group difference in parent language measures at 12 months. While there was no significant group difference in quantity, parents' talk significantly differed in quality at 18 and 24 months. At 18 months, HRA+ mothers produced significantly fewer word types than HRA- (z= -2.46, p= .01) and LRC mothers (z= -3.14, p< .01); HRA+ and HRA- mothers produced significantly shorter MLU than LRC mothers (z=

-3.96, $p < .001$; $z = -2.32$, $p = .02$, respectively). At 24 months, HRA+ and HRA- mothers produced shorter MLU than LRC mothers ($z = -2.44$, $p = .01$; $z = -2.82$, $p < .01$, respectively).

(3) When examining the reciprocal effects of parent language on child language, we found that 18-month parent MLU was a significant, positive predictor of 24-month child MLU, when controlling for child ASD risk, sex, earlier MLU, and parent education. When examining the effects of child on parent language, child word types at 12 months was a significant, positive predictor of parent MLU at 24 months, controlling for the covariates.

Conclusions:

High- and low-risk infants may shape their own linguistic environment over time, with their parents modulating linguistic input based on infant language.

2:42 **187.003** The Effects of Parent Sentence Diversity Input on Grammatical Development in Toddlers with ASD in Early Intervention Programs

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Background: Parents' sentence diversity (operationalized as unique combinations of subjects and verbs) serves as a lexical model, promoting grammatical development in children (Hadley & Walsh, 2014). Parent-implemented intervention increases sentence diversity in typically developing toddlers, and more diverse lexical noun phrase subjects in parents significantly predict children's increased sentence diversity (Hadley et al., 2017). This relationship between parents' lexical flexibility and children's early grammatical growth is promising for children with ASD given that many early interventions are parent-mediated (Schreibman et al., 2015). However, it is unknown how parents' language input contributes to early grammar in children with ASD over the course of early intervention.

Objectives: We 1) measured changes in the sentence diversity in toddlers with ASD over the course of treatments; 2) examined the impact of caregivers' sentence diversity on children's language; and 3) identified the predictors of grammatical changes in parents and children.

Methods: Participants were drawn from 72 caregiver-child dyads with ASD who participated in early intervention programs. Preliminary data included 10-minute play sessions from 34 dyads (Time 1: M=30 months, SD=2.6; Time 2: M=36 months, SD=2.4). Sentence diversity was quantified with a number of unique subject-verb combinations for parents and children from the play sessions while adapting the existing coding scheme from Hadley et al. (2017). The Brief Observation of Social Communication Change (BOSCC; Grzadzinski et al., 2016) was used to assess children's social communication. Children were divided into two groups; those whose sentence diversity scores improved ("Improving" n=20) versus those whose were stable ("Stable" n=14) over time using the median score. Baseline cognitive and social communication skills of these two groups of children were compared using t-tests. Pearson's r correlations between parents' and children's sentence diversity change scores were examined.

Results: Preliminary analyses showed that sentence diversity in children increased significantly over the six months of treatment with a medium effect size (p<0.001, Cohen's d=.5). Parent sentence diversity improvement was marginally significant (p=0.055, d=.3). Parent and child sentence diversity scores were significantly correlated both at Time 1 (r=.5, p<.05) and Time 2 (r=.6, p<.001). Improvements in child sentence diversity from Time 1 to Time 2 were correlated with higher levels of parent sentence diversity at Time 2 (r=.4, p<.05). The Improving group had a higher baseline non-verbal IQ (Stable: M=73, SD=23.2; Improving: M=93, SD=11.5; p<0.01) and less social communication deficits (BOSCC Social Communication; Stable: M=27, SD=7.3; Improving: M=19, SD=5.5; p<0.001). Parents with higher education levels made more significant improvements in their sentence diversity (p<0.05).

Conclusions: Improvements in sentence diversity were examined in both children with ASD and their parents over the course of early interventions. Results also highlight the reciprocal interaction between increased parent sentence diversity and more advanced grammatical skills in toddlers with ASD. Higher cognitive skills and less social impairments may facilitate early grammatical growth in these children. Parental education level may also moderate changes in their lexical flexibility. The final analyses will employ generalized linear mixed models with a larger sample from an on-going study.

2:54 **187.004** Measuring Child Social Communication across Contexts: Similarities and Differences across Play and Snack Routines.

K. M. Frost[1], *G. N. Koehn*[2], *K. M. Russell*[2] *and B. R. Ingersoll*[1], *(1)Psychology, Michigan State University, East Lansing, MI, (2)Michigan State University, East Lansing, MI*

Background:

Measurement of treatment response is essential for understanding the efficacy of early interventions for autism spectrum disorder (ASD). Development of measures that capture meaningful outcomes across contexts while maintaining strong psychometric properties has been identified as a priority in the field (Lord et al., 2005; McConachie et al., 2015; Schreibman et al., 2015). The Brief Observation of Social Communication Change (BOSCC; Grzadzinski et al., 2016) is an observational rating scheme of brief play interactions, which was developed to capture short-term change in child social communication skills.

Objectives:

The goal of this study was to adapt the BOSCC to a new context, a snack routine, and evaluate the psychometric properties and validity of the BOSCC in both play and snack routines.

Methods:

Participants were 50 children (mean=46 months old) and their caregivers who participated in two research studies evaluating the efficacy of a low-dose parent-mediated intervention delivered via telehealth. Caregiver-child interactions of a play routine and a snack routine were filmed in family homes at three time-points (pre- and post-intervention, and a 3-month follow-up). A research-version of the BOSCC (BOSCC-Play) was used to rate play videos, and adaptations were made for application to snack videos (BOSCC-Snack). We evaluated the internal consistency and inter-rater reliability of both BOSCC-Play and BOSCC-Snack. In addition, the relationship between BOSCC-Play and BOSCC-Snack was evaluated concurrently and over time. Last, correlation and hierarchical regression were used to understand how BOSCC-Play and BOSCC-Snack predicted other measures of child skills.

Results:

Results show that the psychometric properties of the BOSCC when rated on snack routines remain strong, particularly for the social communication domain (Cronbach's alpha=0.87; ICC=0.93). The BOSCC Total Score was sensitive to change in both play routines and snack routines, although the trajectories were somewhat different across three time-points (see figure). However, the utility of the BOSCC for measuring restricted and repetitive behaviors (RRBs) is less clear. In addition to positive skew in RRB items, there were differences across the play and snack contexts (see table), and inter-rater reliability was lower, although still acceptable (ICC=0.70). Nonetheless, differences in RRBs across play and snack lend support for the claim that measurement across contexts is essential.

Conclusions:

Application of the BOSCC to two or more contexts may allow for more accurate estimation of intervention response and evaluation of the generalization of child gains in social communication. In addition, it may also provide a method for researchers to evaluate the effect of context on child social communication skills. Future research should attempt to evaluate the effect of parent behavior on BOSCC rating, as child social communication is likely to vary with differences in parent interaction style.

Oral Session - 11A
Epidemiology/Population Studies
188 - Epidemiology
1:30 PM - 2:25 PM - Room: 517B

1:30 **188.001** Preconception Health and Pregnancy Rates of Autistic Women in Ontario

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Background: There is a growing recognition that preconception health, the health of all individuals of reproductive age, impacts reproductive and perinatal outcomes. However, very little is known about the preconception health of autistic women. Similarly, there is an absence of population level data on pregnancies in autistic women, although it is now widely recognized that pregnancies occur and that health supports could be strengthened. The current interest in the health of autistic women should extend to their preconception and reproductive health, so that health care providers can better attend to their unique needs, and support conception and healthy pregnancies for women who wish to become mothers.

Objectives: Our objectives were to first describe the preconception health characteristics of a population-based cohort of autistic women relative to women in the general population and to report on their pregnancy rates.

Methods: We conducted a population-based, cross-sectional study using Ontario health administrative data (2015-2016). We identified 15-44-year-old women with autism (n= 5,426) and women without any developmental, physical, or sensory disabilities (n=2,303,066). Preconception health variables were social (poverty), health (chronic disease, teratogenic medication use, mental illness, history of assault), and health care factors (continuity of care). We described these characteristics using frequencies and percentages and compared autistic women to those without disabilities using standardized differences, wherein differences >0.10 were considered to be clinically meaningful. We also describe the rates of live births, induced abortions and pregnancy losses in both groups.

Results: Compared to women without disabilities, autistic women were equally likely to live in poverty. They were more likely to have asthma and an unstable chronic medical condition although other medical conditions were not more common. They were more likely to have a psychotic mental illness, a mood/anxiety disorder, a substance use disorder, self-harm, or other mental illness and to have experienced assault. They were also more likely to be receiving teratogenic medications (1/3 of autistic women). However, they were more likely to routinely access the same primary care provider, indicating high continuity of care. Pregnancy rates were lower for autistic women than other women with an overall prevalence rate for autistic women of 16.4 per 1000 autistic women compared to 54.0 per 1000 women with no disabilities.

Conclusions: Research on factors contributing to poor preconception health among autistic women is needed, particularly with regard to their mental health, as are tailored interventions to improve preconception health for those women who wish to conceive. It will be important to explore whether lower pregnancy rates are consistent with the reduced desire of this group to become pregnant, or if there are other health or social contributors.

1:42 **188.002** A Nation-Wide Prevalence Study of Very Young Children with ASD in Bangladesh

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Background:

The Bangladesh ASD Survey in Young Children 2017 was funded by the IPNA, a project under the Ministry of Health and Family Welfare of the Government of the People's Republic of Bangladesh. The survey was designed to assess the prevalence of this condition in young children from 16 to 30 months of age.

Objectives:

The main objective of this survey was to determine the prevalence of autistic spectrum disorder (ASD) on young children in Bangladesh. Another objectives of the survey were to detect the prevalence at urban-rural distribution in Bangladesh.

Methods:

A sample size estimate of 38,250 young children. Survey was done in 85 Primary Sampling Units/Enumeration Areas (PSU/EAs) – each PSU containing about 100 households – distributed among each of 30 randomly selected districts across eight divisions of the country. Rural and urban areas were selected proportionately.

Preparatory activities including training of survey personnel (Health Assistants, Heath Inspectors and Medical Officers) took place between January and April 2017 and actual data collection was in two phases – the first in May and June and the second in October and November 2017.

In the first step of the survey, Interviewers collected information as well as carried out household level screening of ASD among survey children using 'Red Flag'. Second step screening of ASD was done among all children referred as positive following Red Flag by trained Medical Officers using M-CHAT at Upazila Health Complex or Sadar (district) Hospitals. At the third and final stage, Expert Teams from Dhaka HQ (Paediatric Neurologists, Clinical and Educational Psychologists) diagnosed ASD with DSM-5 among all children referred after 'Red Flag' at the respective Civil Surgeon offices of sample districts.

Field monitoring was done by spot checks by Quality Control Officers (MO), Master Trainers from IPNA, HQ coordinators and local health administrators such as UHFPOs.

Data from the field was manually edited and entered. Data capturing, editing, cleaning, identifying missing data, duplication detection, analysis and tabulation processes were carried out using CSPro 7.1 and SPSS 21. All results presented in this report are calculated from weighted data

Results:

The survey was undertaken in 37,982 households (71% rural, 29% urban) distributed across eight divisions and containing 38,440 children (52% boys, 48% girls) aged 16-30 months. The prevalence of DSM-5 positive ASD in16-30-month-old children was 17/10,000 young children (boys 24/10,000, girls 9.8/10,000) – in other words 1 in 589 young children (1 in 423boys; 1 in 1,026girls). Rural prevalence was 14/10,000 and urban 25/10,000.

Conclusions:

This was one of the largest surveys of ASD in young children undertaken anywhere in the world. There were many challenges in its implementation. Despite the overall low prevalence of autism, prevention programmes need to start right away because of the higher prevalence of ASD detected in high income families with higher education and Bangladesh's rapid economic development. Further studies need to elucidate the reasons for the higher prevalence in the upper socioeconomic class. Detection and early intervention programmes need to be planned carefully to target those more in need.

1:54 **188.003** The Sex Ratio in Autism Spectrum Disorder and Its Relationship with Risk Factors and Associated Features

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Background: The higher prevalence of autism spectrum disorder (ASD) among males compared to females is well documented but poorly understood. A better understanding of the ASD sex ratio may provide valuable insight into the underlying neurobiological and genetic mechanisms of the disorder. Factors such as cognitive functioning, diagnostic subtype, comorbid disorders, birth weight, and parental age at birth have been found to affect the sex ratio, suggesting that males and females with ASD may be differentially impacted by associated risk factors and underlying neurobiology.

Objectives: This study had three main aims: 1) estimate the ASD sex ratio among children enrolled in EarlySteps, Louisiana's statewide early intervention program; 2) examine changes in the ASD sex ratio across specific phenotypes, risk factors, and associated features; 3) examine whether males and females with ASD are differentially impacted by factors associated with increased risk for ASD.

Methods: Participants (*n*= 12,598) were children aged 17-37 months (*M* = 25.43, *SD)* enrolled in EarlySteps, the State of Louisiana's early intervention program. The Baby and Infant Screen for Children with aUtism Traits- Part 1 (BISCUIT- Part 1) and Battelle Developmental Inventory, Second Edition (BDI-2) were administered to parents/caregivers as part of the EarlySteps assessment protocol. Diagnostic classifications were made through review of EarlySteps assessment results using *DSM-5* criteria for ASD. Bivariate analyses were conducted to examine the male/female (M/F) ratio across factors (i.e., race/ethnicity, ASD symptom severity, developmental delay, cognitive delay, maternal age, paternal age, birth weight, premature birth, multiple births, multiplex families, global developmental delay, Down syndrome, seizure disorder, cerebral palsy) and to examine difference in the mean number of risk factors between males and females with ASD. Hierarchical logistical regression models were used to examine risk factors in relation to ASD classification outcomes, with interaction terms between risk factors and sex allowing for the analysis of differential risk between the sexes.

Results: The overall ASD M/F ratio was 3.15. Significant differences in the M/F ratio were found: between cases with (3.05) and without cognitive impairment (3.26); between cases with (1.97) and without (3.41) advanced maternal age; across birth weight categories (<1500 g: 1.90, 1500-2499 g: 2.05, ≥2500 g: 3.79); and between cases with (1.62) and without (3.28) seizure disorder. Females with ASD had a significantly higher mean of risk factors compared to their male counterparts. Advanced maternal age was found to significantly increase the risk of ASD for females but not males (*OR* = 1.628, 95% CI [1.034-2.564],*p* = .035).

Conclusions: The found ASD M/F ratio of 3.15 is lower than many previous estimates, but similar to other recent population-level studies. The differential impact of risk factors such as advanced maternal age may have important implications for understanding underlying genetic mechanisms. Further research is needed examining the relationship between specific risk factors for ASD and the ASD sex ratio.

2:06 **188.004** Effect Modification By Maternal Diabetes during Pregnancy on the Association between Regional Air Pollution Exposure and Autism Spectrum Disorder

H. Jo[1]*, S. P. Eckel*[1]*, J. C. Chen*[1]*, M. P. Martinez*[2]*, T. Chow*[2]*, F. Lurmann*[3]*, A. H. Xiang*[2] *and R. McConnell*[1]*, (1)University of Southern California, Los Angeles, CA, (2)Kaiser Permanente Southern California, Pasadena, CA, (3)Sonoma Technology, Inc., Petaluma, CA*

Background: Recent studies found that both maternal diabetes during pregnancy and early life exposure to air pollution increase the risk of autism spectrum disorder (ASD). Potential common biological mechanisms of air pollution and maternal immune activation-related pregnancy complications such as diabetes may interact, including inflammation and systemic oxidative stress, which could adversely affect neurodevelopment. However, no study has evaluated the joint effects of maternal diabetes and air pollution on ASD.

Objectives: We evaluated ASD risk associated with prenatal and first year of life exposures to regional air pollution by maternal diabetes during pregnancy.

Methods: This retrospective cohort study included 246,420 singleton children born in Kaiser Permanente Southern California (KPSC) hospitals between 1999 and 2009. Children were followed from birth until age five. Using the local regulatory air monitoring data with inverse distance-weighted monthly averages interpolated to each geocoded residential birth address, we estimated the exposures to ambient ozone and other regional air pollutants, including particulate matter less than 2.5 μm in aerodynamic diameter ($PM_{2.5}$), PM less than 10 μm (PM_{10}), and nitrogen dioxide (NO_2) during each trimester and first year of life. Exposure-associated increases in the relative risks of ASD were estimated by hazard ratios (HRs) using Cox regression models to adjust for birth year, KPSC medical center service areas, and relevant maternal medical, pregnancy, sociodemographic, and child characteristics. Interactions of estimated exposures and a 4-level categorical variable for maternal diabetes (none, gestational diabetes mellitus (GDM) diagnosed <24 weeks' gestation, GDM diagnosed ≥24 weeks' gestation, and pre-existing type-2 diabetes) were tested. For each observed exposure window with statistically significant global interaction, HRs associated with the index pollutant exposure were estimated separately for each subcohort defined by the category of maternal diabetes during pregnancy.

Results: There were 2471 children diagnosed with ASD. Statistically significant interactions between maternal diabetes and ozone exposure during the first trimester (p=0.047) and first year of life (p=0.007) were observed. Risk of ASD was associated with ozone levels among mothers with GDM <24 weeks' gestation with adjusted HRs per 15.7 ppb ozone 1.50 (95% CI, 1.08-2.09) during the first trimester and 2.01 (95% CI, 0.67-6.07) during the first year of life. No statistically significant associations of ASD with ozone were observed in offspring of pregnancies without diabetes, GDM diagnosed at ≥24 weeks' gestation, or pre-gestational diabetes. No statistically significant interactions of diabetes were observed with $PM_{2.5}$, PM_{10}, and NO_2.

Conclusions: GDM diagnosed earlier in pregnancy may increase children's susceptibility to prenatal and early life ozone associated ASD risk.

Oral Session - 11B
Diagnostic, Behavioral, Sensory and Intellectual Screening and Assessment
189 - Developmental Trajectories
2:30 PM - 3:25 PM - Room: 517B

2:30 **189.001** Developmental Trajectories of Repetitive Behaviors in Preschoolers with and without Autism

J. Wolff[1], *A. F. Dimian*[1], *B. Pennington*[2], *K. Botteron*[3], *S. R. Dager*[4], *J. T. Elison*[1], *A. Estes*[4], *H. C. Hazlett*[5], *R. T. Schultz*[6], *L. Zwaigenbaum*[7], *J. Piven*[8] *and .. The IBIS Network*[5], *(1)University of Minnesota, Minneapolis, MN, (2)University of Minnesota Twin Cities, Minneapolis, MN, (3)Washington University School of Medicine, St. Louis, MO, (4)University of Washington, Seattle, WA, (5)University of North Carolina, Chapel Hill, NC, (6)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (7)University of Alberta, Edmonton, AB, Canada, (8)*Co-Senior Authors, IBIS Network, University of North Carolina, Chapel Hill, NC*

Background: There is evidence that restricted and repetitive behaviors (RRBs) are an early-emerging feature of autism spectrum disorder (ASD). We previously reported that RRBs were elevated in high-risk toddlers later diagnosed with ASD over the 12 to 24 month age interval (Wolff et al. 2014). In the present study, we provide a follow-up of our original study sample at preschool age by examining trajectories of repetitive behavior from 12 to 36 months age in a large sample of prospectively ascertained children at low and high familial risk for ASD.
Objectives: 1) Characterize trajectories of repetitive behavior from ages 12 to 36-48 months in infant siblings at high familial risk for ASD and a low-risk control sample; and 2) examine repetitive behavior trajectories in relation to key cognitive and behavioral outcomes.

Methods: Prospective, longitudinal parent-report repetitive behavior data (RBS-R; Repetitive Behavior Scale - Revised) were collected for 202 toddlers at high-risk for ASD and 53 low-risk controls (LR-Neg) at 12, 24, and 36 months of age. Fifty-two high-risk toddlers were classified with ASD at age 36 months based on clinical best estimate (HR-ASD). Longitudinal profiles of RRB across 5 subtypes were compared using generalized estimating equations. Relations of RRB to key cognitive and behavioral variables (i.e. IQ, adaptive behavior, and ASD symptom severity) were examined using nonparametric correlations.

Results: Longitudinal profiles for children with ASD differed significantly between groups on RBS-R composite and all subtype measures of repetitive behavior, $p \leq .001$. The HR-ASD group showed significantly higher rates of repetitive behavior across all RRB subtypes at the 12 month time point, with trajectories significantly diverging thereafter. Groups markedly differed across RRB subtypes by preschool age, with ritualistic and sameness behaviors showing the most dramatic change over time. Trajectories for high-risk children without ASD (HR-Neg) were intermediate to low-risk and ASD positive counterparts. Intercept, but not slope, of composite RBS-R scores were significantly associated with social skills ($F = 28.1$, $p < .001$) and communication scores ($F = 17.3$, $p < .001$) at age 36-48 months. Consistent with findings from age 24 months, RRBs were not associated with motor ability ($F = 3.6$, $p = .06$) or overall IQ ($F = 3.8$, $p = .051$).

Conclusions: These results build upon previous findings by demonstrating that subtypes of RRB develop in dynamic fashion over early childhood. For those diagnosed with ASD at age 36 months, RRBs were elevated at age 12 months, with developmental trajectories diverging sharply from non-ASD groups thereafter. These results further suggest that higher rates of RRB reported in preschoolers with ASD may be preceded by subtle but steady changes in behavior from later infancy and early toddlerhood.

2:42 **189.002** Developmental Trajectories of Social Vocal Behavior As Biomarkers for Autism During the First 24 Months of Life: Risk Status Vs. Diagnosis

M. Kumareswaran[1], *J. Bailey*[2], *S. Ghai*[1] *and G. Ramsay*[1], *(1)Marcus Autism Center, Children's Healthcare of Atlanta, and Emory University School of Medicine, Atlanta, GA, (2)University of Miami, Miami, FL*

Background: Although autism is difficult to diagnose reliably before two years of age, prodromal symptoms may emerge over time during the first twelve months of life. Due to natural variability in developmental timescales, cross-sectional measures of behavior usually fail to capture significant differences over this period. Current research suggests that early biomarkers of risk may be found instead by examining longitudinal trajectories of individual development. Experimental research has shown the importance of contingent interaction between infant and caregiver in scaffolding vocal development, which suggests that developmental profiles of early vocal behavior and vocal interaction may be candidate biomarkers for autism. In previous investigations, we found evidence for a developmental cascade in vocal development discriminating high-risk

and low-risk siblings, beginning at 12 months, with deficits in vocal contingency that lead to later deficits in adult and infant volubility, all of which were predictive of speech and language outcome at 24 months. In this follow-up study, we re-analyzed the developmental profiles of the same children according to diagnostic outcome at 24 and 36 months, to determine whether deficits in social vocal engagement appear earlier in infants who later receive a diagnosis, and whether high-risk siblings who do not go on to receive a diagnosis exhibit patterns that more closely resemble autism or typical development.

Objectives: The goal of this study is to determine the relationship between developmental profiles of social vocal engagement from birth to two years of age, risk status and diagnosis, to test whether early vocal development is a categorical indicator of outcome.

Methods: As part of an NIH Autism Center of Excellence, we tracked vocal development among 37 high-risk infant siblings with a family history of ASD and 35 low-risk controls. Each child wore a recording device (LENA) for one day every month from 0-24 months to provide audio recordings of their vocal behavior and natural language environment. Utilizing automatic speech recognition technology developed by our laboratory, we identified the number of vocalizations per hour for infant and caregiver, and calculated the rate of contingent interactions based on timing statistics. Using Functional Data Analysis, we determined developmental trajectories for each child and mean developmental trajectories by group, based on risk status and diagnostic outcome: 10 children were diagnosed with ASD, 27 were DD/BAP, and 35 were typically developing.

Results: The developmental cascade linking early declines in vocal interaction to later declines in adult volubility and subsequent declines in infant volubility is exaggerated in infants diagnosed with ASD. Differences that only became apparent at 12 months between high-risk and low-risk infants are present between infants with ASD and typically developing peers within the first year of life. Developmentally delayed or BAP infants resemble typically developing infants at birth, but transition towards developmental trajectories resembling infants with ASD by the second year of life.

Conclusions: Developmental trajectories of social vocal engagement over the first two years of life differentially predict diagnostic outcome at two years of age in children with ASD and developmentally delayed and typically developing controls.

2:54 **189.003** Change in Core Symptoms from Ages 2 to 19 and Relative Stability from Ages 19 to 25 on the Adapted-ADOS, a New Instrument to Assess Minimally Verbal Adults

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Background: Parent-reported ASD symptoms show different patterns of change across childhood and adolescence, depending on the individual's age, language or IQ (e.g., Bal et al., 2018, McGovern & Sigman, 2005). Change in symptoms across childhood and adolescence has implications for diagnosis of ASD in adults. Additionally, identification of symptoms that remain stable across development may lead to a better understanding of mechanisms underlying observable impairments. To date, studies examining symptom trajectories are largely based on parent-report instruments or limited to comparisons of symptoms from direct observation measures, such as the ADOS-2, across childhood (e.g., Gotham et al., 2012). Longitudinal comparisons of symptoms captured on the ADOS-2 are hindered by a lack of appropriate instruments to assess older minimally verbal (MV) individuals. While there are different modules for verbally fluent children and adults (Modules 3 & 4), adaptations to the Modules 1 and 2, designed for use with children with less language, are needed to improve their utility with MV adults.

Objectives: To describe the Adapted-ADOS, a new tool designed for use with MV adolescents and adults and use A-ADOS scores to explore changes in the manifestation of ASD in young adulthood.

Methods: Diagnostic algorithms were derived from 160 adolescent and adult assessments [124 ASD, 36 Non-ASD, Mean age=19.18 (3.06) years]. McNemar's test assessed change in the presence or absence of impairment of symptoms at ages 2 and 19 for 60 participants with ASD. Paired-samples T-tests compared A-ADOS totals in 35 participants seen at ages 19 and 26.

Results: Sensitivity was above .8 for all algorithms; specificity ranged from .56 (M1-No Words) to .88 (M1-Some Words). In the longitudinal sample, many adults demonstrated improvements in the areas of response to joint attention (X^2=28.27, p<.001) and gestures (X^2=13.89, p<.001), with significantly fewer participants exhibiting impairments on these items at age 19 compared to age 2 (RJA: 20% vs. 98%; gestures: 60% vs. 93%, respectively). In contrast, impairments in spontaneous initiation of joint attention and facial expressions appeared to persist into adulthood (Table 1). From ages 19 to 26, A-ADOS totals were relatively stable [t(34)=.90, p=.38, Figure 1]. Total scores remained stable or improved for 21 participants (Mdiff=3.10), but worsened for 14 adults (Mdiff=-3.4). The worsening group showed decreased engagement from 19 to 26, both with the examiner [t(13)=-2.69, p<.05] and the A-ADOS activities [t(13)=-2.48, p<.05].

Conclusions: The A-ADOS expands the repertoire of instruments to assess MV adolescents and adults and provides an alternative to the ADOS-2 modules 1 and 2 for assessment of older individuals. Consistent with parent report, adults exhibit both improvements (e.g., response to joint attention, gestures) and persistent impairments (e.g., facial expressions) in directly-observed symptoms considered to be core features of ASD in childhood. Preliminary analyses of a small sample suggest that symptoms appear relatively stable across young adulthood; however, a subset of MV adults may be at risk for decreased engagement during the transition years. Further analyses will explore factors that may explain the observed behavioral change (e.g., onset of depression; loss supports [see Taylor & Seltzer, 2010]).

3:06 **189.004** Trajectories of Autism Severity in Children from Toddlerhood to Childhood in Taiwan: The Roles of Maternal Education Level and Residence Area

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Background: Literature had shown that autism spectrum disorder (ASD) is characterized by heterogeneous severity. However, most of recent studies were done in the West, seldom in the East. As the authors know, this is the first longitudinal study for 6 years from toddlerhood to childhood in Taiwan, to explore the developmental trajectories of autism symptom severity and its early predictors.

Objectives: Two study purposes: (1) to plot longitudinal trajectories of ASD severity from early childhood to elementary school period; (2) to find the early indicator to explain the different trajectory classes in the children with ASD.

Methods: Seventy children with ASD participated at time 1 (mean chronological age was 2.5 years old), and then followed at time 2 (mean

chronological age was 4 years old) and time 3 (mean chronological age was 8.5 years old). Participants recruited from two local areas in Taiwan, 33 of them were from Taipei city, the capital area in Taiwan, and 37 of them were from Chia-Yi city and county, the rural area in Taiwan. The study assessed the autism symptom severity by ADOS and cognitive function by MSEL WPPSI-IV, or WISC-IV at three time points. Additionally, early indicators including maternal education level, child's FSIQ, VIQ, NVIQ at Time 1, and age of first autism sign in ADI-R. Due to different modules were used in ADOS across three time points, ADOS total CSS (calibrated severity score) was used for analysis.

Results: In hierarchical cluster analysis, three classes model was found to represent the observed data. We found that 27% (n = 18) of participants were assigned to persistent high severe class, 61% (n = 43) of participants were assigned to worsening class and 13% (n = 9) of participants were classified as improving class. The proportions of the three classes among two areas revealed that the children living in Chia-Yi were more likely to be classified as worsening group (n = 30, 81%) and no one be classified as improving group. Using multinomial logistic regression analysis, we found only two variables, i.e., maternal education level ($p < .01$) and area ($p < .000$) can explain the subgrouping independently. However, when the former two variables were put into the multinomial logistic regression model simultaneously; the effect of maternal education level was disappeared and the area variable ($p < .000$) was the only significant indicator to explain the subgrouping.

Conclusions: In summary, this study showed that all of the participants with ASD were classified as persistent high, worsening and improving groups with three time points from toddlerhood to elementary school ages. However, the children with ASD living in the rural area such as Chia-Yi were more likely to be classified as worsening group. Additionally, only the residence area could explain the ASD subgrouping. The accessibility and quality of service system of early intervention in two areas are discussed.

Oral Session - 12A
Adult Outcome: Medical, Cognitive, Behavioral, Social, Adaptive, Vocational
190 - Adult Outcomes
1:30 PM - 2:25 PM - Room: 518

1:30 **190.001** Can Executive Functions Predict Study Progress Among College Students with Autism?

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Background: Many students with Autism Spectrum Disorder (ASD) that enter higher education drop out prematurely. Although studies have shown that executive functioning (EF) skills can predict study success in neurotypical individuals, it is unknown whether this is also true for young adult individuals with ASD.

Objectives: To determine whether daily EF and performance-based EF can predict study progress in college students with ASD.

Methods: Fifty-four young adults college students with ASD (M_{age} = 22.48, SD = 2.43, 72% male) were recruited and followed-up for 6 months to determine their study progress. At baseline the adult self-report version of the Behavior Rating Inventory of Executive Functioning (BRIEF-A) and computerized subtasks of the Amsterdam Neuropsychological Tasks (ANT) were assessed to measure daily EF and performance-based EF, respectively. The Social Responsiveness Scale for Adults (SRS-A) was included to assess autism symptom severity. After six months the total proportion of collected study credits was calculated. Correlational analyses and regression models were conducted to determine the best predictors of study progress.

Results: The initial results showed that cognitive flexibility, working memory (both ANT), and planning/organizing skills (BRIEF) were significantly correlated with study progress. Subsequent regression analyses indicated that although these EF skills were able to explain a significant amount of variance in study progress, only planning/organizing skills was a significant predictor above and beyond autism symptom severity.

Conclusions: These preliminary findings suggest that mapping daily EF in young adults with ASD in higher education can potentially aid in increasing their odds of a successful academic outcome.

1:42 **190.002** The ASD Mentoring Program at York University, Canada: Identifying Mental Health Needs and the Benefits of Social Support

***J. M. Bebko**[1], C. A. McMorris[2], M. Ames[3], B. L. Ncube[4] and K. T. Shaikh[1], (1)York University, Toronto, ON, Canada, (2)Werklund School of Education, University of Calgary, Calgary, AB, Canada, (3)University of Victoria, Victoria, BC, Canada, (4)Psychology, York University, Toronto, ON, Canada*

Background:

Young adults with ASD are at risk for academic and personal failure throughout their post-secondary education, due to co-occurring mental health issues, along with the difficulties in social relationships and communication characteristic of ASD (Pinder-Amaker 2014). We summarize two projects: one investigating these mental health issues and barriers for service, and one reporting on the social support experiences of students who participated in the first decade of the York University (Ontario, Canada) ASD Mentoring Program (AMP). The AMP is a peer mentorship program providing individual and group activities to help achieve individualized goals.

Study1:

Objectives: Identify the frequency of mental health issues in AMP participants, their service utilization patterns, and barriers to accessing needed services.

Methods: Participants: 45 students enrolled in the AMP between 2013-2017. 82% were male, average age at program entry was 21 years (SD= 2.38)

Procedure:Students completed an initial interview with their mentor, querying self-disclosed ASD and secondary mental health diagnoses, service utilization, and barriers in accessing services.

Results: The majority of participants (56%) reported at least one additional mental health diagnosis, with half of these (52%) indicating two or more. Most common were anxiety disorders (31%) and mood disorders (24%). Over half of students utilized one or more services in addition to AMP (range = 1–7). 40% of students indicated there were supports they would like to receive but were not currently accessing. The most commonly

reported barrier was self-imposed: a desire to handle problems on their own. Other common barriers included wait time and the steps to accessing services being overwhelming.

Conclusions:

Transitioning to post-secondary institutions can exacerbate risk of mental health issues in individuals with ASD. Participants indicated multiple barriers to access mental health services. We identify strategies to support students to increase probability of successful post-secondary experience.

Study2.

Objectives: We evaluated which aspects of social support were most used and valued by a subset of students enrolled in the York University AMP.

Methods: Participants: 25 students, males=78%, mean age=21.43 years (SD=3.76) in their first year in AMP.

Procedure: Participants completed questionnaires at the beginning and end of the academic year. Goals for participation were collected at the beginning of the year; additional measures at the beginning and end of the year included social support and friendship questionnaires, as well as ratings of how well they had achieved their goals and satisfaction.

Results: Topics addressed in individual meetings included social skills and coursework (87% of participants), followed by dating/romantic relationships (43%). 77% indicated they had achieved their goals (most common: develop/improve social skills and friendships), and 77% indicated the program had been helpful in goal achievement. Satisfaction with AMP was high (M=4.22/5, SD=0.60) and with individual meetings (M=4.52/5, SD=0.59).

Conclusions: Social support is a major barrier for educational attainment for students with ASD (Cai and Richdale, 2016). Our findings reinforce the benefit of providing a targeted mentoring program focusing largely on social skills, even after only one year in the program. The AMP model has been successfully adapted by other institutions.

1:54 **190.003** Examining the Efficacy of a Community College Program Supporting Transition to Adulthood for Individuals with ASD

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Background: The dramatic increase in the rate of individuals with ASD graduating high school with a general education diploma has created challenges for higher education professionals and employers who are seeking evidence-based supports. Few interventions exist that target the employment readiness "soft skills" that are often associated with poor outcomes (e.g., executive function, social competence, emotion regulation). The TEACCH School Transition to Employment and Post-secondary Education (T-STEP) program was designed to target these skills. Community colleges represent an ideal location to provide transition interventions as many adolescents with ASD continue their education in community colleges. The T-STEP was offered in community colleges through a statewide Vocational Rehabilitation Pre-Employment Transition Services program.

Objectives: We implemented an open trial, community college version of the T-STEP across 3 community college campuses. The objectives of this open trial were to (1) provide initial efficacy data for this community-college intervention; and (2) create a behavioral observation measure (the Job Skills Assessment Profile) to assess meaningful outcomes associated with successful transition to adulthood.

Methods: Across three community colleges (7-12 students per semester), 31 adolescents and young adults (16-21-years old) with ASD completed a 24 session (90 minutes each) T-STEP course at their local community college. Students had completed or were completing a general education high school diploma. In addition to the T-STEP class, students received academic and career counseling services. Two measures of employment readiness were evaluated at pre- and post-assessments. The JSAP consists of two simulated work experiences (each 20 minutes) with a series of presses that prompt for organization skills, social skills, and emotion regulation skills. A total score is computed along with subdomain scores for each area. Two versions of the JSAP were created to avoid practice effects; versions were counterbalanced across time; videos were coded by blind raters. Caregivers completed an employment readiness measure, the Becker Work Adjustment Profile (BWAP) measuring 4 domains, Work Performance, Interpersonal Relations, Work Habits, and Cognitive Skills. Finally, during one semester (N = 18) self-report measures of self-advocacy (AIR Self Determination Scale) and symptoms of depression (Center-for Epidemiological Studies – Depression) were evaluated.

Results: Employment readiness skills improved on both measures (see Table 1). On the JSAP, participants showed a significant decrease in total workplace behavioral difficulties, improving from a score of 13.00 at baseline to 7.03 post-intervention [$t(28) = 4.80$, $p < .001$], with significant improvements across all domains (Organization, Social Skills, and Emotion Regulation). On the BWAP, a significant 17.3 point increase in scores from baseline to post-intervention was seen [$t(30) = 5.52$, $p < .001$] with significant improvements across all domains. Significant reductions in depression symptoms and increases in self-determination were also reported.

Conclusions: Results provide promising efficacy evidence for the T-STEP in a community-college environment targeting meaningful outcomes of employment readiness, self-determination, and symptoms of depression. The JSAP also appears sensitive to the employment readiness skills taught during the T-STEP and is a promising measure for other transition intervention studies. Next steps include an RCT and long-term measures of postsecondary and employment outcomes.

2:06 **190.004** Mock Juror Perceptions of Credibility and Culpability in an Autistic Defendant

K. Maras[1], *I. Marshall*[2] *and C. Sands*[2], *(1)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (2)University of Bath, Bath, United Kingdom*

Background:

For a small minority of autistic individuals, characteristics linked to clinical features of autism are associated with engagement with the police and criminal justice system as an offender. However, little is known about whether legal professionals and jurors take autism-related factors into account when making judgements about their offending behaviours. Furthermore, an autistic person may be viewed as strange or awkward in court. This is potentially critical because observers often base their judgments of an individual's credibility on verbal and non-verbal cues such as

eye-contact, body movements, fidgeting, surface features of speech, and displays of emotion (DePaulo et al., 2003). However, several studies have recently reported that informing observers of an individual's autism diagnosis results in significantly more favourable judgements about them in everyday contexts (e.g., Sasson & Morrison, 2017).

Objectives:

The aim of the present study was to examine mock juror perceptions of credibility and culpability of a defendant who is described as displaying autistic-like characteristics and behaviours, and whether the provision of information about the defendant's autism diagnosis alters these perceptions.

Methods:

160 jury-eligible participants read a vignette describing a 27-year-old male who was brought to the attention of police for suspicious and aggressive behaviours and displayed unusual behaviours once in court. Half of participants were informed that he had a diagnosis of autism and read a report from a forensic psychiatrist about what autism is and how the defendant was affected by it ('*Label+info'*); the other half received no diagnosis label or further information ('*No info'*). Participants then rated the defendant's credibility, in terms of likability, cognitive functioning, and honesty, as well as perceived blameworthiness, guilty verdict and sentencing leniency. Participants' responses to follow-up open ended questions formed the basis of a qualitative analysis of the reasons for their ratings and judgements

Results:

Participants in the *Label+info* rated the defendant as significantly more honest, $F(1,158)=14.96$, $p<.001$, $\eta p^2=.09$, and likable, $F(1,158)=7.47$, $p=.007$, $\eta p^2=.05$, and less blameworthy, $t(158)=4.89$, $p<.001$, $d=0.78$, than those in the *No label* condition. There was no significant effect of information condition on ratings of cognitive functioning, $F(1,158) =0.90$, $p =.411$, $\eta p^2 =.004$. There was a significant association between the information that mock jurors received about the defendant's diagnosis and their beliefs regarding whether he should receive a guilty or not guilty judgement, $\chi 2(1, N =159) =8.13$, $p =.004$ (Figure 1). *Label+info* participants also reported more lenient sentencing attitudes towards the defendant, $t(98)=2.20$, $p=.030$, $d=0.45$.

Thematic analysis revealed that participants in the *Label+info* condition were more empathetic and attributed the defendant's behaviours to his autism and mitigating factors, while participants in the *No label* condition perceived the defendant as deceitful, unremorseful, rude and aggressive.

Conclusions:

The information provided to jurors about an autistic defendant can have a profound effect on their judgements of his likeability, honesty, blameworthiness, guilt and sentencing. This has important implications not only for the courts, but also for other areas such as employment and social situations where the disclosure of an individual's autism diagnosis may impact others' perceptions of them.

Oral Session - 12B
Family Issues and Stakeholder Experiences
191 - Caregiver Experience/Participatory Research
2:30 PM - 3:25 PM - Room: 518

2:30 **191.001** Juggling Multiple Roles: The Experience of Caregivers of Adults with ASD

N. Bagatell[1]*, E. M. Lamarche*[2] *and L. G. Klinger*[3]*, (1)University of North Carolina at Chapel H, Chapel Hill, NC, (2)Psychiatry, University of North Carolina at Chapel H, Chapel Hill, NC, (3)TEACCH Autism Program; Psychiatry, University of North Carolina, Chapel Hill, NC*

Background: Most adults with autism spectrum disorder (ASD) require support to live as independently as possible. This support often comes from unpaid caregivers, such as parents. While there is a robust literature regarding caregiving experiences of parents of children with ASD, relatively little research has focused on caregivers of adults. The scant literature has focused largely on coping and burden, with little attention to what caregivers actually do.

Objectives: The objective of this study was to explore caregiving for adults with ASD to inform service delivery and policy. The main research question this study addressed was: What roles do caregivers of adults with ASD enact to support their adult child? In essence, what does caregiving actually entail?

Methods: This descriptive qualitative study was part of the second phase of a larger study investigating outcomes of adults with ASD. The participants were individuals who identified as unpaid caregivers for 31 adults (ages 27-51) (see Table 1). Data were collected using a two-part interview comprised of the Vineland Adaptive Behavior Scales (2nd edition) Parent/Caregiver interview and a semi-structured interview. Interviews were recorded and transcribed. The semi-structured interviews, which lasted 30-60 minutes, focused on hopes and plans for the future and service utilization while the Vineland provided qualitative information about everyday life. Following each interview, reflexive memos were written; in this memoing process, the theme of caregiving emerged. The data analysis process, which involved multiple people, included reading transcripts, coding, grouping codes into categories, and recoding to confirm categories. Through ongoing discussions, themes were confirmed with members of the research team not involved in the coding process.

Results: Three main categories of caregiver roles, each with subthemes, were identified: 1) meeting and managing adult child's daily needs through planning social activities and assisting with basic self-care and instrumental activities of daily living; 2) obtaining services and supports by advocating and navigating systems; and 3) providing supports by being a culture broker, coach, and life line when the unexpected occurred. All caregivers carried out these roles to some degree regardless of the adult child's IQ, sex, and adaptive behavior skills. Caregivers whose adult children lived independently and those whose children lived in residential settings continued to carry out many roles. While caregivers did not convey a strong sense of burden, some expressed fatigue and concern regarding their own health status. Looming large for all caregivers was the question: "Who will do these things when I am no longer able?"

Conclusions: Caregivers of adults with autism across the spectrum enact many roles on a regular basis to promote the quality of life for their adult child. The findings have implications for service provision and policy. First, services should focus on increasing independence through daily living skills and self-advocacy interventions for individuals with ASD across the life span. Second, support should be provided to caregivers so

that they can engage in role release to enhance their quality of life as they age and to provide peace of mind regarding their adult child's future.

2:42 **191.002** Child Impact on the Family and Parent Social Support in Families of Children at Risk for Autism Spectrum Disorder

E. Hickey[1], *S. Broder-Fingert*[1,2], *J. L. Kuhn*[3], *J. Goupil*[1], *A. Chu*[4], *J. E. Rosenberg*[1], *M. Augustyn*[1,2] *and E. Feinberg*[2,4], *(1)Boston Medical Center, Boston, MA, (2)Boston University School of Medicine, Boston, MA, (3)Pediatrics, Boston Medical Center, Boston, MA, (4)Boston University School of Public Health, Boston, MA*

Background: Having a child with autism spectrum disorder (ASD) has been shown to impact parenting experiences (Estes et al., 2013), the family financial situation (Lavelle, 2014), the parent marriage or couple relationship (Hartley, DaWalt, & Schultz, 2017), siblings (Shivers, McGregor, & Hough, 2017), and parent social support (Lu et al., 2015); yet, little data has explored the specific impact of child functioning, or potential moderators of these relationships.

Objectives: The current study explored the impact of child functioning on the family, and assessed the role of parent social support in this relationship. Our research questions were: (1) Is child social functioning associated with child impact on positive feelings about parenting, negative feelings about parenting, parent social life, family finances, parent marriage/couple relationship, and/or siblings? (2) Does parent social support moderate the relation between child social functioning and child impact on feelings about parenting?

Methods: Data were collected from 320 parents/guardians of children, aged 15-34 months (*M* = 21.10, *SD* = 3.67), identified as "at-risk" on the Modified Checklist for Autism in Toddlers (M-CHAT; Robins, Fein, Barton, & Green, 2001) during routine screening for ASD across 14 urban pediatric clinics. This data was baseline data from participants enrolled in an NIMH funded randomized controlled trial of Family Navigation. Parents reported on the child's adaptive social behavior (ABAS-II; Rust & Wallace, 2004), their perceptions of the child's impact on the family, as measured by six subscales (positive feelings toward parenting, negative feelings toward parenting, impact on parent social life, financial impact, impact on marriage, and impact on siblings) of The Family Impact Questionnaire (FIQ; Donenberg & Baker, 1993), and parental social support, measured by the Medical Outcome Study Social Support Survey (MOS-SSS, Sherbourne & Stewart, 1991). Structural equation modeling within Analysis of Moment Structure (AMOS, version 21.0; Arbuckle, 2012) was used for analyses**.**

Results: Child social functioning significantly impacted both positive (β=.23, *SE*=.05, *p*<.001), and negative (β=-.12, *SE*=.05, *p*=.026) feelings about parenting, parent social life (β=-.19, *SE*=.06, *p*<.001), and siblings (β=-.15, *SE*=.07, *p*=.028). Parent social support did not moderate this relation, but there was an independent effect of social support on positive (β=.29, *SE*=.05, *p*<.001), and negative (β=-.27, *SE*=.05, *p*<.001) feelings about parenting, family finances (β=-.11, *SE*=.06, *p*=.047), and parent marriage/couple relationship (β=-.39, *SE*=.07, *p*<.001). Other variables, such as parent language (β=-.19, *SE*=.08, *p*<.001) and child age (β's=.12-.19., *SE*'s=.02-.02, *p*=.002-.045) were also independently related to the level of child impact on the family

Conclusions: Results highlight the importance of child social functioning and parent social support in understanding the impact a child at risk for ASD has on the family, but suggest that social support did not operate as a moderator. Other variables, such as language and child age, should be considered as potential moderators for future attempts to improve parental well-being of children at risk for ASD.

2:54 **191.003** Person-Oriented Ethics in Autism Research: Recommendations for Researchers Developed in Collaboration with Participants, Families, and Other Stakeholders

A. Cascio[1,2], *J. A. Weiss*[3] *and E. Racine*[1], *(1)Institut de recherches cliniques de Montréal, Montreal, QC, Canada, (2)McGill University, Montreal, QC, Canada, (3)Psychology, York University, Toronto, ON, Canada*

Background:

Ethics is an important consideration in any research project, whether involving human subjects, biorepositories, big data, animal models, and so on. Research ethics is not limited to regulatory considerations, paperwork, and consent forms. It also addresses every day considerations such as respecting participants, considering broader social contexts, and attending to relationships between different people involved in conducting, participating in, and applying research.

Objectives:

The goal of this project is to collaborate with stakeholders to develop recommendations for research ethics regarding participants on the autism spectrum.

Methods:

A scoping literature review was conducted to develop the model of person-oriented research ethics. A systematic-interpretive literature review method was followed in order to identify research ethics issues in autism research. Task force deliberation was used to develop best practices in collaboration with autistic self-advocates, parents, professionals, researchers, and advocacy organization representatives. The work of the task force was advised by broader community engagement through a project website and ongoing conversation with community members.

Results:

The task force has produced a report containing suggestions according to the five guideposts of person-oriented research ethics: respect for holistic personhood, acknowledgment of lived world, individualization, focus on researcher-participant relationships, and empowerment in decision-making. Both conceptual and concrete recommendations are included. Conceptual recommendations include considering the difficulties participants and families may be facing in accessing care, being aware of autism and autistic communities and social groups who have a stake in research, and being mindful of stigma when writing up results. Concrete recommendations include, among others, strategies for creating more accessible documentation and practices such as using more visual communication strategies alongside text and verbal strategies; strategies for reducing anxiety by providing preparatory materials such as Social Stories or letting participants familiarize themselves with the experiment room in advance; and strategies for recognizing the contributions of autistic people as participants and otherwise, such as citing autistic authors.

Conclusions:

Research ethics is important to both researchers and participants as well as broader communities of scientists, families, and people on the spectrum who are all stakeholders in ethics issues. Ethics concerns are fruitfully addressed through engagement with stakeholders. This project has used the strength of this approach to develop best practices for researchers. Future research will implement and evaluate these suggestions

in the course of ongoing research projects.

3:06 **191.004** The Effects of Disclosing a Diagnosis of Autism on Social Perception and Behaviour in a Collaborative Game Task

B. Heasman[1] *and A. Gillespie*[2]*, (1)UCL Centre for Research in Autism and Education, London, United Kingdom, (2)Department of Psychological and Behavioural Science, London School of Economics and Political Science, London, United Kingdom*

Background: A constituent part of the social difficulties that autistic people experience is a lack of understanding about autism. This shapes the way non-autistic people perceive and extend social opportunities towards autistic people. Research on how autistic people are perceived by neurotypical people indicates that disclosing a diagnosis leads to a broadly positive discriminatory bias, but autistic testimonies indicate that diagnostic disclosure often results in negative discriminatory behaviour. This perception-behaviour gap is methodologically challenging to study because interactions are idiosyncratic and autism encompasses a broad range of behaviours. To address these challenges, the present study simulated interactions in an online game, where participants were led to believe they were collaborating with another human when in truth their partner was an intelligent virtual agent (hereafter, "Agent") that performed the same across all conditions.
Objectives: To determine the effect of diagnostic disclosure, on in-game behaviour and post-game self-report, in order to probe the perception-behaviour gap in diagnostic disclosure of autism.

Methods: We led participants (n = 256) to believe that they were interacting online with a real person, while playing Dyad3D, a maze navigation game where players must work together to open doors and complete the levels. The diagnostic status of the other player for participants was manipulated, with participants randomly assigned to one of three conditions: a no disclosure condition, without diagnostic information; a dyslexia disclosure condition; and an autism disclosure condition. However, in all conditions participants were actually playing with an Agent programmed to behave exactly the same way across all interactions. A post-game questionnaire recorded participants' self-reported perceptions of the interaction, including levels of coordination and helpfulness. Behavioural measures of participant activity in the game were also recorded, such as the mean distance from the Agent (coordination), and frequency of opening doors in the maze for the Agent (helpfulness).

Results: Our findings show that Dyad3D proved to be an efficient and viable method for creating a believable interaction (deception success rate >96%). Diagnostic disclosure of autism resulted in the Agent being perceived as more intelligent and useful, compared with either the no-diagnosis ($p < .001$) or dyslexia condition ($p = .028$). However, a comparison of self-reported helpfulness with in-game metrics showed no significant association between perception of helpfulness towards the Agent and actual helping behaviour towards the Agent ($p = .667$).

Conclusions: The findings suggest a "helping-bias", whereby individuals who receive knowledge of another person's diagnosis of autism over-estimate their own helpfulness towards the diagnosed individual. This finding highlights a risk that if autistic people claim they are not being helped adequately by non-autistic others, non-autistic others would not see such claims as having legitimacy.

Panel Session
Animal Models
192 - Innovative Outcome Measures Relevant to ASD in Preclinical Models
3:30 PM - 5:30 PM - Room: 517C

Panel Chair: Jill Silverman, *MIND Institute and Department of Psychiatry and Behavioral Sciences, University of California Davis School of Medicine, Sacramento, CA*

Autism spectrum disorders include broad definitions of behavioral phenotypes and reflect the current consensus that the causes and clinical presentations of autism are highly heterogeneous. Although forging definitive links between genetic alterations and behavioral impairments is challenging, it is not insurmountable task. Translational endpoints, including behavioral outcomes, are essential for studying mechanisms of neurodevelopmental disorders and developing therapeutic treatment strategies. And while not all behaviors and phenotypes studied in the laboratory are robust, reliable, or clinically relevant, there are many that are prime and valuable for enabling translational experiments. Our proposed symposium will highlight four speakers whose research highlights robust and reliable behavioral and physiological outcome measures and innovative parameters that can be assessed in both humans and animals. Our speakers will discuss optimizing what behavioral data can tell us and what it cannot, and how to be cautious consumers of behavioral data. We will discuss how multiple domains of behavioral phenotypes and cross species studies could/should be embraced to improve translational efforts. We will also demonstrate how pairing behavior with a physiological marker can corroborate and expand translational research and how these innovative measures can facilitate studies and better predict clinical success for ASD and neurodevelopmental disorders.

3:30 **192.001** Improving Translation in Animal Models: The Science, Art, & Anecdotes

S. J. Rizzo, *Department of Neurobiology, Department of Medicine - Aging Institute, University of Pittsburgh School of Medicine, Pittsburgh, PA*

Background: Animal models are highly valuable tools for investigating the underlying pathophysiology, genetics, and neurocircuitry of neurodegenerative, neuropsychiatric, neurodevelopmental, and cognitive disorders. Translational endpoints, including behavioral outcomes, are essential for studying these CNS disorders and in particular for Autism Spectrum Disorders (ASD) where diagnostic criteria are largely based on behavioral criteria. Not all behaviors and phenotypes studied in animal models are robust, reliable, or optimal for enabling translational experiments leading to interpretable findings for clinical populations. Indeed, preclinical testing in animal models is critical for drug discovery, and while hundreds of interventions have demonstrated efficacy in animal models, successful translation to the clinic has been limited. Importantly, the preclinical studies that have enabled these clinical trials have largely used male subjects of a single inbred strain which is not analogous to the genetically diverse patient population; nor should it be expected that a single mutation on an inbred strain would recapitulate the diverse spectrum of behavioral phenotypes observed in such complex disorders as ASD. While historically preclinical screening of test compounds have employed behavioral endpoints in animal models as the primary screen owing to a falsely perceived ease of conducting these experiments; there have been compromises on the level of rigor, including blinding, randomization, inclusion of relevant controls, appropriate planned sample sizes, and *apriori* inclusion and exclusion criteria. Critically, an understanding of a test compound's pharmacokinetic (PK) and pharmacodynamics (PD) properties is necessary to aid in the selection of relevant and target specific dose ranges, route of administration, and

pretreatment regimen for testing, and these PK/PD modeling data are oftentimes not generated. Moreover, having knowledge of a test compound's therapeutic window, as defined by the dose range that produces the specific pharmacodynamic response relative to the dose range at which adverse or neurotoxic effects occur is crucial to appropriately interpreting the resulting data and its translational utility.
Conclusion: The outcome of implementing these considerations will be discussed in order to improve and enhance the utility of animal models for clinical translation.

Methods: N/A

Results: N/A

3:55 **192.002** Translation in Fast Forward: Cross Species Research on Deletions and Duplications of Chromosome 15q11.2-q13

***J. L. Silverman**, MIND Institute and Department of Psychiatry and Behavioral Sciences, University of California Davis School of Medicine, Sacramento, CA*

Background:
Mutations in chromosomal region 15q11.2-q13 result in at least three neurodevelopmental disorders including Angelman, Prader-Willi and Dup15q Syndromes, all associated with autism spectrum disorders (ASD). Angelman Syndrome (AS) is a rare neurodevelopmental disorder characterized by developmental delay, impaired receptive and expressive communication skills, ataxia, motor and balance deficits, poor attention, intellectual disabilities, microcephaly, and seizures. The genetic cause of AS is loss of expression of *UBE3A* (ubiquitin-protein ligase E6-AP) in the brain, typically due to a deletion of the maternal 15q11-q13 region. Duplications or triplications of chromosome 15q11.2-q13 (Dup15q) are one of the most common and penetrant genomic rearrangements observed in ASD, accounting for up to ~3% of cases. New advances in mouse and rat models have allowed for the development and utilization of clinically-relevant behavioral assays to measure sophisticated outcomes of social communication, fine grained motor skills, and learning and memory with neurophysiological outcomes such as spiking events, spectral power and sleep.

Objectives:

To examine clinically-relevant behavior, neuroanatomy by MRI, and neurophysiology by electroencephalographic (EEG) in our *Ube3a* deletion rats and an *Ube3a* overexpression mouse model system.

Methods: N/A

Results: We discovered delayed reflex development, altered social communication, gait abnormalities, and impaired learning and memory in the *Ube3a* deletion rat model of AS. We also discovered EEG characteristics that are translationally relevant and have been observed in AS and Dup15q clinics, such as abnormal levels of delta and beta power bands. We also discovered that profound neuroanatomical phenotypes.

Conclusion:

Our use of translational innovative outcome measures, like motor skills, social communication, EEG for seizures and power, touchscreen tasks, sleep physiology and motor skills, are required to test the utility of innovative drug designs (i.e. gene therapy, viral vector delivery and/or stem cells), as well as to validate other traditional medicinal therapies (i.e., diet, or pharmaceutics) that may be in the drug discovery pipeline by biotechnological and pharmaceutical companies. Funded by NINDS (R01NS097808) and FAST.

4:20 **192.003** EEG in Cognitive Tasks in Preclinical Models As Translational Biomarker

***J. Brigman**, University of New Mexico, Albuquerque, NM*

Background: There is a pressing need for translational tests of cognitive functioning that demonstrate consistent neurophysiological biomarkers across species. While preclinical studies provide numerous therapeutic targets for neuropsychiatric disorders, the failure to convert these to clinical treatments highlight that behavioral similarity alone is insufficient. Biomarkers of brain function are needed. As part of an ongoing project, we recently integrated tasks measuring specific Research Domain Criteria (RDoC) with electroencephalography (EEG) in mouse and human subjects to directly compare neural activity across species. Despite the procedural differences (e.g., training in touchscreens for mice, instructions and a joystick in humans), psychometric and neural biomarker signatures of performance were consistent across species.
Methods: Humans were tested in a variety of behavioral paradigms including the probabilistic learning task (PLT) progressive ratio breakpoint task (PRBT), and 5-choice continuous performance task (5C-CPT), while neural electroencephalogram (EEG) recording was conducted. Similarly, C57BL/6J mice performed touch-screen analogs of these paradigms while or dura-resting EEG-like signal was recorded for direct comparable analysis.
Results: During PLT performance we observed that frontal Reward Positivity scaled with the degree of positive prediction error, varying in strength according to probability ratio in both humans and mice. On the PRBT we observed parietal alpha power was elevated as both humans and mice neared their breakpoint. In the 5C-CPT, performance varied based on task difficulty in both humans and mice and post response EEG stimuli exhibit consistencies across species.
Discussion: We demonstrated the capability of utilizing identical methods for investigating rodent neuronal activity performing the same behavioral tasks available in rats and humans, in cognitive control, effortful motivation, and reward learning. Current studies will determine whether psychopharmacological challenges alter EEG signaling consistently across humans and rodents. These techniques provide important information regarding the validity rodent models to neural circuitry of behaviors relevant to psychiatry in addition to the likelihood of translating drug-induced changes in performance across species.

4:45 **192.004** Quantifying Preclinical and Clinical EEG Biomarkers in Neurodevelopmental Disorders

***M. Sidorov**, University of North Carolina, Chapel Hill, NC*

Successful clinical trials for neurodevelopmental disorders will require reliable biomarkers that are quantitative, biologically based, and linked to clinically meaningful deficits. Ideally, such biomarkers will also have face validity in animal models. We will describe quantitative EEG biomarkers for Angelman syndrome (AS), a neurodevelopmental disorder caused by loss of neuronal expression of the maternally inherited UBE3A gene. Symptoms of AS include intellectual disability, impaired speech and motor function, epilepsy, and disrupted sleep. We will discuss and evaluate three recently described quantitative EEG biomarkers in AS: enhanced delta rhythms, abnormal coherence, and disrupted sleep spindles. We anticipate that the use of these biomarkers will have value both in preclinical testing of compounds and in the eventual design of clinical trials.

Panel Session
Biomarkers (molecular, phenotypic, neurophysiological, etc)
193 - "Developmental Disconnections" in Infants at Risk for ASD
3:30 PM - 5:30 PM - Room: 524

Panel Chair: Shafali Jeste, *University of California, Los Angeles, Los Angeles, CA*

Discussant: Emily Jones, *Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom*

Converging evidence from genetics suggests that disruptions in the development of healthy neural circuits underlie and precede behavioral signs of autism spectrum disorder (ASD). Imaging and electrophysiological studies have quantified aberrant neural connectivity in children and adults with ASD, with a wide range of (and difficult to generalize) results owing to the heterogeneity of methods and populations studied. Examination of functional connectivity patterns in infants at risk for ASD, well before behavioral signs and confounding comorbidities emerge, can elucidate early brain changes that relate more directly to putative biological mechanisms. These findings can, in turn, inform more targeted studies of biomarkers of functional connectivity in childhood. Here, we present innovative approaches to the investigation of neural connectivity in infants at risk for ASD, through electroencephalography (EEG: Tran, Haartsen) and magnetic resonance imaging (MRI: Ciarrusta, Chen). In the context of these data that demonstrate atypical connectivity patterns both at rest and during social information processing in early infancy, we will discuss (Jones) methodological challenges and opportunities in infant connectivity studies, consider the generalizability of these findings, and share experiences from infant imaging consortia on the value of and next steps in large-scale studies of infant brain development in ASD.

3:30 **193.001** Atypical Brain Network Connectivity Proximal to Behavioral Symptom Onset in Toddlers with Autism Spectrum Disorders

*B. Chen[1,2], A. C. Linke[1], L. Olson[1,2], C. H. Fong[1], S. Reynolds[1], M. Kinnear[1], R. A. Mueller[1,2] and **I. Fishman**[1,2], (1)Brain Development Imaging Laboratories, San Diego State University, San Diego, CA, (2)Joint Doctoral Program in Clinical Psychology, SDSU / UC San Diego, San Diego, CA*

Background: Behavioral signs of autism spectrum disorders (ASDs) appear in the first years of life; however, little is known about brain networks organization in ASDs during this critical developmental period, proximal to autism symptom onset. While there is evidence of early anatomical abnormalities in toddlers with ASDs, including increased cortical surface and brain volume, as well as extra-axial cerebrospinal fluid, less is known about functional network organization early in life in ASDs.
Objectives: To examine functional connectivity patterns in toddlers with (or suspected of having) ASD, utilizing multiband functional MRI data acquired during natural sleep. We hypothesized to find atypical maturational trajectories of network integration (strengthening connectivity within networks) and differentiation (decreasing connectivity between networks) in children with ASDs.

Methods: Participants were young children with ASDs (mean age: 28±7 months) and typically developing (TD) toddlers (26±7 months) continuously enrolling in the ongoing longitudinal study of early brain markers in ASDs. Clinical best estimates of ASD diagnoses were established based on DSM-5 criteria, and supported by the Autism Diagnostic Observation Schedule (ADOS-2), with final diagnoses confirmed longitudinally. The Mullen Scales of Early Learning and Vineland Adaptive Behavior Scales were administered to assess visual reception, motor, language, and social development. To date, T1-weighted anatomical MRI and fMRI data were acquired in 22 toddlers with ASDs and 22 TD toddlers during natural sleep. Group Independent Component Analysis (ICA) was applied to fMRI data, and after identifying 10 independent components (ICs) as non-artifact intrinsic functional connectivity networks (iFNs), mean time series were extracted from thresholded iFN masks and entered into a 10x10 pairwise correlation matrix, for each participant. Group differences in iFN connectivity were examined with two-sample t-tests applied to the correlation matrices.

Results: As expected, participants with ASDs showed delayed development across multiple behavioral domains including gross and fine motor skills, visual reception, receptive and expressive language, and socialization. Group comparisons of iFNs revealed significantly weaker connectivity between medial and lateral visual iFNs (p=0.03, FDR corrected), as well as significantly stronger connectivity between medial visual iFN and sensorimotor network (p=0.01, FDR corrected) in toddlers with ASDs. Connectivity between the medial and lateral visual RFNs was negatively correlated with age in ASD (r=-0.66) but not in TD (r=0.03) toddlers, with significant age by diagnosis interaction. In toddlers with ASDs, greater connectivity between visual and motor networks was correlated with greater symptom severity measured with ADOS (r=0.58, p=0.02) and with worse performance on the Mullen Early Learning Scales (r=-0.50, p=0.04).

Conclusions: These findings point to atypical functional connectivity implicating visual network in 1.5-3.5 years old children with ASDs, including weaker connectivity within visual networks, and stronger connectivity between visual and motor regions. The age-related decline in the connectivity between visual and other primary sensorimotor networks observed in ASDs between age 1.5 and 3.5 years, but not detected in TD children, suggests a maturational delay in network segregation in ASDs. This interpretation was supported by the data indicating that greater network segregation in toddlers with ASDs was associated with decreased symptoms and greater developmental scores.

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Objectives: To examine functional connectivity patterns in toddlers with (or suspected of having) ASD, utilizing multiband functional MRI data acquired during natural sleep. We hypothesized to find atypical maturational trajectories of network integration (strengthening connectivity

within networks) and differentiation (decreasing connectivity between networks) in children with ASDs.

Methods: Participants were young children with ASDs (mean age: 28±7 months) and typically developing (TD) toddlers (26±7 months) continuously enrolling in the ongoing longitudinal study of early brain markers in ASDs. Clinical best estimates of ASD diagnoses were established based on DSM-5 criteria, and supported by the Autism Diagnostic Observation Schedule (ADOS-2), with final diagnoses confirmed longitudinally. The Mullen Scales of Early Learning and Vineland Adaptive Behavior Scales were administered to assess visual reception, motor, language, and social development. To date, T1-weighted anatomical MRI and fMRI data were acquired in 22 toddlers with ASDs and 22 TD toddlers during natural sleep. Group Independent Component Analysis (ICA) was applied to fMRI data, and after identifying 10 independent components as non-artifact intrinsic functional connectivity networks (iFNs), mean time series were extracted from thresholded iFN masks and entered into a 10x10 pairwise correlation matrix, for each participant. Group differences in iFN connectivity were examined with two-sample t-tests applied to the correlation matrices.

Results: As expected, participants with ASDs showed delayed development across multiple behavioral domains including gross and fine motor skills, visual reception, receptive and expressive language, and socialization. Group comparisons of iFNs revealed significantly weaker connectivity between medial and lateral visual iFNs (p=0.03, FDR corrected), as well as significantly stronger connectivity between medial visual iFN and sensorimotor network (p=0.01, FDR corrected) in toddlers with ASDs. Connectivity between the medial and lateral visual RFNs was negatively correlated with age in ASD (r=-0.66) but not in TD (r=0.03) toddlers, with significant age by diagnosis interaction. In toddlers with ASDs, greater connectivity between visual and motor networks was correlated with greater symptom severity measured with ADOS (r=0.58, p=0.02) and with worse performance on the Mullen Early Learning Scales (r=-0.50, p=0.04).

Conclusions: These findings point to atypical functional connectivity implicating visual network in 1.5-3.5 years old children with ASDs, including weaker connectivity within visual networks, and stronger connectivity between visual and motor regions. The age-related decline in the connectivity between visual and other primary sensorimotor networks observed in ASDs between age 1.5 and 3.5 years, but not detected in TD children, suggests a maturational delay in network segregation in ASDs. This interpretation was supported by the data indicating that greater network segregation in toddlers with ASDs was associated with decreased symptoms and greater developmental scores.

3:55 **193.002** Functional Connectivity during Language Processing in Infants at Familial Risk for ASD

X. A. Tran[1]*, A. H. Dickinson*[1]*, N. M. McDonald*[2]*, M. Dapretto*[3] *and S. Jeste*[1]*, (1)University of California, Los Angeles, Los Angeles, CA, (2)UCLA Center for Autism Research and Treatment, Los Angeles, CA, (3)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA*

Background: Autism spectrum disorder (ASD) is a disorder of connectivity, with ASD genes converging to disrupt neural development and cortical connectivity prenatally. Familial-risk infants, defined by having at least 1 older sibling with ASD, have increased risks for ASD and language delay (Messinger 2013). Neuroimaging studies have identified abnormal structural and functional connectivity in FR infants at 6 months that relate to future ASD symptoms (Shen 2017). No prior study has examined connectivity during language processing in familial-risk infants longitudinally throughout the first year of life.

Objectives: We asked if EEG connectivity, as measured by phase coherence, during language processing, (1) differentiates infants based on risk status and ASD symptoms during the first year of life (at 3-month, 6-month, 9-month, and 12-month), and (2) relates to 18-month language ability and ASD symptoms. We hypothesized that atypical connectivity during language processing is detectable at 3 months of age in infants who will have 18-month behavioral-concerns for ASD.

Methods: Participants included 49 familial-risk and 35 low-risk infants, who were divided into ASD-concern and No-concern groups based on their 18-month ADOS-T calibrated severity score (scores ≥ 4 are ASD-concern). 18-month groupings included 17 ASD-concern and 54 No-concern infants. EEG was acquired longitudinally (at 3, 6, 9, and 12-month) while infants listened passively to a continuous stream of syllables for 2.5 minutes (EGI 128 channels). EEG was collected using NetStation and filtered at 1.5-50 Hz. To maximally reduce artifacts, EEG data were cleaned using EEGLAB artifact subspace reconstruction, 1-model adaptive mixture independent component analysis, and transformed to current source density. Using newcrossf, phase coherence was calculated in the theta (4-6 Hz), alpha (6-12 Hz) and gamma (30-50 Hz) bands between 39 electrode pairs in putative language networks (Figure 1). Language ability and ASD symptoms were assessed at 18-month using Mullen Scales of Early Learning (MSEL), MacArthur-Bates Communicative Development Inventory (MCDI), the Vineland Adaptive Behavior Scales, and Autism Diagnostic Observation Schedule-Toddler Module (ADOS-T).

Results: All statistics for coherence analyses are provided in Table 1. Phase coherence differentiated ASD-concern from No-concern infants cross-sectionally at 3-month, 6-month, 9-month, and 12-month. Compared to ASD-concern infants, No-concern infants had higher phase coherence across theta, alpha and gamma bands in multiple frontal-posterior, frontal-temporal and frontal-central electrode pairs throughout the first year of life. At electrode pairs that differentiated risk-groups, greater phase coherence predicted greater language ability and reduced ASD symptoms at 18-month.

Conclusions: Neural connectivity during auditory language processing in early infancy likely supports subsequent language development. This study documents the earliest manifestation of altered connectivity during language processing in familial-risk infants. Hypoconnectivity during language processing could serve as an early marker of atypical neurodevelopmental trajectories. Ongoing work with this study will include longitudinal modelling of 3-month through 12-month timepoints to examine potential divergent developmental trajectories in infants with atypical development.

4:20 **193.003** Atypical Cortico-Cerebellar Connectivity in Newborn Infants at Risk of Developing ASD

J. Ciarrusta[1]*, J. Ó Muircheartaigh*[2]*, R. Dimitrova*[3]*, D. Batalle*[1]*, L. Cordero-Grande*[3]*, A. N. Price*[3]*, E. Hughes*[3]*, M. J. Kangas*[4]*, A. Javed*[4]*, D. G. Murphy*[5]*, A. D. Edwards*[3]*, T. Arichi*[6] *and G. M. McAlonan*[7]*, (1)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Department of Neuroimaging, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Centre for the Developing Brain, Division of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom, (4)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (5)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (6)Imaging Science & Biomedical Engineering, King's College London, London, United Kingdom, (7)NIHR-Biomedical Research*

Centre for Mental Health at the Institute of Psychiatry, Psychology and Neuroscience, South London and Maudsley Foundation NHS Trust, London, United Kingdom

Background:
While atypical functional connectivity in resting state networks has been widely reported in adults with ASD, little attention has been directed to functional activity in the cerebellum, which communicates with somatosensory, executive control network and salience networks (Habas, 2009). Discrepancies in the limited cortico-cerebellar connectivity studies in adults further call for a better understanding of possible atypical developmental of cortico-cerebellar connectivity (Crippa, 2016). Furthermore, adults with social anxiety disorder show decreased functional connectivity between the cerebellum and the executive control network (Yuan 2017), suggesting cortico-cerebellar connectivity might be involved in atypical social behavior observed in ASD.

Objectives:

Here, we used Regional Homogeneity (ReHo) and seed based correlation analysis to quantify functional connectivity in the cerebellum and the cortico-cerebellar connectivity at 'rest' (fMRI) in neonates with (R+) and without (R-) an established risk factor for ASD. We hypothesized that there would be a group difference on the maturation of intra-cerebellar and cortico-cerebellar functional connectivity.

Methods:

High temporal resolution fMRI during natural sleep was acquired in a Philips 3T Scanner from 18 R+ and 18 R- neonates within the first 4 weeks of life [R+ mean age 42.68 weeks post-menstrual age (PMA); R- mean age 42.24 weeks PMA]. Data pre-processing was implemented in FSL (www.fmrib.ox.ac.uk/fsl), with non-linear spatial normalization into an age-appropriate template space (http://brain-development.org/brain-atlases/multi-structural-neonatal-brain-atlas/). Voxel-wise regional homogeneity (ReHo) values were extracted using AFNI 3dReHo for 27 nearest neighbors per voxel. Unpaired t-tests with permutation testing was used to compare the interaction between age and regional homogeneity maps in the cerebellum between groups with false discovery rate (FDR) correction for multiple comparisons. Next, we calculated the correlation between the mean timeseries of the cerebellum with each cortical voxel for each subject and z-transformed it. The same permutation analysis applied for ReHo was used to compare the cortico-cerebellar z-maps between groups.

Results:

We found an interaction effect of ReHo and age in the cerebellum: ReHo increased with age in the R- group, but it did not in the R+ group (Figure 1). While strongest connectivity with the cerebellum was observed in the somatosensory motor regions, significant differences between groups were observed in the superior parietal and dorsolateral prefrontal cortex in the left hemisphere. R+ had higher functional connectivity between the cerebellum and regions involved in executive control network (Figure 2).

Conclusions:

Our results show infants at risk of developing ASD might be born with and proceed with an atypical maturation of cortico-cerebellar connectivity. Atypical connectivity might be particularly vulnerable in networks that have been previously associated to social anxiety.

4:45 **193.004** Diminished Social Network Connectivity in Infancy Predicts Social Communication in Toddlers with High Likelihood of Autism

R. Haartsen[1], *M. H. Johnson*[2], *T. Charman*[3] *and E. J. Jones*[4], *(1)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom of Great Britain and Northern Ireland, (2)Department of Psychology, University of Cambridge, Cambridge, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom*

Background:
Social difficulties form one of the core features of Autism Spectrum Disorder (ASD), and could be associated with variability during early social brain development. Prospective studies examining sensitive measures of social brain development are critical to further examine this. One promising candidate is theta-band EEG power; greater theta responses to faces compared to objects has been related to communication improvement in toddlers with ASD (Dawson et al., 2012). It remains unknown how infant EEG theta connectivity is modulated by social context. Moreover, it is unclear whether theta connectivity modulations relate to likelihood and diagnostic outcome of ASD, or social-communication skills.

Objectives:

The present study is the first to examine a) how infant theta connectivity is modulated by social context, and b) how these socially elicited responses associate with familial likelihood of ASD, diagnostic outcome, and social-communication abilities during toddlerhood.

Methods:

Infants viewed videos of women singing nursery rhymes and spinning toys during EEG recording at 14 months of age. EEG theta connectivity was calculated using the debiased weighted phase lag index for 4 – 5 Hz. Diagnostic outcome and communication abilities were assessed at 36 months of age using parental interviews, questionnaires, and direct observations. The final sample with clean EEG data included 17 infants with low (LL), and 51 infants with high familial likelihood for ASD (HL); 27 infants showed typical development (HL-TD), 8 infants met criteria for ASD (HL-ASD), and 16 infants showed atypical development at 36 months (HL-Atyp).

We used global connectivity (averaged across all channel pairs) and Network Based Statistics to compare whole brain and connection-level differences between social and non-social conditions within the different likelihood and outcome groups. Spearman's correlations were used to examine associations between theta modulations and communication skills using the Socialization and Communication subscales of the Vineland Adaptive Behaviour Scales-II.

Results:

Whole brain connectivity displayed significant increases during social compared to non-social stimuli ($p < .0001$, $\eta_p^2 = .233$). This difference in whole-brain theta connectivity between social and non-social stimuli was greater in the LL group than the HL group ($p = .011$, $\eta_p^2 = .093$, Fig. 1A), whereas this difference was similar between the HL diagnostic outcome groups ($p = .593$, $\eta_p^2 = .022$).

Further, network analyses showed stronger socially elicited responses for connections between parietal and occipital areas in the LL group;

connectivity in this LL network was significantly stronger than in the HL group ($p < .0001$, $\eta_p^2 = .180$), who showed modulation by social content across a different fronto-parietal network (Fig. 1B).

Finally, individual differences in connectivity within the LL network were associated with later social and communication skills in the whole group of infants (*rho's* ≥ .26, *p's* ≤ .033, Fig. 2).

Conclusions:

Theta connectivity is a promising measure of social brain development in infancy. Alterations in connectivity patterns are present in infants with an older sibling with autism, and relate to later developmental outcomes. Early altered connectivity may reflect atypical interactive specialisation of the social brain in the context of increased likelihood of developmental atypicalities.

Panel Session
Interventions - Non-pharmacologic - School-Age, Adolescent, Adult
194 - Social Skills Training in Autism: Yesterday's Challenges and Tomorrow's Solutions
3:30 PM - 5:30 PM - Room: 516ABC

Panel Chair: Sven Bolte, *Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden*

Discussant: Elizabeth Laugeson, *Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA*

Social skills Training (SST) is a widely used intervention technique in autism practice. Latest research has consistently shown moderate effects in large randomized controlled trials. Still, a multitude of questions remain around SST's effectiveness and efficiency. In addition, self-advocates have been critical of SST. This session provides both a state-of-the-art overview of SST, and insights into the latest developments in addressing challenges and the unknowns of SST in autism. We present new research findings and discuss issues of personalization of SST, its generalization, and cross-cultural validity, as well as the need to redefine outcomes, and optimize administration and dosage.

3:30 **194.001** Fifteen Years of Social Skills Group Training "Kontakt"© - Heading for Precision Support, Dosage Optimization and Long-Term Follow-up

***S. Bolte**, Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden*

Background: KONTAKT(c) is a manualized social skills group program for children and adolescents with ASD aged 8-17 years in the normative IQ range. It uses principles of cognitive behavior therapy, psychoeducation, behavioral activation, cognitive training, and observational learning to increase social communication skills, conflict management and prevention, coping strategies, self-confidence, and daily functional skills. The teaching formats include individual goal identification, group discussions and activities, social and role-play, emotion-processing training, and homework assignments based on functional analysis.

Objectives: To summarize quantitative and qualitative research on KONTAKT from the last 15 years across three countries (Germany, Sweden, Australia), current analyses on genetic and psychiatric comorbidity moderators of the effects of training, and planned register-based long-term follow-up of study participants.

Methods: Two pilot studies in Sweden and Germany were conducted, followed by largest (pragmatic) randomized controlled trial (RCT) in ASD ever on 12 and 24 sessions of KONTAKT against standard care across 13 centers [NCT01854346] (n=296 [12 sessions], n=50 [24 sessions]) in Sweden. Saliva samples were collected from the RCT participants for Copy Number Variations (CNV) analyses . A qualitative responder analysis was also carried-out. Subgroup analyses were conducted for KONTAKTs efficacy in children, adolescents, girls and boys. Further, the potential effects of other mediators and moderators were examined, such as IQ, language level, medication, and psychiatric comorbidity.

Results: The RCT showed that effect sizes for social communication and adaptive functioning improvement were large for participants in the 24-session program (d=0.76-0.82) and moderate for female and adolescent participants in the 12-session program (d =0.33-0.40). Aside of age and sex, participant characteristics that were associated with KONTAKT's efficacy were psychiatric comorbidity and the size of CNVs: Clients with additional anxious-depressed symptoms responded better to KONTAKT, while those carrying large CNVs responded poorer. Extensive qualitative studies of KONTAKT showed a multitude of individual progress not covered by the outcome measures used in the RCT, indicating benefits even in quantitative "non-responders".

Conclusions: These results indicate, for the first time, a substantial dose-response effect for social skills group training in autism, which implies that service providers can reach better results by optimizing the length of intervention. Importantly, we found that age, sex, psychiatric comorbidity, and genomic variation impact on KONTAKT effects, endorsing that personalized training decisions might be meaningful.

3:55 **194.002** Cross-Cultural Adaptation to Australia of the Kontakt© Social Skills Group Training Program for Youth with Autism Spectrum Disorder: A Pilot Study

***S. J. Girdler**[1], B. Afsharnejad[2], M. Falkmer[3], M. H. Black[1], T. Alach[4], C. Coco[5] and S. Bolte[6], (1)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (2)Autism Research Team, Telethon Kids Institute, Perth, Australia, (3)Curtin University, Bentley, Australia, (4)Autism Specific Early Learning and Care Centre, Bedford, Australia, (5)Karolinska Institutet, Stockholm, Sweden, (6)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden*

Background: Social skills group training (SSGT) has shown efficacy in remediating the social communication and interaction challenges faced by adolescents with Autism Spectrum Disorder (ASD). KONTAKT, a SSGT for adolescents with ASD, has demonstrated efficacy in young people with ASD in Sweden and Germany, however its cross-cultural feasibility and efficacy in an Australian context remains unknown

Objectives: This pilot study investigated the feasibility and cultural validity of KONTAKT in improving the social skills of Australian adolescents with ASD

Methods: The KONTAKT manual was translated from Swedish to English and subsequently delivered to 16 adolescents with ASD over 16 one and a half hour sessions. The 16 adolescents formed 2 groups of 8 participants, with each group facilitated by 2 trained therapists from the Autism Association of Western Australia. Using a mix methodology design the cross-cultural feasibility and preliminary efficacy of the 16 week variant of KONTAKT was evaluated. A pre-test post-test design evaluated changes in outcomes including socially meaningful goals, ASD related traits, quality of life, emotion recognition and social anxiety, loneliness via adolescent self-report, parent proxy and blind expert rating at 3 time points: baseline, post intervention and at 3-month follow up. Random effects regression model (linear mixed model) examined changes dependent variables. Focus groups were conducted with adolescents and their parents, and KONTAKT trainers eliciting data in relation to the feasibility and outcomes of the program.

Results: All 16 participants completed the program to the follow up. KONTAKT resulted in most adolescents achieving their self-reported socially meaningful goal ($p<0.001$) and a significant reduction of autism related traits as rated by parents on the SRS-2 ($p<0.05$), with the effect size (Cohen's d) ranging from 0.3 to 0.8. Adolescents with ASD also demonstrated improvements in quality of life. Qualitative data suggested that adolescents, parents and trainers were generally satisfied with the KONTAKT program, but identified several areas for improvement particularly in relation to group activities and homework.

Conclusions: Findings indicate that KONTAKT may support Australian adolescents with ASD in reducing their autism related traits and achieving their socially meaningful goals. The pilot study resulted in finalization of KONTAKT Australia in preparation for evaluation of its efficacy in a randomised controlled trial. This study will be designed to control for the potentially confounding effect of exposure to a social context through the use of an active control group and will undertake a cost utility analysis. Findings will inform our understanding of both the efficacy of SSGT interventions in adolescents with ASD and the relationship between dose and response (number of sessions and changes in outcomes) of social skills training programs. (ANZCTR: ACTRN12617001117303, ClinicalTrials.gov: NCT03294668)

4:20 **194.003** A Single-Blind RCT of an Evidence-Based Social Skills Intervention for Youth with ASD: Effects on Behavioral and Neural Indices of Social Functioning

M. D. Lerner[1], *E. Kang*[2], *T. Rosen*[2], *R. Weber*[3], *C. M. Keifer*[2] *and A. H. Gerber*[2], *(1)Psychology, Stony Brook University, Stony Brook, NY, (2)Stony Brook University, Stony Brook, NY, (3)Stony Brook University, Centereach, NY*

Background: While social skills interventions (SSIs) for youth with autism spectrum disorder (ASD) evince modest effects, it is not clear whether widely-reported parent-report effects of SSIs represent true change, or parent expectations for change (Gates et al., 2017). Furthermore, no study has used rigorous component-control designs to examine whether less subjectively-determined effects are specific to particular elements of those SSIs. The SSI socio-dramatic affective-relational intervention (SDARI; Lerner et al., 2011) uses specific game-like activities putatively designed to provide opportunities for intensive practice of social competence elements (e.g., interpreting tone of voice) in a supportive environment. While SDARI has shown effects on parent-report social skills, observed social behavior, peer sociometrics, and neural indices of social perception (e.g., Lerner & Mikami, 2012; Kang et al., 2017), it is unknown whether SDARI-specific activities (versus nonspecific supportive environment) or parent expectations are responsible for these effects.
Objectives: To examine whether SDARI exerts unique effects on social behavior, peer regard, and neural metrics of social perception. To examine whether effects on parent-report are attributable to expectancy effects.

Methods: 55 youth (M_{age}=12.40, SD_{age}=2.92; 40 male), IQ≥70 and ADOS-2 (Lord et al., 2012)-confirmed diagnoses, were randomly assigned to SDARI or an attention control (8 groups total; 1.5 hours/week, 10 week), which followed a schedule identical to SDARI but used structured recreational activities not inherently social (e.g. art projects). As both conditions were likely to produce some benefit, participants and parents were held unaware of condition. Parents completed a questionnaire battery (e.g., SSIS; Gresham et al., 2010) and indicated the group to which they believed their child had been assigned. Participants completed assessments including EEG-indexed evaluation of social processing (e.g., N170 ERP latency to face; N100 amplitude to voice; Lerner et al., 2013). Participants provided sociometric ratings of one another during the first and final sessions; their prosocial behaviors in unstructured free play for 20 minutes during the middle of each session were coded (Bauminger, 2002) by reliable (ICC(1,2) = .829) raters blinded to time and condition. Generalized Estimating Equations (accounting for nesting within groups) were used.

Results: Parent-report effects on social skills were attributable to the condition to which parents believed their child was assigned, not actual condition (Wald's X^2=6.256, p<.05; Figure 1A). The SDARI group showed a relative acceleration in N170 latency and increase in N100 amplitude (both X^2 >6.00, p≤ .05; Figure 1B-C). While those in SDARI became reciprocated friends more quickly, the attention control caught up (X^2=6.522, p<.05; Figure 1D). The same pattern was seen for interactions with peers (SDARI: X^2=35.87, p<.001; condition*time: X^2=4.87, p<.05).

Conclusions: This blinded RCT supports specificity of SDARI activities on neural indices of social processing, sociometrics, and observer-rated social behavior, but suggests the latter may be accomplished – albeit more slowly – without SDARI activities, a pattern found in a previous RCT (Lerner & Mikami, 2012). It also suggests that parent-report effects are attributable to expectations of condition, not SDARI-specific. Future work should employ such designs to better elucidate what aspects of other SSIs are responsible for their effects.

4:45 **194.004** Parent-Mediation and Teacher-Facilitation As Mechanisms of Change in Social Skills Training: Treatment Outcomes for the PEERS® for Adolescents Intervention

E. A. Laugeson, *Y. S. S. Lograsso, M. Jolliffe and N. E. Rosen, Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA*

Background:
Impaired social skills are known to negatively impact individuals with ASD across the lifespan. While social skills training is a common treatment method, few evidence-based interventions exist to improve social functioning for adolescents on the spectrum (Reichow & Volkmar 2010). Parent-mediated interventions have shown promise in teaching social skills to adolescents with ASD (Laugeson et al., 2009; 2012; Van Hecke et al. 2013; Schohl et al. 2013), and teacher-facilitated interventions have also yielded encouraging findings (Laugeson et al. 2014). While parent and teacher involvement are thought to be important mechanisms of change in social skills training, little is known about the differences in treatment outcomes across these two mechanisms.

Objectives:

The purpose of this study is to: (1) examine changes in social functioning following parent-mediated and teacher-facilitated social skills interventions for adolescents with ASD; and (2) examine differences in treatment outcomes when parents or teachers are included in treatment.

Methods:

Participants included 290 adolescents with ASD (76% male) ranging in age from 11-19 (*M*=14.13; *SD*=1.83). Participants received either parent-mediated (*n*=205) or teacher-facilitated (*n*=85) social skills instruction for 14-weeks using the PEERS® curriculum (Laugeson & Frankel 2010; Laugeson, 2014). Skills focusing on friendship development were targeted. Treatment outcome was measured across the two groups (parent-mediated v. teacher-facilitated) using a battery of standardized and criterion-based measures including the Social Responsiveness Scale-Second Edition (SRS-2: Constantino 2012), Social Skills Improvement System (SSIS; Gresham & Elliott 2008), Test of Adolescent Social Skills Knowledge (TASSK; Laugeson 204), and Quality of Socialization Questionnaire-Adolescent (QSQ-A; Laugeson 2014).

Results:

Paired sample T-tests examining outcomes in the parent-mediated program revealed significant improvement in T-scores on the SRS-2 Total Subscale (pre-test: *M*=77.55, *SD*=9.358; post-test: *M*=68.91, *SD*=10.475; *t*(205)=12.22, *p*<0.01), standard scores on the SSIS Social Skills Subscale SIS (pre-test: *M*=78.34, *SD*=12.68; post-test: *M*=85.75, *SD*=11.67; *t*(205)=10.51, *p*<0.01), social skills knowledge on the TASSK (pre-test: *M*=13.45, *SD*=3.188; post-test: *M*=22.22, *SD*=4.376; *t*(205)=28.504, *p*<0.01), and social engagement on the QSQ-A (pre-test: *M*=2.709, *SD*=3.233; post-test: *M*=5.126, *SD*=4.913; *t*(205)=7.214, *p*<0.01).

Paired sample T-tests examining outcomes in the teacher-facilitated program revealed significant improvement in T-scores on the SRS-2 Total Subscale (pre-test: *M*=77.55, *SD*=9.358; post-test: *M*=68.91, *SD*=10.475; *t*(85)=3.476, *p*<0.01), and standard scores on the SSIS Social Skills Subscale (pre-test: *M*=79.34, *SD*=12.174; post-test: *M*=83.55, *SD*=14.209; *t*(85)=3.555, *p*<0.01), and social skills knowledge on the TASSK (pre-test: *M*=13.45, *SD*=4.376; post-test: *M*=22.22, *SD*=4.376; *t*(85)=3.476, *p*<0.01). Significant improvements were not observed on the QSQ-A.

In order to compare differences in treatment outcome across the two groups (parent-mediated v. teacher-facilitated), independent samples T-tests were conducted. Significant differences in change scores were observed across the groups on the SRS-Total Subscale (parent-mediated: *M*=8.646, *SD*=10.156; teacher-facilitated: *M*=3.069, *SD*=8.190; *t*(195.72)=4.514, *p*<0.01), SSIS Social Skills Subscale (parent-mediated: *M*=7.408, *SD*=10.116; teacher-facilitated: *M*=4.209, *SD*=10.980; *t*(290)=2.401, *p*<0.05), social skills knowledge on the TASSK (parent-mediated: *M*=8.777, *SD*=4.419; teacher-facilitated: *M*=4.605, *SD*=3.692; *t*(290)=7.702, *p*<0.01), and social engagement on the QSQ-A (parent-mediated: *M*=2.418, *SD*=4.81; teacher-facilitated: *M*=-0.093, *SD*=3.154; *t*(237.42)=5.259, *p*<0.01).

Conclusions:

Findings reveal that while both program are efficacious, parent-mediation, in comparison to teacher-facilitation, is a greater mechanism of change in social skills training using the PEERS® curriculum.

Panel Session
Medical and Psychiatric Comorbidity
195 - Where Do We Go from Here? Learning How to Prevent Suicide in Partnership with Autistic People and Their Allies.
3:30 PM - 5:30 PM - Room: 518

Panel Chair: Sarah Cassidy, *School of Psychology, University of Nottingham, Nottingham, United Kingdom*

Discussant: Jacqui Rodgers, *Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom*

Autistic people are at increased risk of suicide compared to the general population. This year's INSAR policy brief thus identified the top 10 research and policy priorities to prevent suicide in autism, in partnership with autistic people and their allies. This panel will discuss the findings and implications of this policy brief, in the context of current international suicide in autism research. First, a reflection from a lived experience perspective on the policy brief findings, and importance of researchers working in partnership with autistic people and their allies to decide priorities which will affect their lives. Second, the latest international research findings in relation to effectively understanding, identifying and managing risk of self-harm and suicide in autistic people will be discussed. Third, we will discuss where we go from here to improve our understanding of suicide prevention in autism.

3:30 **195.001** Measurement Properties of the Suicide Behaviours Questionnaire - Revised in Autistic Adults.

S. A. Cassidy[1], *L. Bradley*[2], *R. Shaw*[3], *E. Bowen*[4], *M. Glod*[5], *S. Baron-Cohen*[6] *and J. Rodgers*[5], *(1)School of Psychology, University of Nottingham, Nottingham, United Kingdom, (2)Coventry University, Coventry, United Kingdom, (3)NHS Coventry and Warwickshire Partnership Trust, Warwickshire, United Kingdom, (4)University of Worcester, Worcester, United Kingdom, (5)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom, (6)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: The Mental Health in Autism project (MHAutism) aims to develop a new suicidality assessment tool for autistic adults – a group at high risk for dying by suicide. Our systematic review found no studies exploring suicidality in autistic adults had yet used a tool with evidence of validity, and no suicidality assessment tool had yet been developed for this group. However, we identified the Suicidal Behaviours Questionnaire – Revised (SBQ-R) as a promising candidate tool to adapt for autistic adults. The current study explores the appropriateness and psychometric properties of the SBQ-R in autistic compared to general population adults, to inform future adaptations.

Objectives: First, to explore whether the SBQ-R similarly captures the same latent construct (suicidality) in autistic compared to general population adults. Second, to explore how autistic adults interpret and respond to the items of SBQ-R.

Methods: First, 188 autistic adults (76 male) and 183 general population adults (62 male) completed the SBQ-R online. Multi-group factorial invariance (MFI) analysis compared the structural equivalence of the SBQ-R between the groups. Cognitive interviews subsequently explored how a sub-group (*n* = 15) of autistic adults interpreted and responded to the items of the SBQ-R.

Results: MFI analysis of the online survey data found evidence for configural but not metric invariance of the SBQ-R, with significantly different factor loadings between groups for items three (communication of suicide threat to others) and four (future suicidal intent) of the questionnaire.

Consistent with these findings, cognitive interviews revealed different interpretation of questions requiring abstract future thinking, social and communication skills, and absence of items which captured the unique presentation of suicidality in autism.

Conclusions: Findings suggest that autistic adults attribute a different meaning to some items on the SBQ-R compared to general population adults, and absence of items which capture the unique presentation of suicidality in autism. These results will be used to adapt the SBQ-R to better capture suicidality in autistic adults.

3:55 **195.002** "Where Do We Go from Here?" Identifying the Top 10 Priorities to Prevent Suicide in Partnership with Autistic People.

***J. Adams**, Flow Observatorium, Portsmouth, United Kingdom*

Background: Traditionally, priorities for future research were not decided by those affected by research, which resulted in a lack of research relevant to the day to day lives of autistic people. To address this, partnerships between autistic people and their allies are being developed, to ensure that autistic people have a strong voice in the direction of future research. One example of this new form of partnership, is INSAR's 2019 policy brief, which aims to identify the top 10 research and policy priorities to prevent suicide in partnership with autistic people and their allies.
Objectives: To provide a reflection, as an autistic person with lived experience, on the development of participatory research, the process of the INSAR policy brief, and the top 10 priorities identified in partnership with autistic people.

Methods: First, a summit, with equal representation of autistic, researcher, charity and service provider perspectives, discussed and identified a range of research and policy priorities to prevent suicide in autism. Second, an online survey, with equal weighted representation of autistic, researcher, charity, service provider and policy maker perspectives, prioritised and refined this longer list of priorities for discussion at a 2-day meeting. Third, the INSAR policy brief meeting brought together equal representation of these groups to identify the top 10 research and policy priorities to prevent suicide in autistic people.

Results: The top 10 priorities for future research and policy will be identified and discussed at the INSAR policy brief meeting, on the 4th and 5th April 2019, prior to presentation in this panel at the INSAR 2019 meeting. I shall reflect on the overall process and findings, as an autistic person with lived experience of the issues at hand.

Conclusions: Research which positively affects the lives of autistic people can only be achieved in close partnership between autistic people and their allies. It is important that we learn from examples of participatory working, such as this INSAR policy brief, to ensure that autistic people have a strong voice in the direction of future international research and public policy. This will help ensure that autism research and policy initiatives are useful to autistic people.

4:20 **195.003** Screening for Suicide Risk in Children with Autism and Related Disabilities in a Pediatric Autism Center.

***P. H. Lipkin**[1], S. Rybczynski[2], T. Ryan[3] and H. C. Wilcox[4], (1)Medical Informatics, Kennedy Krieger Institute, Baltimore, MD, (2)Kennedy Krieger Institute, Baltimore, MD, (3)Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (4)Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD*

Background: Suicide thoughts and behaviors are reported at high rates in people with autism spectrum disorder (ASD). With high rates of suicide in the general population, suicide risk screening has been promoted during medical visits to US health care facilities by The Joint Commission since 2016.
Objectives: Determine suicide risk in children with ASD seen during medical visits using a suicide risk screening instrument at a specialty developmental medical center; and examine clinical characteristics of those with screening-identified suicide risk.

Methods: Suicide risk screening was performed on children ages 8 to 17 years seen for a medical visit at the Center for Autism and Related Disorders at the Kennedy Krieger Institute, a specialty children's developmental health facility, as part of an institutional quality improvement project over five months. The "Ask Suicide Screening Questions" (ASQ) was completed by nursing staff through child or parent/guardian interview before seeing a physician. Screening results, demographics, and clinical characteristics of those with ASD and identified suicide risk were analyzed, including past and current ideation and attempts, associated mental health diagnoses, therapies, medications, and family history of suicide.

Results: There were 775 children eligible for screening between August 2017 and January 2018. 542 were screened; 30% (233) eligible declined. 58 (10.7%) children demonstrated suicidal risk. Risk was two-fold higher in white children. 48 (8.9%) had confirmed or probable ASD diagnosis (73% male; 71% white; median age 12 years [range 8-17]). Of those with ASD screening at suicide risk, 40 (83%) were child-completed, 8 (17%) by the parent /guardian.

On the ASQ questions, 27 (56%) of the 48 children with ASD wished they were dead in the past few weeks, 16 (33%) thought they or family would be better off if they were dead, 17 (35%) had suicide thoughts within the past week, and 22 (46%) reported trying to kill themselves. Five (6%) were actively suicidal at screening; one was sent to the emergency department. None required hospital admission.

Chart review indicated that 44 (92 %) of the children with ASD who screened at risk had psychiatric comorbidities, with 15 (31%) having one disorder and 29 (60%) two or more. 35 (73%) had a history of ADHD, 28 (58%) anxiety, and 15 (31%) depression. Four (8%) had family history of suicide. They had high rates of mental health treatment (39; 81%), with 35 (73%) receiving psychiatric care and 29 (60%) psychotherapy. 40 children (83%) were currently treated with psychotropic medication, with 38% (18) taking one and 46% (22) two or more. 21 (44%) received an SSRI, 20 (42%) stimulant, and 12 (25%) antipsychotic medication.

Conclusions: Suicide risk screening in children with ASD at a specialty medical center demonstrates that suicide thoughts and attempts are common. Those with suicide risk have high rates of psychiatric comorbidity and are commonly treated with medication and psychotherapy. Children with ASD seen in specialty centers, particularly those receiving mental health treatments, are at high risk and should be screened for suicidal behavior as part of best clinical practice.

4:45 **195.004** The Phenomenology of Non-Suicidal Self-Injury in Autistic Adults.

***A. E. Robertson**[1], L. Bradley[1], R. Shaw[2], M. Pelton[1], B. B. Maddox[3], S. W. White[4], A. T. Wieckowski[5] and S. A. Cassidy[6], (1)Coventry University, Coventry, United Kingdom, (2)NHS Coventry and Warwickshire Partnership Trust, Warwickshire, United Kingdom, (3)University of Pennsylvania, Philadelphia,*

PA, (4)Psychology, The University of Alabama, Tuscaloosa, AL, (5)Western Psychiatric Institute and Clinic, University of Pittsburgh Medical Center, Pittsburgh, PA, (6)School of Psychology, University of Nottingham, Nottingham, United Kingdom

Background:
Non-suicidal self-injury (NSSI) is defined as socially unsanctioned harming of the body without suicidal intent. Two studies have shown increased rates of NSSI in autistic (50-65%) compared to non-autistic adults (5-30%), and similar phenomenology of NSSI in a small sample of autistic and non-autistic adults (*n*=42). Larger scale studies are needed to confirm similarities and differences in NSSI behaviour between autistic and non-autistic adults, to inform new assessment and treatment strategies for autistic people. As many autistic adults are currently undiagnosed, and mental health problems are the most common presenting concern prior to being diagnosed autistic, it is important to include adults who self-identify as autistic but have not yet been formally diagnosed.

Objectives:

To compare the phenomenology (methods, frequency, severity, functions, and initial motivations) of NSSI between autistic, self-identified autistic, and non-autistic adults.

Methods:

An online cross-sectional survey in the UK and USA, measuring NSSI (Non-Suicidal Self-Injury – Assessment Tool; NSSI-AT), in: 1) *n*=132 autistic adults (UK), 2) *n*=56 self-identified autistic adults (UK), 3) *n*=57 non-autistic adults (general population) (UK), and 4) *n*=257 non-autistic adults (undergraduate students) (US).

Results:

Rates of NSSI differed across the samples, with more autistic adults (66.5%) and self-identified autistic adults (70.4%) endorsing NSSI than UK (29.6%) and US (20.5%) non-autistic adults. Autistic adults reported significantly more episodes of NSSI across their lifetime than non-autistic UK [$t(187) = 4.87$, $p<.001$] and non-autistic US adults [$t(288.1) = 11.28$, $p<.001$], but not self-identified autistic adults. There were also significant differences in certain self-reported forms, functions, motivations and wound locations of NSSI in autistic compared to non-autistic adults. Conversely, there were no significant differences – with the exception of one item – between autistic and self-identified autistic adults. Autistic adults also reported being significantly more likely to injure themselves in the future than non-autistic adults [UK: $t(186) = 5.27$, $p<.001$; US: $t(387) = 8.82$, $p<.001$], but not self-identified autistic adults. Overall, the endorsement of NSSI-AT items was very similar between autistic and self-identified autistic adults (Table 1).

Conclusions:

We compared the phenomenology of NSSI behaviour in a large sample of autistic, self-identified autistic, and non-autistic adults. Autistic adults reported a wider range of forms and functions of NSSI, different initial motivations for NSSI, reported injuring more parts of their body, a higher number of NSSI episodes in their lifetime, and increased likelihood of future self-injury, compared to two samples of non-autistic adults. Interestingly, the phenomenology of NSSI was very similar between the autistic and self-identified autistic group. Our results have important implications for clinical practice, as there is very little awareness of NSSI in autistic people, as traditionally defined in the general population. Self-identified autistic adults (i.e. those who identify as autistic but do not have a diagnosis) are also a high-risk group for NSSI, and further research is needed to explore their specific needs.

Panel Session
Medical and Psychiatric Comorbidity
196 - Sleep, Circadian Neuroscience, and Autism across the Lifespan
3:30 PM - 5:30 PM - Room: 517B

Panel Chair: Beth Malow, *Sleep Disorders Division, Department of Neurology, Vanderbilt University Medical Center, Nashville, TN*

The theme of this panel is to explore the relationship of sleep and circadian neuroscience to autism in children, adolescents, and adults. The session will begin with the basic science of sleep and circadian rhythms, followed by genetic contributors. Clinical aspects and behavioral and pharmacological interventions will then be discussed.

3:30 **196.001** The Circadian Timekeeping System As a Window into Neurodevelopmental Disorders

***J. Lipton**, Boston Children's Hospital, Harvard Medical School, Boston, MA*

Sleep is a ubiquitous animal behavior that still remains a fundamental mystery. Among the least understood aspects of sleep is that its expression and architecture are highly regulated during animal development. Sleep is crucial for learning and memory, mood regulation, and metabolic health. It is not surprising then that sleep dysfunction is particularly common in children with neurodevelopmental disorders including autism spectrum disorders (ASD). Sleep is regulated by the combined influences of a homeostatic mechanism and the circadian clock. The clock is a multi-scaled biological timekeeping system that synchronizes gene expression, physiology, metabolism, and behavior with the 24 hour oscillations of the light/dark cycle.
There is an abundance of evidence from both the clinic and animal models that suggests a strong interplay between circadian rhythms and ASDs, however the mechanisms remain an area of active inquiry. I will review the molecular and cellular biology of the circadian clock and its links to animal and clinical models of ASD. I will review how the biology underlying syndromic disorders related to ASD such as Tuberous Sclerosis Complex, Fragile X Syndrome, and Angelman's syndrome is intimately intertwined with circadian biology. I will suggest that many ASDs (and related disorders) are, at a fundamental level, 'rhythm-opathies'.

The nexus between circadian clocks, sleep, and ASD is a new and important frontier that will lead to new targets and new therapies.

3:55 **196.002** Genetic Mechanisms Connecting Autism with Sleep & Circadian Rhythms

***O. Veatch**, University of Pennsylvania School of Medicine, Philadelphia, PA*

Sleep and circadian rhythm disorders are common in individuals with ASD. Disturbed sleep is shown to exacerbate core symptoms of ASD. Sleep problems may also intensify expression of other serious ASD comorbidities, such as epilepsy. Sleep has strong, neuronal-specific effects on the function of molecular, cellular and network mechanisms of neuronal plasticity. Further, studies in model systems indicate that sufficient sleep promotes proper neurodevelopment. In addition, mistimed sleep (i.e. mismatch between endogenous circadian rhythms and preferred sleep/wake schedule) is associated with a number of negative health outcomes and has been observed to disrupt physiological rhythms and circadian regulation of the transcriptome. Given the observations that disturbed sleep relates to more severe symptoms in ASD and that sleep is important to neuroplasticity, it is likely there is a crucial window during neurodevelopment where the quality of sleep has a lasting impact on neurological function. As such, the need for effective treatments for sleep disorders in ASD is profound. Understanding the causes and consequences of sleep disturbances in children with ASD is an important step toward mitigating these symptoms. It is possible that ASD symptoms drive disturbed sleep or that expression of ASD symptoms with comorbid sleep disturbances are modified by convergent genetic risk factors. Notably, the known biological functions for recurrently implicated genes in ASD suggest involvement of convergent molecular mechanisms. Evidence also indicates many of these convergent mechanisms overlap with those associated with risk for sleep disorders and expression of circadian rhythms. This suggests that pleiotropic genetic effects contribute to sleep and/or circadian disorders in some individuals with ASD. Understanding the genetic architecture underlying the relationship between ASD and expression of sleep and circadian disturbances may provide evidence useful toward optimizing more effective, personalized treatments in this population. This presentation will offer a broad overview of key findings from genetic studies of ASD, sleep traits, and circadian rhythm regulation highlighting shared genetic mechanisms that may underlie expression of sleep and circadian rhythm problems in ASD.

4:20 **196.003** Clinical and Circadian Aspects of Poor Sleep Quality

***A. L. Richdale**, Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia*

This presentation will briefly cover basic information about sleep structure, sleep as a circadian rhythm, and the impact of poor sleep quality as a background to discussion of the clinical and circadian aspects of sleep difficulties in autism spectrum disorder and their impact across the lifespan. Sleep has a circadian structure, with 24-hour cycles of waking and sleeping governed by the suprachiasmatic nucleus, and the neurohormone melatonin. The primary zeitgeber for the sleep-wake cycle is the light-dark cycle.Likewise the sleep EEG structure and pattern changes through infancy and early childhood, resulting in approximately 90-minute cycles of rapid eye movement sleep (REM) and non-REM sleep in children and adults. Poor sleep quality can negatively impact learning and memory, mood and behaviour, and physical health. While there is a vast array of sleep problems, the most common are those associated with sleep onset and maintenance, and insufficient sleep. Sleep disorders most commonly associated with these symptoms include behavioural sleep disorders in childhood, insomnia, and circadian sleep-wake rhythm disorders (CSWRDs). Poor sleep in autism begins in early childhood, when sleep patterns begin to deviate from those of age-matched peers, continuing into at least middle age. Across this age range some 50-80% of autistic individuals will suffer from significant symptoms of insomnia or CSWRDs, and at least in childhood, these sleep problems are often chronic. Sleep problems in children with autism spectrum disorder can also have a significant behavioural component. In autism associations between poor sleep quality and intensified autistic symptomatology, aggression, peer relationships, psychopathology, unemployment, screen time, gastrointestinal symptoms, melatonin and clock genes are reported. Parents' sleep and wellbeing is also affected. Nevertheless, the aetiology of increased susceptibility to poor sleep quality in autistic individuals remains unknown. There are likely subgroups and multiple causal factors including hyperarousal and differences in the melatonin rhythm. Research that examines aetiology, impacts on the individual with autism, and intervention is required.

4:45 **196.004** Approaches to Improving Sleep in Autism across the Lifespan

***B. A. Malow**, Sleep Disorders Division, Department of Neurology, Vanderbilt University Medical Center, Nashville, TN*

Sleep problems are common in children with autism spectrum disorder and persist into adolescence and adulthood. Improving sleep can impact favorably on an individual's overall health, as well as daytime behavior and quality of life. Family quality of life may also improve when a child's sleep is improved. This presentation will discuss behavioral and pharmacological approaches to treating sleep problems in autism across the lifespan, with an emphasis on insomnia (defined as difficulty initiating or maintaining sleep).
For insomnia, supplemental melatonin is the most studied agent, and is effective in many individuals with autism with minimal adverse effects. Novel preparations of prolonged-release melatonin, which also improve night wakings, and melatonin agonists are becoming more available. However, the mechanisms whereby melatonin and melatonin agonists promote sleep are not clear, and in many individuals, insomnia may persist after treatment with melatonin. A wide variety of other medications are used to treat insomnia in autism, many with minimal evidence and significant potential for adverse effects. Behavioral sleep education and other non-pharmacological approaches have shown promise, although additional study is needed for how to effectively deliver these interventions, combine them with medications, and tailor treatments to individuals across the autism spectrum. The use of practice pathways to guide treatment, along with questionnaires and actigraphy to monitor treatment, will also be addressed.

Panel Session
Neuroimaging
197 - Advances in Mechanisms of ASD Connectopathy: Multiscale Perspectives
3:30 PM - 5:30 PM - Room: 517A

Panel Chair: Adriana Di Martino, *The Child Mind Institute, New York, NY*

The last decade has witnessed a burgeoning of neuroimaging studies substantiating models of atypical brain connectivity in Autism Spectrum Disorder (ASD) – connectopathy. Yet, their promise to lead to clinically useful ASD biomarkers remains unmet. A key challenge has been the variation of neuroimaging findings across studies. In fact, mixed reports of hypo- and/or hyper-connectivity affecting a range of neural circuits have left the precise nature of ASD connectopathy unclear. Additionally, a primary investigative focus on phenomenology has limited the progress on capturing underlying mechanisms. Here, we will introduce state-of the-art multidisciplinary work aimed to address these gaps. To this end, empirical findings from studies on idiopathic and/or genetically determined ASD, using multiscale time and space investigations will be presented. These will be integrated with studies targeting heterogeneity as a source rather than a confound and emphasizing replicability and reproducibility. In doing so, this panel will provide an advanced framework highlighting the next steps necessary for delineating clinically useful biomarkers and discerning the mechanisms at the origin of brain connectopathy in ASD.

3:30 **197.001** A Study of Cortical Functional Network Hierarchy: A Novel Perspective on Atypical Connectivity of Autism

***B. Bernhardt**, Neurology and Neurosurgery, Montreal Neurological Institute, Montreal, QC, Canada*

Background:
Together with its parallel and modular architecture, network hierarchy has been widely recognized as key principle of human brain organization. This overarching system is thought to facilitate abstract, high-order cognitive functions by helping segregate information that reflects sensory and motor interactions with the immediate environment from more self-generated operations emerging in transmodal, integrative cortices. As ASD is linked to deficits both in sensory processing and high-level cognitive functions such as theory of mind, analysis of macroscale brain network hierarchy may provide a parsimonious account to consolidate its diverse symptoms.

Objectives:

I will present novel findings from resting-state functional MRI (rs-fMRI) connectome analysis, harnessing recent analytical approaches to characterize hierarchical segregation between higher order transmodal areas and lower order systems in a multi-site cohort of individuals with autism and typically-developing controls

Methods:

We studied 103 males with ASD and 108 neurotypical males from three sites of the ABIDE dataset. Rs-fMRI time series were mapped to cortical surfaces in subject-specific space, followed by time-series cross-correlation of all surface-points. Nonlinear connectome compression techniques identified principal gradients of spatial variations in connectivity across the cortical mantle in individual subjects. Following Procrustes alignment, we used surface-based linear models to compare gradient scores in ASD to controls, controlling for site, age, and multiple comparisons. We furthermore carried out a systematic step-wise functional connectivity (SFC) analyses initiated in primary sensory seeds (primary visual, auditory, somatosensory cortex). Supervised pattern learning leveraged hierarchy features to predict symptom severity as indexed by the Autism Diagnostic Observation Schedule (ADOS) within a 5-fold cross-validation setting.

Results:

Compared to typically-developing controls, ASD showed contracted rs-fMRI connectome gradients, indicative of atypical hierarchical segregation, between higher-order transmodal areas and lower order systems. While SFC patterns in controls recapitulated gradient-based findings, showing a selective convergence of sensory-initiated connectivity in default mode core hubs**,** ASD presented with distorted patterns and a failure to converge in the default mode network. Effects were reproducible across included sites, in an independent validation dataset (n=110; 53 ASD, 57 neurotypical individuals), and with respect to several rs-fMRI processing choices. Using supervised pattern learning, we could furthermore show that imaging features capturing hierarchical network imbalances predict symptom severity in individuals with ASD, supporting the behavioral relevance of our findings.

Conclusions:

Our study shows that ASD is characterized by perturbations in macroscale cortical hierarchy, which may consolidate its seemingly paradoxical combination of low-level and higher-order symptoms.

3:55 **197.002** Using MEG to Measure Rhythm Specific Functional Connectivity in ASD

***T. Kenet**, Massachusetts General Hospital, Charlestown, MA*

Background:
Since about 2004, findings of functional connectivity (FC) abnormalities have motivated an important line of research on the neurophysiological etiology of autism spectrum disorder (ASD). These findings led to the framing of ASD as a disorder of brain connectivity, with the most common hypothesis being that long-range FC is abnormally reduced in the brain in ASD, and local FC is abnormally increased. While appealing in its simplicity, this idea has been repeatedly challenged over the past few years by inconsistent and conflicting findings. In parallel, the importance of the cortical rhythms has become central in the study of both normal and abnormal brain function. However, despite many studies in Autism Spectrum Disorders (ASD), there remains a gap in our understanding of how the 5 intrinsic neuronal rhythms delta, theta, alpha, beta and gamma contribute to cortical function abnormalities in ASD in general, and across different spatial scales of functional connectivity more specifically.

Objectives:

To test rhythm specific functional connectivity abnormalities in ASD, both locally, and across distant cortical regions (long-range), from childhood through adolescence.

Methods:

We used source localized magnetoencephalography, which has millisecond temporal resolution and good spatial resolution, to probe frequency-band specific functional connectivity differences in ASD across a range of paradigms, spatial scales, and measures. We examined the results in a wide age range (7-18); sample sizes varied by paradigm, and ranged from about 15 to 40 per group.

Results:

Results from multiple paradigms converged towards normal or reduced local functional connectivity in ASD, alongside increased functional connectivity in the bottom-up direction and reduced functional connectivity in the top-down direction. More specifically, results from a

somatosensory based paradigm indicated increased long-range functional connectivity in ASD in the bottom-up direction alongside reduced local functional connectivity. Results from visual somatosensory paradigms indicated reduced local and top-down long-range functional connectivity. Results from resting state were consistent with reduced long-range functional connectivity in the top-down direction, manifesting in the beta (13-30Hz) frequency band, and increased long-range functional connectivity in the bottom-up direction, manifesting in the gamma (30-80Hz) frequency band. In parallel, we also found that the results were dependent on the age of the participants, which shifts occurring over adolescence.

Conclusions:

The pattern of functional connectivity abnormalities in ASD is extremely complex, and cannot be reduced to general hypotheses. Spatial scale (local versus long-range) is a critical variable when considering these abnormalities, but even when narrowing down spatial scale, factors such as the specific frequency band, age of the participants, directionality, and the paradigms used, need to be considered carefully.

4:20 **197.003** Are There Reproducible and Replicable Connectivity Patterns in the Intrinsic ASD Connectome?

***A. Di Martino**, The Child Mind Institute, New York, NY*

Background:

Heterogenous reports of hypo- and/or hyper-connectivity affecting different neural circuits have cast doubts on the validity and utility of connectivity models of ASD. Recently the field has begun to amass the samples and approaches necessary to test robustness and reproducibility of findings. This is a critical step towards the testing and refinement of connectivity models.

Objectives:

To examine, using multiple and relatively large samples, the extent to which patterns of mixed hypo- and hyper- connectivity in ASD are consistent, are represented by distinct connectivity subtypes, and associated to specific functional neuronal systems, clinical impairments and biological sex.

Methods:

Three resting state fMRI (R-fMRI) studies of large-datasets examining the whole brain architecture will be presented. *Study 1* examined functional connectivity cortical and subcortical units in an independent male-only sample selected from ABIDE II using the same criteria as the original ABIDE I report (N=298 ASD and N=339 typically developing controls [TC]). *Study 2* (collaboration with T Yeo's laboratory at U Singapore) applied a Bayesian model inge identification of latent distinct, but possibly overlapping, connectivity factors in a sample of both males and females (F) selected from ABIDE II and GENDAAR (N=306 ASD, N=348 TC). Associations with clinical measures were analyzed using canonical correlations. *Study 3* examined the reproducibility of diagnosis, sex and sex by diagnostic interaction effects across multiple R-fMRI metrics in the same dataset (ABIDE I and II: N= 444 [82 F] ASD, N=576 TC [166 F]) analyzed with different pipelines and across independent samples after removing batch effects (GENDAAR: N=87 ASD [44 F], N=89 TC [53 F]; EUAIMS: N=173 ASD [43 F]; N=153 TC [48 F]). Analyses were conducted controlling for micromotion at the individual and group levels and using stringent statistical correction.

Results:

Study 1: consistent with prior results in ABIDE I sample, analyses revealed whole-brain pattern of coexisting hypo and hyper-connectivity in ASD relative to TC. Hypo-connectivity characterized cortico-cortical regions albeit with a lesser extent than previous findings. Hyperconnectivity affected subcortico-cortical circuits with primary somatomotor and unimodal association units being mostly affected. *Study 2*: Bayesian analyses revealed three dissociable whole-brain connectivity factors, each with coexisting ASD-related hypo and hyper connectivity. Importantly, most ASD participants expressed multiple factors with different degree of probability; each factor each was differently associated to core ASD, comorbid symptoms or sex. *Study 3:* While statistically significant effects of diagnosis, sex and their interactions identified in the ABIDE II dataset were largely robust to the preprocessing pipeline, their replicability across samples varied with by R-fMRI metrics and particularly for diagnostic effects.

Conclusions:

Mosaic patterns of co-existing hypo- and hyper- connectivity characterize ASD. Their variation in the specific network and metrics affected underscore the relevance of emerging data driven approaches accounting for heterogeneity. Findings that differential combination of brain functional connectivity represent each individual are consistent with models of continuous ASD heterogeneity. Challenges in identifying reproducible sex differences in the neural basis of ASD likely reflect the relatively limited availability of data in affected females and identifies a gap needing greater attention.

4:45 **197.004** Mapping the Neuro-Connectional Landscape in Autism with Cross-Species fMRI

***A. Gozzi**, Istituto Italiano di Tecnologia, Functional Neuroimaging Lab, Centre for Neuroscience and Cognitive Systems, Rovereto, Italy*

Background:

Functional brain mapping using resting-state functional magnetic resonance imaging (rsfMRI) and other imaging techniques has revealed prominent, yet highly heterogeneous abnormalities in interregional connectivity in individuals with autism. However, several fundamental questions as to the origin and significance of this phenomenon remain unaddressed.

Objectives:

This research tackles two major open questions in the field: (a) does genetic or etiological variability associated with autism account for the heterogeneous rsfMRI findings observed network disruption? (b) Can we link individual autism-associated genetic etiologies or pathophysiological motifs to specific patterns of rsfMRI dysconnectivity?

Methods:

We have developed rsfMRI-based methods for connectivity mapping in the laboratory mouse, where genetic determinants and neuronal activity can be controlled with high precision. To probe the translational relevance of our measurements, we have mapped and compared rsfMRI connectivity patterns in human carrier of 16p11.2 deletion (*del*; SFARI VIP cohort), and a mouse line harboring an orthologous chromosomal

deletion. We have next applied our rsfMRI approach to map N = 20 different mouse lines (collaboration with ETH, Zurich) harboring high-penetrance mutations associated to syndromic forms of autism, with the aim to identify etiologically-relevant connectional fingerprints representative of human ASD heterogeneity.

Results:

We observed remarkable correspondences between mouse and human fMRI network organization, enabling a direct extrapolation of imaging features across species. Corroborating the translational relevance of our approach, rsfMRI mapping in human 16p11.2 *del* patients and a mouse model recapitulating the same genetic defect, revealed highly consistent prefrontal hypoconnectivity. We next applied this approach to multiple mouse lines harboring autism-associated mutations. Results showed that different genetic etiologies can give rise to diverse even diverging, yet classifiable cross-mutational connectivity fingerprints, and that these alterations are associated with disrupted fMRI network dynamics.

Conclusions:

Our results establish a mechanistic link between specific neuro-genetic etiologies and distinct patterns of dysconnectivity and point at a key contribution of etiological variability to the observation of heterogeneous patterns of connectivity in ASD. The implication of these findings for the origin and mechanistic interpretation of rsfMRI findings in human ASD studies will be critically discussed.

Oral Session -
Invited, Keynote Speakers, Awards
199 - Keynote Address - Vikram Patel, MBBS, PhD
5:30 PM - 6:30 PM - Room: 517A

5:30 From Clinics to Communities: Addressing Global Disparities in Autism Care

***V. Patel**, Harvard Medical School, Boston, MA*

The vast majority of the world's children with autism live in low and middle income countries; in contrast, the vast majority of the resources to support families and children impacted by autism are concentrated in high income countries. As a result, the detection and diagnosis of autism in low income settings is delayed by several years; and for those families and children who are able to get a diagnosis, only a tiny proportion will receive any clinical intervention. Those that do will often be relying entirely on poorly evidenced specialized care of uncertain quality at high out-of-pocket cost. This lecture will describe the innovative approaches of a program of research in South Asia which has sought to address these large detection and care gaps. The approach has adapted well-evidenced practice in UK into low resource settings using community delivered technology and front-line worker enabled interventions, and has done this without loss of original intervention quality or effectiveness. The focus will be to consider how such approaches may help expand access to evidence based care for the large majority of the world's children who are currently unreached.

Poster Session
200 - Adult Outcome: Medical, Cognitive, Behavioral, Social, Adaptive, Vocational
5:30 PM - 7:00 PM - Room: 710

1 **200.001** Educational Outcomes from a Longitudinal Study of the SSC Cohort

***B. Vernoia**[1], E. Brooks[1], C. W. Lehman[1], L. A. Green Snyder[1], K. Walton-Bowen[2] and W. K. Chung[3], (1)Simons Foundation, New York, NY, (2)Clinical Research Associates, LLC, New York, NY, (3)Pediatrics, Columbia University, New York, NY*

Background: The Simons Simplex Collection (SSC) contains 2,644 families, each with only one family member with an Autism Spectrum Disorder (ASD). Approximately 1,500 participants joined the online research registry SSC@IAN (Interactive Autism Network) and were invited to complete an online longitudinal follow-up study questionnaire. This study examines predictors of educational outcomes in dependent and independent adults with ASD.

Objectives: To describe educational outcomes in adults with ASD in SSC.

Methods: Full scale IQ (FSIQ), Autism Diagnostic Observation Schedule (ADOS) and Vineland Adaptive Behavior Scales-2ndeditionwere collected at baseline in 8 to 17-year olds in the SSC, and education history and other updates were completed at follow-up an average of 8 years later. Regression analysis was conducted for predictors of current and completed level of education, specifically college attendance.

Results: Of 84 dependent and 23 independent adults completing the follow-up survey, 80% were male, and the majority of the sample was of European ancestry (88%). The mean age at follow-up was 21 years (range 18 to 26). 78% of adults declared independent had average-or-above IQ in childhood vs. 20% of those declared dependent. Together, at baseline, FSIQ distribution showed: 41% <70 (impaired), 14% 70-79 (borderline-impaired), 12% 80-89 (low average), 17.7% 90-109 (average), 5.6% between 110-119 (high average), 9.3% >120 (superior and very superior range). 67.2% had fluent speech (Module 3/4), but mean Vineland expressive language age equivalent (AE) was 5.2 years. Mean ADOS Calibrated Severity score (CSS) was 7.6.

Level of completed education at follow-up was categorized as: alternate special education diploma (39.6%), high school diploma or GED (37.5%), some college coursework (6.2%), bachelor's degree (10.4%), and other/ "not sure" (6.3%). In terms of those currently attending school (55%), 49% are attending high school, 11%, vocational/trade school, and 40%, college.

Of those who completed a bachelor's degree or some college, including those currently attending college, 70% had average-to-above average IQ at baseline, while 30% had below average to impaired IQ. 97% had fluent speech by school age (ADOS Module 3). Mean expressive language AE was 7 years (range 2-10.5) at baseline. 73.3% had a moderate to severe CSS (6-10).

In multiple regression analysis, FSIQ score significantly predicted college attendance (p<.0005), while severity (CSS) and language level (ADOS module or Vineland expressive AE) were not significant.

Conclusions: Outcome in adulthood is a common concern of parents of children with ASD. The SSC@IAN cohort provides the opportunity to investigate longitudinal outcomes. Of the now-adult SSC participants who completed the follow-up study, over 25% later attended college, including those who are not legally independent in adulthood. Individuals who go on to attend college show a surprisingly wide range of IQ and symptom severity; however, similar to other outcome research in ASD, IQ is the best predictor of later attainment. Identification of reliable predictors can helpfamilies to prepare for the future.

2 **200.002** Educational and Vocational Disengagement of Young Adults with a Special Education Need and Autism in the United Kingdom

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Background: Successful transition to adulthood poses a great obstacle for many young people with special education needs (SEN) and autism. Compared with the general population, autistic people are over twice as likely to be 'not in employment, education or training' (NEET). Being NEET has wide-ranging implications from poor mental health and suicidal ideation to economic viability and independence. It is known that SEN status and autism are themselves risk factors for disengagement. However, little is known about what social and educational vulnerabilities are linked to NEET outcome in the SEN and autistic population.

Objectives: Using data compiled by the UK government, the current study aims to explore how autism and other special education needs are linked to educational and occupational disengagement, taking into account additional factors relating to educational and social vulnerabilities.

Methods: All data originated from the National Pupil Database, obtained by permission of the Department for Education. The database contains information about school-aged children in state-funded schools across the UK. For this analysis, the National Client Caseload Information from 2016 (N= 2,289,792) was used to identify pupils who have become NEET. Using unique pupil identification numbers, we linked this data to the School Census for the preceding academic year 2014-2015 (N= 7,845,011) to obtain information on demographic variables (age, gender, first language, ethnicity) as well as the official SEN status of students (Autism, Other SEN category, No SEN). To account for further social and educational vulnerabilities we also linked social service records and records on school absences and exclusions. Logistic regression was used with NEET as the binary outcome to determine the odds of disengagement depending on SEN category (Autism, Other SEN category, No SEN).

Results: After controlling for demographic variables and social-educational vulnerabilities, autistic young people were significantly more likely to be NEET compared to young adults with no SEN (odds ratio = 1.23, 95% CI 1.04-1.44). Young people with other SENs were also significantly more likely to be NEET compared to young people with no SEN (odds ratio =1.87, 95% CI 1.79-1.96). Statistical comparison of coefficients revealed that the effect of having a SEN other than autism was significantly greater than the effect of having a diagnosis of autism alone in terms of becoming NEET ($\chi^2 = 25.04$, $p<0.000$).

Conclusions: After adjusting for the effect of demographic variables and social-educational vulnerabilities, we found that a diagnosis of either autism or another SEN significantly increases the odds of becoming NEET, indicating that SEN status independently increases the likelihood of educational and vocational disengagement in the UK. We also found that having autism is less strongly associated with NEET outcome compared to having a different SEN. A limitation of this study is that it only includes pupils from state-funded schools, therefore it does not account for certain segments of the population. Future work will examine how each major SEN sub-type is linked to NEET outcome and how social-educational vulnerabilities mediate disengagement across these groups.

3 **200.003** Employers' Perspectives on Individuals with IDD Working in Integrated Employment Settings: A Systematic Literature Review

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Background: Individuals with intellectual and developmental disabilities (IDD), which include autism spectrum disorder (ASD) and intellectual disability (ID), experience high rates of unemployment and underemployment. In 2016, 68.6% of adults without disabilities were competitively employed, relative to 26.3% of individuals with ID (Kraus et al., 2018) and 14% of individuals with ASD (Roux et al., 2017). To improve sustainable employment outcomes, it is imperative to take an ecological systems approach by examining factors and perspectives from both demand-side (employer) and supply-side (employee) that may impact employment opportunities. Studies show that negative societal attitudes toward hiring and/or working with people with IDD contribute to poor employment outcomes (Smart, 2008). Addressing these negative attitudes will create a more inclusive employment culture and diminish the prejudice and discrimination that has become a barrier for individuals with IDD to obtain and maintain employment in integrated work settings (Erickson et al., 2014). Therefore, understanding employers' perspectives on individuals with IDD working in integrated employment settings is necessary to potentially improve their employment outcomes.

Objectives: The purpose of this systematic literature review is to summarize the research conducted on the perceptions and attitudes of employers on individuals with IDD working in integrated employment settings.

Methods: An extensive literature search on articles published before 2018 that focused on employers' perspectives of individuals with IDD working in integrated employment settings were conducted. After the initial search was completed, titles and abstracts of the 1765 articles were screened. Inclusion criteria included: (a) contains information on employer perspectives, attitudes, or beliefs about individuals with IDD in the workplace; (b) study is either quantitative or qualitative in nature; (c) include employers in the participant pool; (d) data collected via surveys/questionnaires /interviews); and (e) was published in English. Sixty-nine articles were subsequently identified and thoroughly examined to confirmed the suitability of the articles. This resulted in 33 articles to be included in the final review. Following this examination, ancestral (i.e., reference list review) and forward searches (i.e., Google citations) were conducted with 30 additional articles identified for a total of 63 articles included in the final review.

Results: Based on the 63 articles identified, preliminary data show that <50% employers have prior experience working/hiring individuals with IDD and most employees in these workplaces have an ID versus ASD. Findings also demonstrate that studies have been conducted globally using

primarily a quantitative/descriptive methodology and informal non-validated survey tools. Included studies' outcomes have demonstrated that when employers had experience hiring/working with an employee with IDD, they were satisfied with the employee's performance and would continue to hire people with IDD if adequate support was provided.

Conclusions: There are few studies and minimal evidence available to inform employment interventions for individuals with IDD from the employers' perspective or which supports the employer requires. Individual studies suggest a positive shift in knowledge and attitudes towards individuals with IDD at work, however, our understanding on how to promote the hiring of and maintaining individuals with IDD in the workplace is limited.

4 **200.004** Executive Functioning in Middle Adulthood: A Follow up Study of Children Diagnosed with ASD from 1970-1999

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Background: Executive functioning (EF) refers to a range of higher order cognitive skills, which are considered integral to goal-directed, flexible behavior. Impairments in EF are reported in ASD, though there is some disagreement about the pattern of impairments. While there are a growing number of adults with ASD, less research is available on EF in middle adulthood and ASD and its relations to other aspects of adult functioning.
Objectives: Objectives of this study were to: 1) examine the profile of EF strengths and weaknesses in adults with ASD; 2) compare ratings of real-world EF skills to standardized, behavioral measures of EF; 3) examine how executive functions relate to other measures of functioning (adaptive behavior, employment, quality of life) in middle adulthood for individuals with ASD diagnosed as children.

Methods: Participants were 24 adults with ASD (age range 27-57 years; M age=35) who completed behavioral assessments of EF (D-KEFS: Trail Making Test, Color-Word Interference, Verbal Fluency), self-reported EF (BRIEF-Adult Version), and IQ (Stanford Binet-5; FSIQ range 73-120; M FSIQ=91.3). Caregivers of adults with ASD completed measures assessing their adult's EF (BRIEF-Adult Version), a measure of adaptive behavior (Vineland-II), and questions about the adult's employment and quality of life. Analyses were conducted to examine the profile of EF in middle adulthood and the relation of EF to areas of adult functioning.

Results: 1) Across domains assessed, adults with ASD performed similarly on D-KEFS subtests (scaled score range 7.0-9.21, *p*'s > .05) to the expected performance for adults with similar FSIQ (z-score transformed mean = 8.27). However, they reported significantly more difficulties on self- and informant-report BRIEF-A indices (t-score range 54.25-57.21 compared z-score transformed mean). 2) Controlling for FSIQ, the only D-KEFS measure correlated with self- or informant-report on the BRIEF-A was Color-Word Interference Inhibition (both *r*'s > -.51, *p*'s < .02), such that difficulty with D-KEFS inhibition was associated with EF difficulties on the BRIEF-A self- and informant-report. 3) Controlling for FSIQ, D-KEFS Color-Word Inhibition switching and Verbal Fluency switching were positively correlated with the Adaptive Behavior Composite on the Vineland-II (both *r*'s > .44, *p*'s < .05). D-KEFS and BRIEF-A performance were not related to employment length, hours worked per week, or wages. D-KEFS was not related to overall quality of life (all *r*'s < .02, *p*'s > .05). BRIEF-A informant-report was significantly negatively correlated with informant-reported overall quality of life (*r* = -.55, *p*'s < .008), such that EF difficulties were related to lower quality of life.

Conclusions: Overall, adults with ASD performed similarly on the D-KEFS to adults at similar levels of cognitive ability. However, on ratings of everyday executive function, adults performed more poorly than predicted by intellectual ability. Overall, behavioral measures of EF and ratings of everyday EF were minimally correlated with each other suggesting that they are measuring different constructs. Both reports of everyday EF and standardized measures of EF contributed to our understanding of adult adaptive behavior and quality of life outcomes suggesting that both types of measures may be important to administer.

5 **200.005** Exploring Barriers to Employment for Individuals on the Autism Spectrum: Perceptions of Autistic and Non-Autistic Job Candidates at Interview

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Background: Adults with a diagnosis of autism spectrum disorder (hereafter autistic) face considerably lower employment rates compared to the general population. In Australia, only 40.8% of working aged autistic individuals are employed, compared to 53.4% of individuals with a disability and 83.2% of individuals without a disability (Australian Bureau of Statistics, 2015). One suggested barrier is the job interview due to its heavy reliance on social skills, which are, by definition, different among autistic individuals (American Psychiatric Association, 2013).
Objectives: The current study investigated perceptions of autistic and non-autistic job candidates using 10 second videos of simulated employment interviews. The aim was to understand how disclosure of autism during the job interview may affect perceptions of employability and hiring outcomes for autistic adults.

Methods: 353 individuals (40.2% male, 59.2% female, 0.6% unspecified, age *M* = 35.27 years, *SD* =12.71 years) were recruited via online platform Prolific Academic. Disclosure of ASD was manipulated using videos, with three levels of information: no autism disclosure, brief autism disclosure, and detailed autism disclosure, which corresponded to the three experimental conditions. Participants were randomly assigned to one of the three conditions and were each shown two 10 second videos of a 'job candidate' (one autistic candidate, one non-autistic candidate), presented in random order. They were then asked to make a judgement on their each candidates' employability and make a decision regarding which of the two candidates they would 'hire'.

Results: Across conditions, participants chose to 'hire' the autistic job candidates in 37.5% of the time, and non-autistic job candidates 66.3% of the time. A mixed 2 (diagnosis) X 3 (condition) ANOVA investigating ratings of candidate employability revealed a significant effect of diagnosis, $F(1,350) = 53.65$, $p < .001$, whereby autistic individuals were rated lower on employability, a significant effect of condition, $F(1,350) = 4.17$, $p = .016$, whereby employability ratings of autistic individuals improved between disclosure conditions, and a significant interaction between diagnosis and condition, $F(2,350) = 4.04$, $p = .018$, whereby employability rating for autistic candidates changed between conditions while the rating of non-autistic individuals remained relatively stable. The presentation will explore post-hoc comparisons of results, explore whether data patterns were different depending on relationship with autism (e.g., if autistic, or a family member of an autistic individual), and other measures on which

candidates were assessed.

Conclusions: The results showed that the autistic job-candidates were less likely to be 'hired' compared to their non-autistic counterparts and were rated significantly lower on employability. Further, employability rating changed between conditions, showing an influence of autism disclosure. These results, and what this indicates about the job interview as a barrier for autistic individuals, will be discussed.

6 **200.006** Job Seeking Experiences of Autistic and Non-Autistic Youth

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Background: Engaging in employment can result in a number of positive outcomes for autistic individuals (e.g., Hedley et al., 2017; Lounds Taylor, Smith, & Mailick, 2014). However autistic individuals often face significant challenges in seeking, gaining and maintaining employment (Baldwin, Costley, and Warren 2014; Lopez and Keenan 2014; Hedley et al. 2017, 2018; Harmuth et al. 2018; Wei et al. 2018). In Australia, this is reflected in the labor participation rate of 40.8% among autistic individuals, which is lower than individuals with and without a disability (53.4% and 83,2% respectively; Australian Bureau of Statistics [ABS], 2015). Among transition aged youth on the autism spectrum, successfully gaining employment has been cited as a common challenge (e.g., Roux et al., 2013; Shattuck et al., 2012), and vocational outcomes among this group have been cited as low (e.g., Pounds Taylor & Seltzer, 2011).

Objectives: The current study explored the job seeking experiences of transition aged autistic and non-autistic youth aged 15-25 years who were recruited as a part of a larger longitudinal study.

Methods: Data were extracted from the first phase of a national longitudinal online study of autistic and non-autistic youth aged between 15-25 years (M = 19.39, SD = 2.33). Respondents were N = 252 individuals, of whom n = 136 identified as autistic and n = 116 identified as non-autistic (46 % male, 54% female) who answered a series of questions about their job-seeking experiences adapted from the Labour Force Survey (ABS, 1960).

Results: Of the 252 individuals, 39% (n = 53) of the autistic individuals reported seeking work, while 43.1% (n = 50) of the non-autistic respondents reported actively seeking work.

There were no differences in the number of jobs applied for over a three month period between the autistic (M = 11.48, SD = 18.79) and non-autistic (M = 15.21, SD = 16.70) individuals, $t(93) = 1.023$, $p = .309$. However, the autistic respondents (n = 48) reported applying up to 103 jobs, while the non-autistic respondents (n = 47) reported applying for up to 60 jobs.

Autistic job-seekers reported using less strategies in their search for a job (M = 1.87, SD = 1.74) than non-autistic job seekers (M = 2.52, SD = 1.47), $t(101) = 2.044$, $p = .044$.

Autistic and non-autistic job seekers reported similar levels of success in their search for a job, with 17% (n = 9) of autistic, and 18% (n = 9) non-autistic individuals reporting finding a job.

Conclusions: While autistic individuals reported less strategies in their search for employment, a similar number of autistic and non-autistic respondents reported seeking employment, and a similar number reported success in their search. These results are at odds with the existing literature addressing autism and employment.

This presentation will further explore the data, to look at whether their role involves additional support, the number of hours each group reported working, and the perceived reasons for not finding work for those who were unsuccessful across the two groups.

7 **200.007** Feasibility of Schema Therapy in Young Adults with High-Functioning Autism Spectrum Disorder in Japan: A Pilot Study

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Background:

Individuals with autism spectrum disorder (ASD) have better subjective prognosis or higher quality of life (QOL) when they are diagnosed in childhood (Kamio, 2012). However, diagnosis is often delayed until adulthood in high-functioning ASD (HF-ASD) individuals, who may not receive the appropriate care or support (Mandy et al., 2012). Furthermore, undiagnosed ASD individuals are at a higher risk for mistreatment, such as bullying or abuse (White, 2009); 65%–80% of ASD adults have accompanying mental disorders, including depression and anxiety. Schema therapy (ST) is a psychotherapy that has evolved from cognitive behavior therapy with good therapeutic results on complicated diseases, such as personality disorders and post-traumatic stress disorder (Hawk & Provencher, 2012). Additionally, it has shown positive results for borderline personality disorders. However, there are few studies of ST in HF-ASD adults (Vuijk & Arntz, 2017). ST follows the process of understanding nonfunctional coping mechanisms that an ASD individual has been implementing for many years, while instilling and implementing new coping mechanisms. We believe that ST is effective in HF-ASD individuals suffering from a sense of chronic social maladaptation; therefore, we examined the effectiveness of ST in a pilot study.

Objectives:

This study evaluated the feasibility, acceptability, and preliminary effectiveness of ST in 10 HF-ASD individuals with comorbidity of psychiatric disorders.

Methods:

Ten HF-ASD individuals (age, >20 years) with at least one psychiatric symptom were administered a treatment protocol comprising 30 weekly offered sessions. A concurrent multiple baseline design was used, with a baseline of 1–3 weeks, followed by a psychological assessment using developmental tests such as autism diagnostic interview-revised and autism diagnostic observation schedule. Next, the study therapist started a psychological education with the patients about HF-ASD and ST for 5–8 weeks, which was followed by a 10-week exploration phase with weekly sessions wherein current and past functioning, psychological symptoms, and schema modes were explored and information about the treatment was provided. Subsequently, 15 weekly sessions in cognitive-behavioral interventions and 20 weekly sessions in experiential interventions were conducted. Finally, a follow-up session was conducted 3 months after the intervention. During pretreatment, posttreatment, and follow-up session, we evaluated the Global Assessment of Functioning score as the main outcome from independent researchers in this study as well as WHO-QOL scale and other psychiatric symptom severity scales .

Results:

Regarding pretreatment and posttreatment scores, we found significant reduction in symptoms of depression and improvement in social functions and QOL. Effect sizes of Cohen's d was 3.3 for global assessment of functioning, 0.69 for WHO-QOL, 0.62 for maladaptive schema reduction increase, and 0.56 for mode reduction. Regarding follow-up score, we found significant reduction in symptoms of general anxiety, social anxiety, and obsession and significant in overall functioning (Fig.1).

Conclusions:

To our knowledge, this is the first uncontrolled clinical trial to provide evidence that ST combined with psychoeducation in ASD can be implemented and adapted for use in short-term outpatient settings. However, generalizability of this study is limited owing to the small sample size and lack of control group.

8 **200.008** GPS Mapping of Community Participation Patterns in Adults with Autism Spectrum Disorder

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Background:

The presence of meaningful daytime activity is one of the most important factors contributing to quality of life for adults with ASD (Tobin et al., 2014). Yet little is known about how adults spend their time, whether they consider their daytime activities meaningful, and if they feel connected to the community.

Objectives:

This study used Global Positioning Systems (GPS) measures to better understand where and how adults with ASD spend their time, how they interact with their community, and whether they feel connected in the community.

Methods:

Participants carried GPS trackers to capture time away from home, distance traveled, and locations visited for seven days. Travel diaries completed by participants or caregivers provided context for GPS locations. Follow-up interviews asked participants which locations were most important, where they felt most productive, where they felt they belonged the most, and if they felt part of the community. Results were combined with caregiver-reported adult outcome survey data to explore the role of communication skills, living situation (independent, with family, group home), and employment status on community participation.

Results:

Table 1 contains demographic and community participation outcomes for 23 adults aged 21-50 years across the spectrum (47% had ID) who completed the study. GPS measures of average time away from home was just over 5 hours per day although 39% had at least one day during the week they did not leave home. Number of unique locations visited during the week ranged from 5 to 59 (average=18.6). The individual's space occupied in the community area ("activity space") averaged 87.57 sq. mi., with social/recreational locations contributing to the largest spatial presence in the community. Social/recreational locations were also most frequently (52%) identified as "most important" and where participants wished they spent more time. Most participants identified home as where they felt they belonged the most (65%) and vocational locations as where they felt most productive (65%).

Most participants (83%) reported feeling part of their community, primarily due to feeling known by others in the community. No significant differences in feeling part of the community or any of the GPS participation outcomes were present by employment status or conversation ability. Qualitatively, those who lived in group homes or had family exerting significant effort in planning activities visited multiple locations during the week, while adults who were driving independently but unemployed averaged less than two hours away from home per day. These patterns were present across different geographic regions.

Conclusions:

Most individuals in the current study were involved in several activities in locations throughout the community area and felt connected to their community through personal interactions. Individuals traveled great distances to participate in social/recreational activities and rated these locations with high importance. Those who were unemployed or had less conversation ability were still engaging in the community in ways that were meaningful to them. Findings suggest that adults with good conversation ability but were unemployed had limited participation and may need more support services. Increased social/recreational opportunities for adults in the community are needed overall.

9 **200.009** Group Rehabilitation Program for Undergraduate Students Improves Their Social Adaptation Ability and Prevents Their Dropouts.

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Background: Group rehabilitation for undergraduate and grad students with autism spectrum disorder (ASD) has not been established in Japan while that for adults has already been approved as a health insurance treatment. A previous study has shown that substantial number of undergraduate students with ASD unfortunately dropped out of their school and consequently being socially isolated because they could not ask for any effective supports around them in Japan (Takei et al. 2014). This result raises the possibility that developing a group rehabilitation program specialized for undergraduates could prevent their maladjustment to school life. Thus, it is necessary to develop a group rehabilitation program for undergraduates and evaluate its outcomes.

Objectives: We aim to evaluate how effective our group rehabilitation program specialized for undergraduate students is, utilizing longitudinal data that measures the degree of social adaptation.

Methods: We recruited 45 undergraduates with ASD who participated in our group rehabilitation program specialized especially for undergraduate students from July 2015 to June 2018. Our monthly one-year rehabilitation program included communication skill training and psychological education partly specialized for undergraduates (e.g. a role-play session about how to ask for professors and make friends with classmates). Out

of 45 participants we analyzed the data of 30 participants (4 female; mean age=20.7, SD = 2.0) who attended more than half of our rehabilitation sessions because we aimed to strictly evaluate the effectiveness of our program throughout a series of sessions and indeed we could not follow up the data of remaining 15 students. We used social adaptation self-evaluation scale (SASS) as a primary end point.

Results: We compared the scores in modified version of SASS for students completed at pre-intervention with those at post-intervention. A t-test showed that the scores of SASS at post-intervention was significantly higher than those at pre-intervention (t = 2.68, p = 0.01), which means that participants improved social functioning after the rehabilitation program. In fact, their outcomes after intervention were as follows: 17 participants were in school, 4 participants obtained jobs, 3 participants participated in employee assistance program, and 6 participants participated in other rehabilitation programs in our hospital after graduation. It was notable that no participant dropped out of their school.

Conclusions: Our preliminary results indicate that our group rehabilitation program specialized for undergraduates could help participants to be well adapted to their school life and consequently not to drop out of their school and be socially isolated.

10 **200.010** Happiness and Wellbeing of Autistic Young Adults and Their Families: Evidence from a Population-Based Twin Sample

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Background:
There is evidence that suggests those diagnosed with ASD in childhood have poor outcomes in young adulthood. One area which has received little attention is the happiness and wellbeing of emerging adults with ASD as a subjective measure of adult outcome. Given previous research has identified many young adults with ASD continue to reside with, or receive support from, family, happiness and wellbeing among family may also be important to consider.

Objectives:

This study used data from a population-based twin sample covering the whole autism spectrum. Objectives were to examine parent and twin wellbeing and happiness in families with and without a young person with ASD.

Methods:

Parental and self-report data were collected for young adults with ASD, their non-affected co-twins and a non-ASD comparison group. Parent and self-reports were independent i.e. parent reports were not always accompanied by twin self-reports and vice versa. A wide range of issues were explored by participant questionnaires including mental health, wellbeing and young adult outcomes.

Twins and parents self-reported their own levels of happiness/wellbeing on the 4-item Subjective Happiness Scale (Lyubomirsky & Lepper, 1999), Life Satisfaction Scale (Diener et al., 1985), and Life Orientation Test (tapping optimism; Scheier, Carver & Bridges 1994). The twins self-reported self-esteem was also assessed (Rosenberg, 1965). Self-report data was available for 45 young adults with a research diagnosis of ASD (78% male; mean age 18 years 11 months), 24 non-ASD co-twins (33% male; mean age 18 years 11 months) and 50 comparison twins (68% male; mean age 18 years 8 months). A total of 77 parent self-reports were available, 43 from families where one or both twins met criteria for ASD and 28 from comparison families.

Results:

Parents with one or both twins on the autism spectrum had lower levels of subjective happiness (t= -2.32, 69, p<.05), life satisfaction (t= -4.21, 69, p<.001) and optimism (t= -3.08, 69, p<.01) than parents of comparison twins. From twin self-reports it was shown that there were significant differences between groups (ASD, co-twins and comparison) in levels of subjective happiness (F=6.43, 2, p<.01), life satisfaction (F=12.55, 2, p<.001), optimism (F= 4.48, 2, p<.05) and self-esteem (F=16.96, 2, p<.001). Average ratings of subjective happiness and optimism were significantly lower in the ASD group than the comparison group, with the co-twin group showing intermediate levels between the two. However, with regards to life satisfaction and self-esteem ASD and co-twins both reported significantly lower levels than the comparison group.

Conclusions:

ASD twins, their parents and co-twins were less happy, had lower life satisfaction and optimism, and ASD twins and co-twins had lower self-esteem, than the comparison group. This indicates that family wide wellbeing and happiness could be impacted when one or more family members have ASD. Even into young adulthood this suggests that services and support targeting the whole family unit of affected individuals may be necessary.

11 **200.011** Heart Rate Variability and Psychopathology Influences on Face Recognition in People with and without ASD

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Background:
A significant body of research has examined face recognition in individuals with ASD and while this research suggests that they often exhibit deficits, studies have demonstrated important variability. However, most previous studies have compared average performance between an ASD group and a control group, ignoring the important heterogeneity occurring within ASD. It is well known that there is a high prevalence of comorbid psychopathology in ASD, such as anxiety and depression, and that individuals with anxiety and depression also experience face processing dysregulation. Moreover, research suggests sympathetic over- arousal, parasympathetic underactivity, or atypical interaction of both systems in ASD and literature in the general population shows that greater arousal, shown by lower heart rate variability, affects cognitive skills such as facial emotion processing. We hypothesised that autistic trait severity, anxiety, depression and ANS arousal together may negatively impact face recognition performance in individuals with and without ASD.

Objectives:

(1) Evaluate if autistic, social anxiety, anxiety and depression traits are correlated with face-recognition performance; (2) Assess if HRV is linked to face recognition; and (3) Determine which factors emerge as significant predictors of face recognition performance.

Methods:

Participants were 30 adults (21 typically developing, 9 with ASD) aged 18 to 59 years (M = 31.93, SD = 12.5 years). Participants undertook a face recognition task and completed online questionnaires evaluating autistic traits (abridged Adult Autism Spectrum Quotient; AQ-short), anxiety and depression (Hospital Anxiety and Depression Scale; HADS) and social anxiety (Severity Measure for Social Anxiety Disorder; SMSAD). Heart rate variability (RMSSD) during baseline and while performing the task was collected and analysed. According to the literature age, non-verbal intelligence (WASI-II) and gender can impact on face recognition, thus these variables were controlled for when examining performance. We utilised 5000 bootstrapped samples for correlation and regression analyses examining the relationship between face recognition variables, diagnosis, psychopathology scales, autistic traits and HRV.

Results:

Face recognition accuracy (A prime) was negatively associated with SMSAD BCa 95% [-.79;-.07] and task_RMSSD r=-.455, BCa 95% [-.72;-.12]. Response bias was associated with task_RMSSD r=.411, BCa 95% [-.76;-.07]. Hit rate correlated with HADS_ Anxiety r=-.459, BCa 95% [-.75;-.09] and task_RMSSD r=-.509, BCa 95% [-.75;-.22]. Finally, false alarm rate was associated with diagnosis r=.445, BCa 95% [.08;.76]. Regression analyses showed that task-RMSSD emerged as unique significant predictor for A prime (β=-.39, BCa 95% [-.004;-.001]) and response bias (β=.41, BCa 95% [.001;.014]). However, for hit rate both HADS_Anxiety (β=-.38, BCa 95% [-.285;-.026]) and Task-RMSSD (β=-.49, BCa 95% [-.073;-.016]) emerged as unique predictors, while age was a unique predictor (β=.40, BCa 95% [.021; .253]) for false alarm rate.

Conclusions:

These results suggest that levels of social anxiety, general anxiety and HRV affect face recognition above ASD traits or diagnosis. These results also demonstrate that distinct psychopathology symptoms affect different face recognition variables and could explain the important heterogeneity within the ASD population. Findings emphasise the need to evaluate individual differences (psychopathology, arousal) and their impact on cognition.

12 **200.012** Implicit Attitudes Towards Adults with Autism: A Multi-Study Investigation

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Background: Research examining attitudes towards individuals with autism has primarily relied on self-report measures that explicitly ask about attitudes and thus, may be subject to bias, particularly social desirability effects. Further, the majority of these studies have assessed perceptions of children rather than adults with autism. Given the increasing numbers of people with autism, it is important to develop a better understanding of attitudes towards adults with autism by their peers and other adults. Using measures of both explicit and implicit attitudes will provide a more comprehensive view of attitudes towards adults with autism.

Objectives: The goal of this research was to develop an Implicit Association Test (IAT) to assess implicit attitudes towards people with autism.

Methods: Participants in Study 1 were 175 college students (63 males; M_{age} = 19.15 years, 50.0% White). In Study 2, participants were 94 individuals (50 males; M_{age} = 31.3 years, 66.0% White) who were recruited through Amazon MTurk. There were 127 participants in Study 3 (75 males; M_{age} = 33.4 years) who were also recruited from Amazon MTurk. All participants completed a modified version of the IAT (Nosek et al., 2002) that we developed to assess attitudes towards autistic and neurotypical individuals. In Studies 1 and 2, the descriptors used in the IAT included positive and negative stereotypes that pre-test participants had identified as describing autistic and non-autistic adults. In Study 3, the words selected to describe autistic and non-autistic adults were descriptive rather than stereotypical (i.e., autistic, spectrum, non-autistic). Participants also completed two questionnaires that assessed explicit attitudes towards autism: the Autism Quotient questionnaire (Baron-Cohen et al., 2001), and the 16-item Societal Attitudes towards Autism Scale (Flood et al., 2013).

Results: University students (Study 1) and individuals from the general U.S. population (Studies 2 and 3) showed a negative implicit bias against their autistic peers, with students having the most bias, and the adults in Study 3 having the least bias. Across all studies, the fewer autistic behaviors participants reported, the more negative their implicit bias was against people with autism. The findings indicated that across all three studies, the responses to the explicit measures indicated positive attitudes towards individuals with autism. Further, the associations between the implicit and explicit measures were non-significant within each study.

Conclusions: Across three different samples from two different populations, the findings reveal that the participants have negative implicit attitudes towards persons with autism, although reporting positive explicit attitudes. The social desirability bias inherent in explicit measures is apparent in these findings. These results may provide insights concerning why individuals with autism report experiences of discrimination such as social exclusion, humiliation, and neglect (e.g., Peyton, 2004). Universities, workplaces, and other organizations may need explicit facilitation to make their environment more welcoming to adults with autism.

13 **200.013** In Their Own Words: Associated Features in Intellectually Able Adult Males and Females with Autism Spectrum Disorder (ASD)

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Background:

Adults with ASD can experience difficulties not limited to the primary criteria for diagnosis of ASD. We sought to examine associated features that verbally able adults report about themselves, and in particular, whether there are differences by gender in the type and severity of features reported. Qualitative information about associated features reported by outpatients with ASD was compiled to develop a questionnaire including 51 statements (Adolescent and Adult Autism Spectrum Checklist – AAASC). (See Table 1).

Objectives:

1) To determine which associated features were most highly rated in our sample, 2) To determine whether mean scores were associated with scores on other widely used self-report measures for assessment of adult ASD, 3) To compare findings on male and female respondents.

Methods:

The AAASC was rated by 107 individuals with ASD (37.5% female; 73.7% Euro American; 44.7% 18 – 30 y/o; 55.3% 31-71 y/o) seen at a clinic

specializing in adult ASD diagnosis and intervention. Statements were rated on a 0 -5 scale where 5 was highest. For analysis the statements were grouped in four content areas: Preference for Sameness and Routine; Cognitive Style and Executive Functioning; Difficulties in Conversation; Social Awareness and Expectations.

Mean values for each content area were calculated, and five items with mean ratings lower than 2.0 were removed from further analysis. The remaining 46 items in their four groupings were examined first for their relative frequency, then for the association of their mean scores with scores on the *Social Responsiveness Scale, 2nd Edition* (SRS-2), *Autism Quotient* (AQ), *Empathy Quotient* (EQ), and *Ritvo Autism Asperger Diagnostic Scale-Revised Version* (RAADS-R). Mean scores were then examined using multivariate analysis of variance, with chronological age covaried, to examine differences by gender.

Results:

For the sample as a whole, items associated with Preference for Sameness and Routine were rated highest, followed by Cognitive Style and Executive Function, Difficulties in Conversation, and Social Awareness and Expectations, respectively (Table 1). Multiple regression revealed that total scores on the SRS-2, RAADS-R, and AQ were strongly related to some or all of the 4 groupings, and the EQ only to Preference for Sameness and Routine (Table 1). Results of the MANOVA were statistically significant (Wilks Lambda = .871; F (4, 95) = 3.53, p=.01) for differences by gender. Tests of between subjects effects found that females reported significantly higher levels of associated features in all categories than did males (Preference for Sameness and Routine, p=.024; Cognitive Style and Executive Functioning, p=.05; Difficulties in Conversation, p=.002; Social Awareness and Expectations, p=.001).

Conclusions:

The associated features reported by adults with ASD were highly congruent with existing self-report measures of ASD characteristics. It is of note that adults with ASD frequently endorsed problems that reflect cognitive differences, especially in executive function, an area not typically assessed on ASD measures. Interestingly, women reported significantly higher levels of problems than men across content areas. They may experience their problems as more severe, or they may be more willing to report on problems.

14 **200.014** Insights from a Qualitative Analysis of Sexual Minority-Identifying Individuals with Autism Spectrum Disorder

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Background: Individuals with Autism Spectrum Disorder (ASD) are more likely to endorse a sexual minority orientation than those with typical development (TD, DeWinter et al., 2017). However, no empirical studies have examined factors that contribute to higher rates of sexual minority orientation in ASD. A biopsychosocial model has been proposed for sexual orientation development in TD individuals (Dillon, Worthington, & Moradi, 2011). This model may have applicability to sexual minority orientation development in individuals with ASD, but this has yet to be explored. Qualitative data analytic methods may yield insights into whether these factors capture the unique experiences of sexual minority individuals with ASD.

Objectives: 1) Identify themes related to sexual minority orientation in individuals with ASD and 2) compare themes to extant model for TD.

Methods: Eleven participants with ASD ages 18-30 (mean age 23.5; 7 female, 3 non-binary, 1 male; 8 Caucasian, 1 Asian, 1 African-American, 1 Other) who identified as sexual minorities provided qualitative responses to questions related to sexual minority orientation development either in person (*n*= 1) or through an online questionnaire (*n*= 10). Questions were based on the six factors of the model or on other relevant themes identified in the literature (openness to discussing sexuality, characteristics of participant's romantic and sexual relationships). The data were examined using thematic analysis: responses were double-coded by the first two authors into groups based on which of the theoretical themes they best represented. Data that were judged by both coders to not fit one of the relevant theoretical themes were grouped together under a new theme.

Results: A total of ten themes emerged from the data. Eight were theoretical themes (biology, microsocial context, culture, religious beliefs, gender norms, socialization, systematic homonegativity, openness to discussing sexuality, and relationship characteristics)and two were inductive themes that emerged from the data (being a sexual minority with autism and sexual orientation). Participants reported unique experiences with regards to minority identification and polyamory. For example, participants noted that social differences made it difficult for them to find other sexual minority individuals to interact with, and that language difficulties and lack of exposure to other sexual minority individuals made it harder for them to conceptualize their identities.

Conclusions: Overall, the experiences of sexual minority individuals with ASD were similar to those of TD sexual minority individuals in relation to the model of sexual orientation development. However, participants indicated that characteristics of ASD sometimes made expression and communication of their sexual minority identity difficult. Experiences with polyamory, the interaction of language with identifying and understanding their sexual minority orientation, and other interactions between autism and sexual orientation are aspects of the experience of individuals with ASD that have not yet been researched. Using qualitative designs which ask questions directly of adults with ASD is an effective way to capture aspects of their lived experiences that may not be articulated in quantitative, survey-based research studies. Additionally, using online data-collection methods appears to be especially effective.

15 **200.015** Interviewing Autistic Adults: Adaptations to Support Recall in Police, Employment, and Healthcare Interviews

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Background:

Recounting past experiences is a crucial feature of most formal social interactions, including when being interviewed for a job or in the Criminal Justice System (CJS), during a health or social care consultation, or as part of assessments for welfare. During such interviews we usually need to recall personal memories of specific episodes, which can be difficult for autistic adults under standard questioning structures (e.g., open questioning).

Objectives:

There is little research into methods of facilitatingautistic adults' recall outside of lab-based memory tasks. The current study aimed to investigate this within the framework of the 'Task Support Hypothesis' (Bowler et al., 1997) by testing the efficacy of interview prompting techniques in supporting autistic adults' recall of specific personal memories.

Methods: Based on an a-priori sample size calculation (assuming α =.05), in order to achieve Cohen's (1992) recommended power of .80 to detect a medium-to-large effect size, 32 ASD and 31 typically developing (TD) participants were recruited. Participants were asked to recall specific instances from their past that were relevant to CJS, healthcare, and employment interviews. Eighteen questions were split into three blocks: (1) OPENquestions (e.g., "Tell me about a specific instance when you have been to the supermarket"); (2) SEMANTIC SUPPORT- general personal memories were prompted first to support recall of a specific instance (e.g., "are you a worrier?" ... "Tell me about a specific instance when you have felt worried"); (3) VERBAL LABELS - participants received a visual pie-diagram with prompts to recall: When? People? Actions? Setting? Objects? Half of the participants also received preparatory information which included the question topics. The study used a mixed factorial design: 2 (Autistic, TD) x 2 (Preparation, No Preparation) x 3 (Support: Open, Semantic Support, Verbal Labels), where Support was within-subjects

Results:

Participants' interview answers were coded for *specificity*(level of specific detail provided) and *relevance* (number of episodically and semantically relevant details recalled).

Specificity- autistic participants recalled less specific memories overall ($F(1, 55) = 5.58$, $p = .022$, $n_p^2 = .09$). Specificity was improved for both groups in the Verbal Labels condition($F(2,110) = 14.39$, $p < .001$, $n_p^2 = .21$). Answers to CJS questions were more specific than those for health and job questions ($F(2, 110) = 24.20$, $= p < .001$, $n_p^2 = .31$). Employmentquestions were particularly difficult for autistic participants (Context*Group: $F(2, 110) = 3.14$, $p = .047$, $n_p^2 = .05$). Finally, when answering job questions, semantic support aided autistic participants to recall a more specific memory (but not for health and CJS; Support*Context*Group:$F(4, 220) = 3.28$, $p = .012$, $n_p^2 = .06$).

Preliminary analyses also indicate that question support facilitates recall of more episodically-relevant details.

Conclusions:

Autistic participants recalled less specific memories overall, and struggled with job questions in particular. Verbal labels provided the most effective support for specificity. The findings will inform interviewing professionals about methods they can use to facilitate communication with autistic adults. The results provide further evidence for the task support hypothesis (Bowler et al., 1997).

16 **200.016** Facial First Impressions of Neurotypical Adults with Varying Degrees of Autistic Traits

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Background:

Recent studies suggest that there are structural differences in facial morphology that are related to ASD and autistic traits in the general population. An extension of this research is the study of facial first impressions formed by people around autistic individuals. Facial first impressions are typically formed quickly and intuitively, and they tend to influence the quality of social interactions. Several studies found that neurotypical individuals consistently formed less favourable first impressions of autistic persons compared to those of non-autistic individuals. At present, it is unclear whether the relationship between ASD and negative first impression extends to neurotypical individuals with different degrees of autistic traits.

Objectives:

The present study aims to examine whether facial first impression ratings of neurotypical adults vary according to levels of autistic traits.

Methods:

Stimulus Participants

A total of 1,995 undergraduate students completed the autism-spectrum quotient (AQ). Students aged between 18 and 25 yrs, and with an AQ score that fell in the bottom, middle and top 15% of the distribution were invited to participate further in this study. Fifty-four Caucasian men and 54 Caucasian women had their facial photographs taken under standardised conditions (e.g., neutral facial expressions, make-up free).

Raters

An additional group of 53 raters (mean age = 20.6 yrs; 38 females) were recruited to provide first impression ratings on a 10-point slider scale in response to four items: (1) Social: *How likely is it that this person is socially awkward?* (2) Get Along: *How likely is it that this person gets along well with others?* (3) Hang Out: *How likely is it that you would hang out with this person in your free time?* (4) Start Conversation: *How likely is it that you would start a conversation with this person?*

Results:

For women, repeated measures ANOVA revealed that relative to those who scored low on the AQ, women with high AQ scores consistently received less favourable first impression rating across all four items—Social: $F(2,104) = 24.6$, $p < .001$, $\eta_p^2 = .32$; Get Along: $F(2,104) = 23.8$, $p < .001$, $\eta_p^2 = .31$; Hang Out: $F(2,104) = 35.8$, $p < .001$, $\eta_p^2 = .41$; Start Conversation: $F(2,104) = 25.8$, $p < .001$, $\eta_p^2 = .33$.

In contrast, compared to men with low AQ, men with high AQ scores consistently received more favourable first impression ratings across the four items: Social: $F(2,104) = 4.4$, $p = .002$, $\eta_p^2 = .08$; Get Along: $F(2,104) = 31.7$, $p < .001$, $\eta_p^2 = .38$; Hang Out: $F(2,104) = 26.8$, $p < .001$, $\eta_p^2 = .34$; Start Conversation: $F(2,104) = 12.0$, $p < .001$, $\eta_p^2 = .19$.

Conclusions:

The current findings suggest that increased autistic traits are related to less favourable first impressions in women but more favourable first impressions in men. Our lab group has previously published a study reporting increased facial masculinity in high-AQ women and reduced facial masculinity in high-AQ men (Gilani et al.,2015). Taken together, these findings imply that more masculinised facial structures in high-AQ women may be linked to less favourable impressions formed while less masculinised structures in high-AQ men may be associated with more favourable first impressions.

17 **200.017** Longitudinal Trajectories of the Behavioral and Health Phenotype of Adolescents and Adults with Fragile X Syndrome

ABSTRACT WITHDRAWN

Background: Individuals with fragile X syndrome (FXS) display behavior problems, functional limitations, and health problems across the lifespan (Smith et al., 2016; Raspa et al., 2010). However, much of what we know about the phenotype comes from cross-sectional studies investigating children and adolescents.
Objectives: To use longitudinal data to examine ten-year trajectories of behavior (daily living skills and behavior problems) and health (body mass index [BMI] and number of health conditions) in adolescents and adults with FXS, accounting for sex and autism spectrum disorder (ASD) symptoms.

Methods: Participants (n = 134) were drawn from a longitudinal study of families of adolescents and adults with FXS (Mailick et al., 2014). At study entry, individuals with FXS met three criteria: 1) were 12 years of age or older, 2) had received a diagnosis of FXS, and 3) lived with parents or had at least weekly contact. If there was more than one co-residing child, mothers reported on the child she viewed as most severely affected. Individuals with FXS were mostly males (85.1%), in their 20s on average (M = 20.19, SD = 6.92, range 12–48 years), and most lived with mothers (90.3%). About one-quarter (24.2%) of the sample had a co-occurring diagnosis of ASD. Mothers reported on sons' or daughters' daily living skills, behavior problems, height and weight, and number of health conditions, as well as lifetime ASD symptoms. The present sample was restricted to those with intellectual disability.

Results: Hierarchical linear modeling was used to describe change in the behavioral and health phenotype of adolescents and adults over ten years and to examine effects of between-person differences in sex and ASD symptomatology on trajectories. We evaluated separate growth curve models for four outcomes: daily living skills, behavior problems, BMI, and health conditions. Sex and lifetime ASD symptoms at Time 1 were entered as predictors of the intercept and the linear and quadratic slopes. Results indicated increased independence in daily living skills and decreases in behavior problems improved over time. However, BMI increased over time, indicating a greater proportion of individuals meeting the cutoffs for overweight or obesity across the course of the study. The number of health conditions also increased over time. Adolescents and adults who started with fewer ASD symptoms were more independent in daily living skills and had fewer behavior problems.

Conclusions: This is the first study to examine longitudinal trajectories of behavioral and health phenotypes for adolescents and adults with FXS over the course of a decade. Trajectories for daily living skills and behavior problems indicated improved over time. Individuals with elevated levels of ASD symptoms were at risk for lower levels of independence in daily living and more behavior problems at the initial time point than were those with lower levels of ASD symptoms, suggesting possible targets for intervention.

18 **200.018** Measuring Autistic Adults' Healthcare Self-Efficacy, Visit Preparedness, and Use of Accommodations

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Background: Autistic adults report greater unmet healthcare needs, lower satisfaction with patient-provider communication, and greater barriers to healthcare than non-autistic adults. Qualitative data suggest that potential interventions to improve healthcare outcomes may work by helping patients prepare for visits, increasing their self-efficacy in managing their health and healthcare, and ensuring that they receive the accommodations they need. However, there are no validated instruments for measuring such constructs.
Objectives: Develop and psychometrically test three new scales: the Confidence in Managing Health and Healthcare Scale (CMHHS), the Visit Preparedness Scale (VPS), and the Provider and Staff Use of Accommodations Scale (PSUAS).

Methods: We used a community-based participatory research approach throughout the project, in partnership with academic researchers, autistic adults, family members, and healthcare providers. We used our prior qualitative research to create the 21-item CMHHS, the 6-item VPS, and the 8-item PSUAS. Each scale has two versions – one for use with autistic adults directly, and another for supporters. We collaborated with community partners to ensure content validity. This analysis used baseline data from an ongoing study to assess the effectiveness of a primary care intervention on healthcare outcomes for autistic adults. We administered the baseline survey online or the telephone to 244 autistic adults recruited from 8 primary care clinics in Oregon and California, USA. All participants had medical diagnoses on the autism spectrum. Among them, 194 participated directly, and 50 participated via a supporter. Participants had a mean age of 30 years (range 18-72); 70% were male; and 62% were non-Hispanic white. Thirty-nine percent often or always, 24% sometimes, and 38% rarely or never needed assistance in healthcare settings. Thirty-eight percent reported a co-occurring chronic physical health condition, and 61% reported a co-occurring mental health condition. We assessed the scales' internal consistency reliability using Cronbach's alpha, and convergent validity using pair-wise correlations and t-tests.

Results: Community partners ensured that items were easy to understand and captured the intended construct. Both versions of all three scales had good to excellent internal consistency reliability, with alphas ranging from 0.81 to 0.96. The scales showed convergent validity in the expected directions. Participants who reported unmet healthcare needs had lower confidence in managing their health and healthcare (p= 0.0002), felt less prepared for healthcare visits (p=0.006), and were less likely to receive necessary accommodations (p=0.0001). There were strong positive correlations between satisfaction with patient-provider communication *and* healthcare self-efficacy (r=0.47, p<0.0001); visit preparedness (r=0.55, p<0.0001); and use of accommodations (r=0.52 p<0.0001). There were negative correlations between barriers to healthcare *and* healthcare self-efficacy (r=-0.53, p<0.0001); visit preparedness (r=-0.44; p<0.0001); and use of accommodations (-0.32; p<0.0001).

Conclusions: The three new measures demonstrated strong internal consistency reliability and convergent validity with unmet healthcare needs, satisfaction with patient-provider communication, and barriers to care. Future research is needed to validate these scales in additional populations, to assess whether interventions improve healthcare outcomes, and to test whether they do so via these hypothesized mechanisms of action.

19 **200.019** Neurodiversity Career Initiatives Should Encompass Diverse Careers: Insights from a Participatory Study with Autistic and Non-Autistic College Students

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Background: Autistic youth are *less* likely to enroll in college or obtain employment than people with other disabilities (Shattuck et al., 2012). However, those who enter college are *more* likely to enroll in STEM majors than students without disabilities (Wei et al., 2013). Growing recognition that many autistic people are drawn to STEM has sparked promising technology-focused neurodiversity employment initiatives (e.g., Specialisterne). Yet, autistic people remain chronically underemployed, and those who obtain jobs work fewer hours for less pay than people with other disabilities (Cimera & Cowan, 2009). Social challenges, difficulties adapting to change, and stigma impact employment success (Pfieffer et al., 2017). To help autistic people overcome these barriers, researchers recommend aligning employment opportunities with their interests (Hendricks, 2010). However, little is known about their career interests/goals. One online study used Holland's career interest categorizations to compare 136 autistic (63% female) and 155 non-autistic (59% female) participants. Autistic participants endorsed realistic, investigative, and conventional interests more and social and enterprising interests less than non-autistic participants (Lorenz & Heinitz, 2014). Like other online studies (e.g., Gillespie-Lynch et al., 2017), autistic females were overrepresented in the sample. No prior research has examined career goals/interests among autistic college students in particular.

Objectives: To compare the career goals/interests of autistic and non-autistic college students. One of the autistic co-authors/coders initiated this focus.

Methods: Autistic students (*n* = 27; 92.6% male; 64.0% White; *M* = 21.23 years) in a participatory mentorship program and non-autistic students (*n* = 33; 39.4% male; 30.0% White; *M* = 21.15 years) from a subject pool answered open-ended questions: What would you like to do: 1) right after college; 2) five years after college? Responses were coded after establishing reliability. Autistic students and a larger subject pool sample of non-autistic students (*n* = 255; 25% male) completed an adaptation of Holland's career interests inventory (Liao et al., 2008) on O*NET, receiving 3 of 6 possible career interest classifications (Table 1).

Results: Autistic students did not differ from non-autistic students in career goals (Table 2). When gender, age and autism were entered as predictors of career goals in binary logistic regressions, *only* being *older* predicted specific and high-status career goals (*ps* < .04). Autistic students received Enterprising classifications *less* frequently (32%) than non-autistic students (55%, Table 1). No other interests differed by autism status. Gender predicted social (favoring women), conventional and realistic (both favoring men; *ps* < .04) career interests.

Conclusions: Autistic and non-autistic college students expressed similar career aspirations. Autistic students expressed less interest in enterprising careers. Contrary to popular representations of autism, many autistic students expressed social career interests. This finding aligns with recent evidence that autistic people in Germany are most likely to work in "health and social sector, teaching and education" fields (Frank et al., 2018). Use of career interest inventories early in college may help autistic students identify skills (e.g., time management, adapting to unspoken expectations at work) that they may need help developing to obtain jobs well-matched to their interests.

20 **200.020** Next Steps – Improving Adult Transition Outcomes through Parent/Family Education and Empowerment

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Background:

Within the next 15 years, an estimated 500,000 children in the United States with autism spectrum disorder (ASD) will enter adulthood. Additionally, there has been limited research into adult services and outcomes. As a result, a challenge faces clinicians in providing families with evidenced-based transition tools in a manner that allows caregivers to build resiliency in becoming creative and flexible consumers for their young adult children. We have developed and implemented three consecutive 90-minute classes entitled "Next Steps," focused on educating caregivers about transition related topics in small group settings. (See Figure 1. Curriculum Content). We have successfully conducted this class over the past 5 years and 205 families have participated.

Objectives:

To assess the impact of Next Steps classes on family empowerment and readiness for transition to adulthood.

Methods:

Course evaluations were collected from 13 families before and after the classes over 3 class cohorts to evaluate the impact of the Next Steps training on the Family Empowerment Scale. A survey questionnaire called Transition Daily Rewards and Worries Questionnaire (Glidden & Jobe, 2007) was also used.

Results:

On the Family Empowerment Scale, there was a statistically significant increase in the mean scores of the Service System subscale before Next Steps training (M = 44.38, SD = 6.23), and after training (M = 48.00, SD = 6.95). The mean increase in Service System subscale scores was 3.62 with a 95% confidence interval ranging from -6.77 to -.46. The Service System subscale is characterized as parental interactions with service systems to attain services needed by their child (Koren, Dechillo, and Friesen, 1992). The Service System subscale consisted of questions like, "My opinion is just as important as professionals' opinions in deciding what services my child needs." On the Transition Daily Rewards and Worries Questionnaire, there was a statistically significant increase in the mean scores of the Positive Future Orientation subscale before Next Steps training (M = 18.00, SD = 5.61), and after training (M = 21.31, SD = 9.92). The mean increase in Positive Future Orientation subscale scores was 3.31 with a 95% confidence interval ranging from -5.79 to .82. The Positive Future Orientation subscale is defined by general feelings of the parent surrounding their child's future (Burke, Fisher, & Hodapp, 2012). The Positive Future Orientation subscale consisted of questions like, "I am confident that my child will be okay even after I die."

Conclusions:

Transition to adulthood for individuals with autism poses unique challenges to caregivers. Administering transition-related curriculum in small group settings helps to empower families in accessing services and feeling more positive about the future. Future directions include improving

our understanding of long-term impact of course participation, broadening delivery of the Next Steps to include non-English speaking families and including patients along with their caregivers in the Next Steps classes.

21 **200.021** Oral and Dental Healthcare of Autistic and Non-Autistic Adults

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Background: Oral health is an integral part of health and well-being which impacts on quality of life. Adults on the spectrum maybe at a higher risk of poor oral health compared to adults not on the spectrum due to the nature of the neurodevelopment condition, high rate of comorbidities or limited adaptive skills. Little is known about the oral and dental healthcare of autistic adults which limits the capacity for any intervention.
Objectives: To 1) examine oral hygiene practices 2) identify dental needs 3) examine dental visit experiences and 4) identify barriers to accessing professional dental care in autistic and non-autistic adults.

Methods: We developed an online survey to better understand oral and dental health of autistic adults in Australia, in comparison to a general adult population. Survey items asked about socio-demographics, oral hygiene practices, dental problems and dentist visit experience including barriers to dental care and services. The Autism Quotient (AQ) was included as a diagnostic proxy for autism spectrum disorder. Autistic adults either self-completed or sought assistance from a substitute decision maker to complete the survey. Twenty six autistic adults and 21 non-autistic adults completed the survey.

Results: Autistic adults were significantly older than non-autistic adults (36.7 vs 23.1 years, p = .001). Across both groups, most adults held degree qualifications and were single. The AQ among autistic adults was significantly higher compared with non-autistic adults (38.4 vs 17.3, p = .001). Daily oral hygiene practices did not differ significantly across the two groups for tooth brushing. Over 40% of autistic adults reported oral/dental problems compared to 9% non-autistic adults (p = .015). Dental decay and tooth sensitivity were the most commonly reported problems while sensory sensitivities made dental visits more difficult for autistic adults compared with non-autistic adults (p = .001). Oral instrumentation, bright lights and smells were reported as significant challenges for autistic adults as well as perceived feelings of being afraid to go to the dentist for routine dental cleaning. However, no significant differences emerged between the two groups for how often they visited the dentist.

Conclusions: Autistic adults' oral hygiene practices are similar to non-autistic adults in the Australian community. Dental decay and tooth sensitivities appear to be an unmet dental need among autistic adults. Although the frequency of dental visits was similar to those of non-autistic adults. Sensory sensitivities posed as barriers to dental care whilst fear about teeth cleaning may further compromise the dental visit experience among autistic adults. Although this preliminary study requires exploration, the results suggest preparatory or supporting preventative dental interventions may be beneficial to autistic adults. The findings have implications for future research into clinical dental health care of autistic adults including psycho-educational strategies which may assist them in overcoming sensory sensitivities or dental fear.

22 **200.022** Parent-Child Interactions in Families of Adults with Autism Spectrum Disorder during an Intervention Focused on Increased Social and Adaptive Functioning

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Background: Research on adults with autism spectrum disorder (ASD) has found that a significant proportion of these individuals struggle to attain independence, and continue to live with their parents well into adulthood. Yet, we know little about relationships between adults with ASD and their parents, and the few studies to date have relied solely on parent-report questionnaires and interviews assessing parent perspectives when investigating their associations with young adult outcomes. This is a clinically important gap in our knowledge as enhancing the understanding of parent-young adult relationships may aid in the development of treatments for adults with ASD.
Objectives: The current pilot study is the first to use observational coding to assess positivity and control during parent-young adult discussions regarding autonomy, and to examine how the correlates of these relationship characteristics are associated with change during the course of a recently published intervention to enhance coping and adaptive skills in young adults with ASD.

Methods: Eleven adults with ASD (aged 18 – 39) were recruited from the wait list of an ongoing randomized control trial designed to improve coping skills and adaptive skills (Oswald et al., 2017). Adults and one parent engaged in a standardized discussion task with their parents and were given assessments of adaptive behavior (Adaptive Behavior Assessment-3rd Edition, Harrison & Oakland, 2003; Adult Behavior Checklist, Achenbach & Rescorla, 2003) before and after receiving the intervention. The discussions were coded with the Iowa Family Rating Scales (Melby et al., 1998) for levels of parent and child positivity and controlling behavior.

Results: There was high levels of baseline positivity in both parents and adults with ASD. Levels of controlling behaviors in dyads (e.g., behaviors that served to control, influence, or dominate the opinions, actions, or points of view of others) were negatively associated with changes in levels of adult adaptive functioning. Specifically, controlling behaviors observed in dyads before intervention were negatively associated with growth on conceptual adaptive behaviors—which consist of items regarding an individual's academic, communicative, and self-direction skills ($r_s(9)$ = -.66, p = 0.03). The association with growth on adaptive behavior was similar for both parent and child control (see Figure 1).

Conclusions: Higher levels of control during conversations about autonomy may prevent adults from making improvements in the skills required to attain independence. Perhaps, in consideration of their children's strengths and difficulties, parents of adults with ASD may feel the need to more closely guide their young adult's behavior by lecturing or directing their thinking about how to live independently. However, parents who use controlling communication may be limiting their young adults' ability to develop decision-making and self-direction skills. Findings emphasize the need to better understand features of the parent-child relationship and their association with the functioning of young adults with ASD. This is especially true given that the emerging literature indicates that interventions targeting self-determination and coping skills appear to be most effective for promoting optimal outcomes in young adults with ASD (Hume, Loftin, & Lantz, 2009; Oswald et al., 2017; Palmen, Didden &

Lang, 2012).

23 **200.023** Patient-Provider Communication Gap: Barriers to Healthcare for Patients with Autism Spectrum Disorder

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Background:

Difficulties in social interactions characteristic of an Autism Spectrum Disorder (ASD) diagnosis may make navigating the healthcare system challenging, therefore, having healthcare providers in all sectors of healthcare that are confident and competent in communicating with patients with ASD is paramount.

Preißmann (2017) reported that many providers lack the knowledge, skills and confidence to work with individuals with ASD, which can lead to refusal to treat. Thus, there remains a considerable discrepancy between the number of individuals with ASD seeking medical care and the number of healthcare professionals willing/capable/trained to provide care to them, which might result in long waiting periods, and delays in diagnosis and treatment of medical conditions. Identifying the communication gap between patients with ASD and their healthcare providers is a key to minimize the barriers to healthcare for patients with ASD.

Objectives:

The purpose of this study is to collect healthcare professionals' perspective on the current barriers to healthcare for patients with ASD, and the need to develop a patient-provider communication instrument/tool that takes in consideration the social skills and language/communication level of patients with ASD.

Methods:

An online questionnaire (designed by the research team and approved by the Institutional Review Board) was distributed to healthcare professionals who provide direct patient counseling at their practice. Invitation to participate was sent to hospitals, clinics, private pharmacies, dental clinics, and healthcare associations in the Northeast United States with a link to the questionnaire. The questionnaire consists of 18 items (4 demographics, 7 multiple choice, 2 Likert-scale, 5 open-ended). Information regarding the practice type, years of experience and type of health care setting was collected. Additionally, information on additional degrees, certificates or training the participants might have received on their own or through their institutions was also gathered.

Results:

116 participants completed the online questionnaire. The majority (62.9%) were pharmacists, followed by (22.4%) nurses, and females (69.8%) followed by males (29.3%). Practice setting varies with 54.3% came from an inpatient hospital setting, 14% at community pharmacy, 13.8% at outpatient hospital setting. Years of experience span from less than 5 years (31%) to greater than 20 years (26.7%). Although 10.3% indicated they are comfortable in communicating with patients with ASD, only 4.3% indicated they are prepared to provide patients with ASD quality care, and only 3.4% had additional training, certificates related to help them prepare to provide patients with ASD quality care. 78.8%, 86.7%, 68.1% feel that having additional training, continuing education and communication aids will improve the quality of care they provide to patients with ASD.

Conclusions:

Information from the questionnaire pointed several barriers to healthcare for patients with ASD, and the need to developing an innovative communication aid/tool as an exchange between the patient and the healthcare provider. The communication aid will be piloted in the next phase of this research, taking in consideration the social skills, and language/comprehension level of patients with ASD.

24 **200.024** Prevalence, Correlates and Predictors of Good Outcomes in Autism Spectrum Disorder in Late Childhood

ABSTRACT WITHDRAWN

Background: The outcome literature in ASD has focussed largely on changes in symptoms and cognitive skills over relatively short time frames with few data points. There are very few studies that investigate what constitutes a 'good' outcome in late childhood in ASD. This is an important developmental stage as health status at this stage is often more stable compared to earlier periods and predicts health status at later ages. Objectives: To describe the process whereby parents defined domains to be assessed in measuring good outcomes and to describe the prevalence, agreement, correlates and predictors of good outcomes in children with ASD at 8-11 years of age followed longitudinally from 2-4 years of age.

Methods: Data are drawn from the Pathways in ASD study which assembled an inception cohort of children with ASD (N=421) soon after the diagnosis was given at between 2- 4 years of age. The children were seen at several time points and this presentation will focus on outcomes investigated at 8-11 years of age. Multiple domains of a good outcome were defined by parents who identified socialization, communication, independence, and emotional challenges as key domains. These domains were measured using the Vineland Adaptive Behaviour Scales and the CBCL. A 'good outcome' in these domains was defined by scoring in the 'typical' range on any instrument or by an improvement of one standard deviation in standardized scores between the two time points. The prevalence of a good outcome in each domain by either metric was calculated, the agreement between good outcomes definitions was calculated, and the predictors of these outcomes were assessed

Results: The prevalence of a good outcome on any of the 5 domains ranged between 4 and 26% depending on the domain and the metric. There was little agreement between the different ways of defining a good outcome or between different outcome domains, even within a measurement tool. In particular there was no agreement (beyond chance) between the good outcomes defined by scores in the typical range and good outcomes defined by improvement in key domains. A good outcome defined by either metric was associated with lower ASD symptom scores, higher IQ scores and more friendships in late childhood. Important contextual factors such as family functioning were important predictors of a good outcome, controlling for baseline scores.

Conclusions:

The results suggest that there are multiple ways of defining a good outcome that individualy are not uncommon in this cohort during late childhood. Given the heterogeneity seen in ASD, it is possible to arrive at a 'good' outcome by multiple pathways, either by achieveing a typical

score or by showing clinically significant improvement. Although these ratings of outcome were based on parental input, we do not have the perspective of children with ASD which will be crucial in future studies. In addition, the stability of a good outcome in unknown. The different domains of outcome appear to be relatively independent suggesting that interventions must be broadly based to ensure improvement across multiple domains.

25 **200.025** Program Evaluation of a Community Organization Supporting Employment for Adults with ASD

V. Martin *and M. J. Lanovaz, École de psychoéducation, Université de Montréal, Montreal, QC, Canada*

Background: Action main-d'oeuvre (AMO), a community organization in Montreal (Canada), offers services for adults with ASD looking for employment. To receive services, clients must have a documented diagnosis of ASD, be motivated to work, be independent for transportation and have the potential to enter the competitive labour market. Counsellors support their client's job search and may assess potential jobs and workplaces. AMO offers direct support in the workplace for training, for developing adaptations, and for raising awareness of supervisors and colleagues about ASD, as needed. They can also be called upon to resolve issues in the workplace.
Objectives: The main objective of our study is to assess the characteristics of AMO's clients as well as the impact of their services on job integration.

Methods: All new clients between January 2017 and October 2018 were invited to participate in our study. Participants filled out questionnaires about their symptoms of autism, their adaptive skills, their work self-efficacy and their anxiety. AMO's database provided socio-demographic data, information on services, and employment status. After 6 to 9 months of unsuccessful job search, or after 6 weeks of employment (whichever came first), participants repeated the self-efficacy and anxiety measures, as well as questionnaires to assess their satisfaction.

Results: Participants were 28 males and 5 females whose ages ranged from 19 to 49 years. Twenty-eight percent had a high school degree, 30% a college degree and 24% went to university. Half of the participants lived independently (55%). Most were single (79%) and 9% were parents. Half of participants (55%) had no work experience or less than six months. Thirty percent had an SRS-2 global score in the mild range, 27% in the moderate range and 21% in the severe range. Adaptive scores were normal or above average for 67% of participants. Sixty percent of participants had a 2nd diagnosis, the most common of which were ADHD, depression, general anxiety disorder, unspecified mental health disorder, physical or sensory impairments. Anxiety scores were significantly higher than working population (p=0.001). Work self-efficacy score was low (63%) and negatively correlated with work situational anxiety (–0.538; p=0.001). Data collection for employment status is ongoing. Of 28 participants, 45% found competitive employment, 9% competitive employment with a partial salary subsidy, 6% a paid internship to develop job skills, 9% went back to school, 6% were still looking for a job 6 months after starting services. Sixteen participants filled up follow-up questionnaires (7 are lost to follow-up) and were satisfied with services. Those employed (12) were somewhat satisfied with their job, positive about their supervisor, but less with colleagues.

Conclusions: Participants showed strengths regarding adaptive skills, a high proportion of participants have a normal score, and regarding education, 54% have post-secondary education. Half of the participants never had a job or did not have more than 6 months of work experience, showing a need for employment support. Preliminary results indicate that participants were satisfied with services and 54% found employment. Job duration is a concern and will be investigated.

26 **200.026** Pronounced Overlap of Autistic and Schizoid Personality Trait Burden in Adolescence

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Background: Similarities in the respective clinical presentations for (a) schizoid personality disorder (PD) and (b) autism spectrum disorder (ASD) have long been recognized (Wolff & Barlow, 1979), but never formally reconciled with the question of whether they reflect overlapping developmental origins, nor whether the reciprocal nature of their respective frequencies over the life course (with ASD historically more common in childhood and schizoid PD more common in adulthood) reflects symptom continuity between the two conditions.
Objectives: This study explored the association between trait-like elements of the autistic syndrome and schizoid PD symptoms in a longitudinal study of youth with and without high-functioning autism spectrum disorder (Wagner et al., 2018).

Methods: We compared verbal males with ASD, ages 11-25 (n=53) with non-ASD psychiatric controls in the same age range (n=22) with respect to quantitative autistic trait burden using the Social Responsiveness Scale-2 (SRS-2, parent- and teacher-report) and schizoid PD trait burden using the Diagnostic Interview for Genetic Studies (DIGS, parent- and self-report, with diagnostic criterion items presented on a 4 point Likert scale for frequency). In this cohort, scores on the SRS-2 exhibited marked stability from childhood through adolescence.

Results: Both autistic traits and DSM IV schizoid PD criterion item burden were continuously distributed throughout the sample (Fig. 1), and individuals with ASD manifested a distinct pathological shift in comparison to non-ASD controls (Table 1, $t(50) = 5.6$, $p<.001$ with an effect size of 1.35); the magnitude of the between-groups difference was comparable to that for autistic trait burden. Moreover, within individuals, schizoid PD and autistic traits were strongly correlated (r =0.46, $p<.01$). When selecting a Likert-scale threshold of 2 ("often true" or higher) for schizoid PD endorsement on the DIGS, 54% of high-functioning ASD males exceeded the threshold in comparison to less than 10% of their counterparts in the non-ASD psychiatric control group (n=2). We next explored specific symptoms that contributed to similarities and differences between groups, notably distinctive of which were ASD participants' most frequently endorsed lack of close friends and tendency to choose solitary activities. 5.8% of subjects with ASD met full diagnostic criteria for schizoid PD, in comparison to 0% of the non-ASD psychiatric control group.

Conclusions: Over half of high-functioning males with ASD demonstrate unequivocal schizoid PD trait burden in adolescence. It is extremely likely that historic cohorts of adults diagnosed with schizoid PD either: a) had childhood-onset autistic syndromes; b) have been misdiagnosed; and/or c) have syndromes that were substantially contributed by autistic trait burden throughout childhood. Future studies to clarify overlap and distinctions between these two syndromes are strongly warranted, given that higher-functioning ASD syndromes are now recognized in close to 1% of all children, and that the characterizing features of both conditions are continuously distributed in the population.

References:

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27 **200.027** Selective Attention and Context Memory in Adults with ASD

P. S. Powell[1] *and A. Duarte*[2]*, (1)School of Psychology, Georgia Institute of Technology, Atlanta, GA, (2)Georgia Institute of Technology, Atlanta, GA*

Background:
Previous evidence suggests intact item memory but impaired context memory in adults with ASD. Similar findings have been observed in healthy older adults (HOA) and thought to be related to deficits in relational binding (i.e., forming an association between the item and context). However, this deficit can be overcome when attention is directed towards single item-context associations (James et al., 2016; Powell et al., 2018). While many studies used aging analogies to describe the pattern of memory performance in ASD, few have directly compared performance to HOA (Bowler, et al., 2004; 2007; Ring et al., 2016).

Objectives:

To address whether context memory performance in adults with ASD can be characterized as 'cognitively old', and whether it can be improved when attention is directed towards single item-context associations.

Methods:

Participants were 22 young adults (ages 18–35), 18 HOA (ages 60–80), and 26 adults with ASD, ages 20–58. Participants completed an experimental task designed to assess item memory and context memory. During the study phase, participants were shown a centrally-presented object in the presence of two contextual features: a color and a scene positioned to right and left of object. For each trial, participants directed their attention to the object's relationship with one of the two contextual features (Target Context) while ignoring the other (Distractor Context). EEG was recorded throughout the experiment.

Results:

Memory for the centrally-presented object (item memory) indicated similar performance across diagnostic groups (Younger: M = .73; Older: M = .71; ASD: M = .62), $F(1,49) = 1.71$, p = .20, η_p^2 = .07. Next, the proportion of correctly recognized Target and Distractor Contexts was examined using a 2 (Target vs. Distractor) by 3 (Diagnostic Group: ASD vs. Younger vs. Older) Repeated Measures ANOVA. This analysis demonstrated a main effect of context indicating greater memory for the target context relative to the distractor context (M = .66, SD = .11; M = .52, SD = .04, respectively), $F(1,63) = 92.66$, $p < .001$, η_p^2 = .65. However this main effect was qualified by a significant context by diagnostic group interaction, $F(2,63) = 8.56$, p = .001, η_p^2 = .26. Post-hoc comparisons indicated target context memory was significantly greater in younger adults (M = .74, SD = .08) relative to HOA (M = .63, SD = .06) and adults with ASD (M = .59, SD = .12). There was no difference in performance between adults with ASD and HOA.

Conclusions:

The current findings suggest that context memory in adults with ASD can be improved when attention is directed to single item-context associations. However, the level of context memory performance in adults with ASD was more comparable to the level of performance seen in HOA than younger adults, suggesting a 'cognitively old' pattern of context memory performance. Given that the majority of current sample of adults with ASD were less than 45 years old, these findings may have important implications for the specific cognitive abilities that may be more disrupted in adults with ASD as they age.

28 **200.028** A Participatory Exploration of Writing Skills and Predictors of Writing Quality Among Autistic and Non-Autistic College Students

K. Gillespie-Lynch[1]*, E. Hotez*[2]*, D. Bublitz*[3]*, A. Riccio*[4]*, D. DeNigris*[5]*, M. C. Zajic*[6]*, K. Luca*[7]*, B. Kofner*[7] *and N. Gaggi*[8]*, (1)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY, (2)City University of New York, Hunter College, New York, NY, (3)Dr., NY, NY, (4)Department of Psychology, The Graduate Center, City University of New York (CUNY), New York, NY, (5)Psychology & Counseling, Fairleigh Dickinson University, Madison, NJ, (6)University of California at Davis MIND Institute, Davis, CA, (7)CUNY, NY, NY, (8)College of Staten Island, Staten Island, NY*

Background: Although essential for success in college, the writing skills of autistic college students have received limited empirical attention (Gerstle & Walsh, 2011; Jackson et al., 2018). Autistic people often exhibit writing difficulties (Brown et al., 2014; Zajic et al., 2018). Difficulties with Theory of Mind (ToM) and/or global coherence may contribute to narrative challenges in autism (Brown & Klein, 2011; Joliffe & Baron-Cohen, 2001). However, some autistic adults report communicating *more* effectively through writing than speaking (Davidson & Smith, 2009) and autistic people with developed language skills may not struggle with ToM (Happé, 1995). Therefore, autistic college students may not experience specific challenges writing. As writing demands change throughout the lifespan (Bazerman et al., 2018), more information about the writing abilities of autistic college students is critical.

Objectives: To compare the writing skills of autistic and non-autistic college students and to examine predictors of writing quality.

Methods: Autistic (n = 26; 92.6% male; 64% White; Mean age = 21.3) and non-autistic college students (n = 24; 43.5% male; 45% White; Mean age = 20.5) completed a measure of ToM (RMIE; Baron-Cohen, 2001), a global integration task (Joliffe & Baron-Cohen, 2011), a personal essay (wherein they were asked to share something they found meaningful by highlighting what it meant to them and whether or not it would mean the same thing to others), and a short story. After realizing that our initial hypotheses/coding lacked autistic perspectives, we asked two autistic college students to develop their own hypotheses and coding schemes. One neurotypical and one autistic coding pair developed coding schemes and obtained reliability. The neurotypical coding scheme included global coherence, ToM, and non-literal language. Autistic coders coded for creativity, readability, specificity, repetitiveness, emotional dullness, and point of view. We used paper.rater.com to assess length, errors, and quality (AutoGrader).

Results: Autistic students (20%) less frequently included multiple perspectives in their essays than non-autistic students (67%; p = .001). Their essays trended toward lacking global coherence (autistic 20%; non-autistic 0%, p = .051) and being more creative (15% autistic; 0% non-autistic; insufficient instances for chi-square analysis). Autistic students' essays exhibited *fewer* simple sentences and *heightened* writing quality. Autistic students used fewer simple sentences and more complex vocabulary in their stories ($ps < .02$). No qualitative group differences in fiction were observed. A linear regression revealed that autism classification (r = .55) and RMIE (r = .53, $ps < .004$), but not age or gender, were positively

associated with writing quality. Global integration was not included in the regression due to collinearity with RMIE, $r(38) = .04$, $p = .01$ but was *not* correlated with writing quality.

Conclusions: Autistic students exhibited subtle difficulties using ToM in their personal essays (wherein attention to multiple perspectives was prompted) but not in open-ended fictional writing. Though demonstrating variability, findings suggest that autistic college students leverage narrative skills to help them succeed in college and understand others. Future participatory explorations of the writing of autistic college students should examine institutional factors that contribute to writing development longitudinally.

29 **200.029** A Thematic Analysis of First-Hand Reports of Face Recognition and Eye Contact in Adults with and without Autism Spectrum Disorder

K. B. Parkington *and R. J. Itier, Psychology, University of Waterloo, Waterloo, ON, Canada*

Background: It is well-established that many individuals with autism spectrum disorder (ASD) exhibit difficulties with maintaining and integrating eye contact during social overtures. Anecdotal reports have alluded to experiences of sensory or emotional overload when individuals with ASD engage in mutual eye contact, as well as a general unawareness of why eye contact is "necessary". However, it remains unclear what thematic relationships are present amongst a number of individuals on the spectrum, as well as what factors and motivations underlie this socially salient behaviour. Empirical theories also propose that reduced eye contact may lead to cascading effects in social cognition, including face recognition difficulties, a concept yet to be addressed in qualitative reports.

Objectives: We sought to understand how adults with and without ASD experience eye contact and situations involving face recognition to clarify the motivations and reasons guiding their social behaviours.

Methods: A thematic analysis was conducted on semi-structured interviews collected in a sample of high-functioning adults with ASD and age-, gender-, and IQ-matched neurotypical adults in relation to their feelings, beliefs, and experiences with face recognition and the engagement of eye contact.

Results: Whilst adults with ASD were more likely than neurotypical adults to report difficulties with face recognition, a relationship between attention to another person's eyes and face recognition was not reported by either group. Most adults with ASD reported they were aware of social conventions surrounding eye contact, indicating an awareness that it helps establish connection, rapport, and social attention with another person. Many also indicated they can engage in eye contact when required by social demands but if offered a choice would prefer to allow their eyes to wander or look away from the person completely. Several adults with ASD also discussed using strategies which mimic eye contact to an observer (e.g., looking at the forehead, nasion, or nose). A few informants also reported that attending to the eyes results in perceptual or sensory overload and "too much information", leading to tendencies to look to less visually distracting areas. Adults with ASD also reported difficulties in maintaining eye contact when in a pre-existing emotional state, especially increased states of anxiety or depression, and eye contact itself was also deemed to be emotionally and/or physiologically overwhelming, thereby making regulation more difficult. Finally, whilst both groups reported reduced eye contact when thinking or trying to collect their thoughts, adults with ASD exclusively reported increased cognitive load during interactions, particularly in relation to monitoring socially anxious thoughts and gaze duration. These findings will also be discussed in relation to gender differences and how reports coincide with quantitative measures of face recognition and attention to the eyes.

Conclusions: These first-hand reports confirm that whilst adults with ASD are able to engage in mutual eye contact to a degree, many experience perceptual, emotional, and/or cognitive overload, making continuous eye contact difficult or uncomfortable. These findings have important implications for understanding the motivations sub-serving gaze behaviours in ASD, and the need for individualized interventions targeted to the type of overload experienced.

Poster Session
201 - Affective Neuroscience
5:30 PM - 7:00 PM - Room: 710

30 **201.030** Behavioral and EEG Abnormalities during Cognitive Control and Visual Perception in Autism Spectrum Disorder (ASD)

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Background: People with Autism Spectrum Disorder (ASD) are hypothesized to show atypical connectivity. However, the majority of studies testing this hypothesis used MRI, a technique with limited temporal resolution.

Objectives: Here we use EEG to investigate the temporal dynamics and the network properties of the brain connections associated with behavioral differences in ASD during rest, visual perception of gratings of varying spatial frequency, and cognitive control (i.e., Simon Task).

Methods: Young adults with and without ASD (N=17 in each group) matched on age, gender, and estimated intelligence quotient (IQ) were recruited. We measured their behavior and their EEG during rest, a low-level visual perception task, and a cognitive control task. Offline, we computed EEG power and inter-site phase clustering (ISPC; a measure of connectivity) in various frequency bands, as well as visual Event Related Potentials (ERPs).

Results: During rest, there were no ASD vs. controls differences in EEG power, suggesting typical oscillation at baseline. During visual processing, we found a decreased broadband EEG power in ASD vs. controls pre-baseline normalization that we interpret as an indication of higher efficiency in visual processing in ASD. We also found decreased P2 ERP amplitude in ASD vs. controls during visual processing, which may suggest higher ability to ignore irrelevant aspects of stimuli. This ability to ignore irrelevant aspects of stimuli was most apparent with the behavioral results of the Simon task (i.e., reverse Simon effect in controls but not in ASD participants) and is consistent with an increased fluid intelligence in ASD.

Conclusions: Our results of (1) typical EEG at rest, (2) decreased interference to irrelevant stimuli during the Simon task, and (3) enhanced efficiency of visual processing in ASD vs. controls demonstrate areas of strength in the cognitive profile of autistic young adults.

31 **201.031** Comfortable, Valid and Reliable? Measuring Stress in Children with ASD Using Select Consumer-Grade Heart Rate Trackers

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Background: New wearable monitoring devices have the potential to revolutionize psychophysiology research among people with ASD by bringing it to the settings that matter – out of the laboratory and into schools and homes. However, due to sensory sensitivities, people with ASD may not be comfortable wearing such devices. In addition, formal testing of the reliability and validity of such devices among people with ASD is limited. Objectives: This study tested whether commercially-available heart rate trackers (1) can be comfortably worn by children with ASD, and (2) validly and reliably measure stress in children with ASD.

Methods: 55 children, 32 with ASD and 23 without ASD, 8-12 years old were fitted with four heart rate trackers, including one chest-strap (Polar H7), two wrist-bands (Mio Fuse and Pulse On), and one set of headphones (Jabra). They participated in a two-hour battery that included a rest task (watching a relaxing video) and low-level stress tasks taken from the Laboratory Temperament Assessment Battery, including the transparent box task. Heart rate (beats per minute; BPM) and heart rate variability (R-R interval) data were recorded simultaneously from each of the devices with custom software. Researchers administered the Comfort Rating Scales to children at the end of the session; children rated the devices on eight dimensions: 1) Emotion (*I feel tense or on edge because I am wearing the device*); 2) Attachment (*I can feel the device on my body*); 3) Harm (*the device is causing me some harm*); 4) Perceived change (*I feel strange wearing the device*); 5) Movement (*the device affects the way I move*); 6) Anxiety (*I do not feel secure wearing the device*); 7) Sensory sensitivity (*the device feels annoying on my skin*); 8) Attention on sensation (*I cannot stop thinking about the feeling of the device on my skin*). Validity of stress measurement was analyzed using BPM and R-R interval data in 2 groups (ASD, non-ASD) 2 tasks (rest, stress) repeated measures ANOVAs.

Results: *Comfortability.* As shown in Table 1, 85% of children with ASD kept the Mio Fuse wrist-band and Polar H7 chest-strap on during the entire session (fewer children kept the other devices on). Although the Polar H7 chest-strap was less comfortable for children with ASD than for children without ASD with regards to the Emotion and Movement dimensions, absolute scores show that, on average, all children found the devices comfortable (see Figure 1). *Validity.* In the stress relative to rest condition, heart rate went up for the Polar H7 chest-strap, $F(1,41)=56.27$, $p<.001$, $\eta p^2=.58$, and Mio Fuse wrist-band, $F(1,40)=13.70$, $p=.001$, $\eta p^2=.26$, respectively, and R-R interval (ms) went down for the Polar H7 chest-strap, $F(1,41)=56.27$, $p<.001$, $\eta p^2=.58$, and Mio Fuse wrist-band, $F(1,40)=21.17$, $p<.001$, $\eta p^2=.35$, respectively. *Reliability.* Presentation of results will include technical reliability data (spike rate and sampling fidelity).

Conclusions: Findings show that select heart rate devices may be used for measuring stress in children with ASD. Results from this study may inform methodologies used in future studies to measure physiological stress in children with autism in community settings.

32 **201.032** Emotional Facial Expressions Evoke Regionally-Specific Activation in the Amygdala in Children, Adolescents and Adults with Autism Spectrum Disorder Relative to Typically-Developing Individuals

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Background: Direct eye gaze is essential for the identification of emotional expressions. Averted gaze is a common behavioural phenotype in children with autism spectrum disorder (ASD), which is thought to underlie social communication impairments seen in this population. While averted gaze is increasingly included in early diagnostic assessments for ASD, the neural mechanisms are poorly understood. Previous neuroimaging studies have reported conflicting reports on the neural activation and behavioural responses during viewing of emotional face stimuli in individuals with ASD, with some studies reporting hyperactivation in the amygdala and fusiform gyri, key regions for emotional face processing, while others have reported hypoactivation. Findings may reflect differences in saliency cues directed towards the eye region when viewing emotional face stimuli during the experimental tasks.
Objectives: Using meta-analytic methods, to determine whether individuals with ASD demonstrate differential activation in brain regions involved in processing emotional face stimuli, compared to typically developing (TD) individuals. Further, we aim to examine whether task differences (constrained or fixated gaze) affects regional activation in the brain, particularly in the amygdala.

Methods: A comprehensive literature search of electronic databases was conducted for peer-reviewed studies which included comparisons of functional magnetic resonance imaging (fMRI) data acquired during an emotional face viewing task between individuals with ASD and typically developing controls. BrainMap GingerALE v2.3 was used to conduct an Activation Likelihood Estimate (ALE) meta-analysis of all studies found which met the inclusion criteria. Data were corrected for multiple comparisons using the false discovery rate (FDR, $p<0.05$).

Results: A total of 22 studies were identified, encompassing data from 418 individuals diagnosed with ASD, and 476 TD participants (ages ranging from 8-44 years), which served as a comparison group. A further measure of constrained or fixated eye gaze to the eye region of the stimuli was identified in 8 of these studies (comprised of 184 individuals with ASD and 219 TD individuals), which were included in sub-analyses examining the likelihood of activation in the brain in response to constrained gaze during the emotional face processing tasks. Analyses of all studies, regardless of gaze constraints, confirmed significant bilateral amygdala activation in both typically developing (right: $p=0.004$; left: $p=0.004$) and ASD individuals (right: $p=0.003$; left: $p=0.003$). The fusiform gyrus was activated only in TD participants only ($p=0.003$). The analyses of the constrained eye gaze studies revealed that only ASD participants had increased activation of the left amygdala in compared to TD controls ($p=.003$).

Conclusions: ASD and TD participants employ different networks when processing emotional face stimuli. Findings from the constrained gaze analyses, suggest individuals with ASD are experiencing increased arousal reflected in an increased likelihood of evoking activation in the left amygdala when viewing the eye region of emotional stimuli. Desire to avoid this negative biological response to emotional stimuli, and eye regions specifically, may underlie atypical gaze patterns and emotional face processing in individuals with ASD.

33 **201.033** Mindfulness Training-Induced Increases in Middle Cingulate Cortex Activity during Self-Reflection Predicts Depression-Reduction in Adults with Autism Spectrum Disorder

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Background: Adults with autism spectrum disorder (ASD) experience high rates of depression and anxiety. There is some evidence that Mindfulness-Based Stress Reduction (MBSR) is effective in reducing depression and anxiety in adults with ASD, however the neural mechanisms and benefit above and beyond support/education groups are unknown. Functional MRI (fMRI) research shows adults with ASD do not activate the ventral medial prefrontal cortex (vmPFC) and middle cingulate cortex (MCC) during self-reflection as seen in neurotypical (NT) adults. Mindfulness training regulates self-reflection neural activation in NT adults, making this a likely mediator of symptom-reducing effects in adults with ASD. Objectives: In a pilot study, we investigated whether adults with ASD who received MBSR training increased the blood-oxygen-level dependent (BOLD) response in regions activated during self-reflection, compared to a support/education control group, and if the BOLD signal change correlated with changes in self-reported depression and anxiety.

Methods: Twenty-eight adults (nine women; mean age=31.8±12.9, range=18-64; mean IQ=106±18.5, range=70-139) with ASD were randomly assigned to an 8-week MBSR group (n=15) or a support/education control group (n=13). All participants self-reported an ASD diagnosis and met ASD criteria on the ADOS-2. The MBSR training was adapted by removing metaphorical language similar to Spek et al. (2013), and was co-instructed by an experienced MBSR instructor and ASD clinician. Participants met for two-hours once/week for eight weeks with homework. The novel control group met for the same amount of time with a cognitive neuroscience instructor to control for social interaction/support. Control participants were given minimal education on relaxation techniques from the National Center for Complementary and Integrative Health and homework. Pre- and post-intervention fMRI scans were collected for the self-reflection task where participants: (1) reflected on whether or not the word displayed was a trait they possessed (self-condition), and (2) made a judgement about the positive or negative valence of words (word-condition). Self-reported symptom ratings were assessed via the Beck Depression Inventory-2 and the State-Trait Anxiety Inventory. Within group comparisons were performed with paired t-tests and correlations with Pearson product-moment.

Results: The MBSR group demonstrated significant depression reduction with a moderately-large effect size ($t(14)=3.31$, $p=0.005$, $d=0.66$; Fig. 1a). The control group's depression reduction approached significance with a moderately-small effect size ($t(12)=1.82$, $p=0.09$, $d=0.40$; Fig. 1a). Neither group significantly reduced anxiety symptoms (Fig. 1b). The MBSR group demonstrated increased activation in MCC ($p=0.018$, small-volume family-wise error corrected; Fig. 2a), but not vmPFC, in the Self>Word contrast after training; the control group demonstrated no changes. Change in MCC activation was negatively correlated with depressive symptom change in the MBSR group ($r(11)=-0.49$, $p=0.04$ one-tailed; Fig. 2b).

Conclusions: In a pilot study, we demonstrated that MBSR is effective for reducing depression in adults with ASD, and the neural mechanism may be increased MCC activation during self-reflection. Additionally, our novel support/education group shows promise for modest depression-reduction, which is an important consideration for individuals or communities with limited access to or funding for MBSR training. A larger clinical trial is warranted to fully understand the efficacy and neural mechanisms of each behavioral intervention.

34 **201.034** Neurobiological Markers of Vocal Emotion Recognition in the Broader Autism Phenotype

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Background: Relatives of individuals with Autism Spectrum Disorder (ASD) demonstrate atypical brain activation in regions of the "social brain" when judging emotional states in the face and eyes. These findings are consistent with an ASD profile and suggest the presence of neurobiological markers of the Broader Autism Phenotype (BAP), or endophenotypes of ASD, for emotion recognition. Neuroimaging studies have not examined whether the BAP in relatives is also associated with atypical brain activation for the recognition of emotional voices, although there is evidence for this in individuals with ASD.

Objectives: We aimed to examine the neural correlates of vocal emotion recognition in relatives of individuals with ASD, specifically using non-linguistic emotional vocalizations known as vocal affect bursts (e.g., laughter, cries, screams).

Methods: We assessed 13 adult family members of individuals with ASD and 13 adult controls without a family history of ASD (matched on age and IQ). The family group consisted of first-degree (n = 11) and second-degree (n = 2) relatives from seven different families. Prior to recruitment, all family members were determined to have clinical markers of the BAP on extensive cognitive and behavioural testing, and all controls were screened for BAP traits on a self-report measure. The block-design fMRI task consisted of (i) "emotion" blocks, in which participants identified basic emotions in vocal affect bursts, and (ii) "gender" (baseline) blocks, in which they identified gender (male/female) in non-linguistic neutral vocalizations. We used whole-brain, fixed effects analyses to determine brain activation in each group ("emotion > gender" contrast) and to compare activation between groups at a cluster-corrected threshold.

Results: The family group and controls were able to classify vocal affect bursts at ceiling levels, suggesting brain activation reliably related to correct task performance. Both groups largely activated similar networks (e.g., social brain, mirror neuron system and memory structures; salience, cognitive control, motor and visual networks). However, while controls demonstrated bilateral activation in the superior temporal sulcus (STS) and adjacent middle temporal gyrus (MTG), activation in these regions were left-lateralised in the family group. Between-groups analyses also revealed that the family group had significantly higher activation than controls in the left lateral occipital cortex, whereas no regions showed significantly lower activation in the family group.

Conclusions: Our findings suggest that the family group used neural compensatory mechanisms to successfully classify vocal affect bursts. In particular, they appeared to engage in more effortful processing of vocal affect bursts in left rather than right temporal voice areas (e.g., STS/MTG), which could have contributed to increased left occipital activation. This is consistent with previous research indicating that temporal voice areas are connected to the ipsilateral occipital cortex and that occipital activity is modulated by attention to auditory stimuli. Increased left occipital activation may also indicate more cross-modal processing (e.g., visual imagery) to perform the task. Overall, our findings suggest a neurobiological marker of the BAP for vocal emotion recognition.

35 **201.035** Symptoms of Depression but Not Anxiety Modulate Resting State Activity in Children with ASD

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Background:
Alterations to resting-state alpha activity have been identified in a number of neuropsychiatric and neurodevelopmental conditions. Previous work from our laboratory showed age-related increases in peak alpha frequency (PAF) in typically developing children (TDC) but not in children with autism spectrum disorder (ASD). Lack of change in the ASD sample was attributable to early maturation of PAF, such that younger (6 to 9-year-old) children with ASD had significantly higher PAF values than TDC. In contrast, older children with ASD had similar or slightly lower PAF values than TDC. Given the literature on alpha activity alterations in individuals with depression and anxiety, as well as high rates of comorbid anxiety/depression in ASD, the present study sought to examine effects of co-occurring anxiety and depression symptoms on resting-state alpha activity in children with ASD.

Objectives:

To explore the association between PAF and clinical symptoms of anxiety/depression in children with ASD.

Methods:

Magnetoencephalography (MEG) resting-state eyes-closed data were obtained from 89 male children with ASD, ages 6 to 17 (mean age = 10.03 +/- 2.42). Using BESA Research 6.1, a source model with 15 regional sources projected the raw MEG surface data into brain source space and a Fast Fourier Transform was applied to artifact-free 3.41 second epochs of continuous data at each regional source. From the 15 average power spectrum, PAF was identified in each participant from the source (most often the midline parietal source) showing the largest amplitude alpha activity (8-12Hz). Clinical measures of interest included parent-rated anxiety and depression symptoms on the Child Behavior Checklist (CBCL) and indices of behavioral regulation and emotional control by parent report on the Behavior Rating Inventory of Executive Function (BRIEF).

Results:

Correlations indicated that higher levels of depression were associated with lower PAF ($p = 0.05$, $r = -0.03$). Given known associations between age and PAF, follow-up analyses examined findings in younger (6-9 years) versus older (10-17 years) children. Results indicated a significant negative association between depression symptoms and PAF in younger ($p = 0.02$, $r^2 = 0.10$) but not older ASD children ($p = 0.83$, $r^2 = 0.002$). No associations were observed between PAF and anxiety symptoms ($r^2 = 0.002$).

Conclusions:

Increased symptoms of depression were associated with lower PAF values in younger children with ASD, whereas no associations were observed between PAF and anxiety measures. These findings therefore suggest that co-occurring depression symptoms modulate PAF in ASD, altering the anticipated ASD pattern. Further work with larger samples is needed to better understand the effect of mood symptoms on resting-state alpha activity in ASD, with particular focus on younger children, who may be most susceptible to altered alpha activity in the context of symptoms of depression.

36 **201.036** Young Adults' Autistic Behaviors Predict N170 Responses to Emotional Faces

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Background:
Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by deficits in communication and social interaction. ASD individuals show impairments in emotion identification, especially for negative and complex emotions. This deficit may be related to neural differences in the processing of faces; previous psychophysiological research suggests that autistic individuals show differences in activity in brain areas necessary for facial recognition than non-autistic individuals. In particular, the N170 event-related potential (ERP) has been established to be sensitive to the neural processing of faces. Thus, examining N170 activity during face processing may help reveal the neural correlates of early emotion identification in autism.

Objectives: The purpose of the current study was to test whether the neural processing of emotional facial expressions differs as a function of levels of autistic traits and differs based on task type in a neurotypical adult population. Because ASD is a spectrum condition, using non-clinical samples of individuals on the broader autism phenotype (BAP) can help us understand emotion processing related to ASD. Studying low and high BAP individuals allows us to isolate the effects of autistic traits on emotional processing between groups that are well-matched, limiting confounding variables between groups. The current study uses both full-face and eye region stimuli to control for known behavioral scanning differences and to isolate the resulting impact on neural activity.

Methods:

Neurotypical participants (n=34) completed an emotion identification task while EEG data were recorded. For each trial, a face depicting an emotion (happy, angry, fear, surprise) or a neutral expression was presented for 1000 ms; an inter-stimulus interval of 500 ms was used between trials. In half of the trials, participants indicated if the emotion of the face matched that of the face presented before it (matching task). In the other trials, participants indicated if the emotion of the face was positive or negative (valence task). Each participant completed the Broad Autism Phenotype Questionnaire (BAPQ) to measure their level of autistic traits.

Results:

A 5 (Emotion: Angry, Fear, Happy, Neutral, Surprise) x 2 (Task: Valence, Matching) x 2 (BAPQ: Low, High) mixed model Analyses of Variance (ANOVA) was conducted. For the matching trials, there were no significant effects. For the valence task, however, there was a significant Emotion x BAPQ interaction, $F(4,88) = 3.83$, $p = .025$. Simple main effects analyses revealed that for the fear trials, low BAPQ participants demonstrated a larger amplitude N170 than high BAPQ participants, $t = -2.68$, $p = .014$. Furthermore, correlational analyses revealed that BAPQ was significantly correlated with N170 amplitude for angry faces, $r = .37$, $p = .033$.

Conclusions:

These results provide a better understanding of neural activity during emotion processing for those on the BAP and add to work investigating the neural underpinnings of emotion processing deficits for ASD individuals. By studying social processing within the wider context of the BAP, we are better able to evaluate specific autism-associated behaviors in isolation of other clinical features as well as include a broader community of persons with autistic traits.

37 **201.037** Young Children with Autism Spectrum Disorder Exhibit Shorter Average Look Duration to Social As Compared to Nonsocial Stimuli

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Background: When viewing complex dynamic stimuli, children with autism spectrum disorder (ASD) spend a lower proportion of time looking at the social as compared to the nonsocial elements (reduced *social attention*) of those stimuli. In this analysis, we evaluate a different measure related to social attention, namely, the *average look duration* to a social vs nonsocial stimulus. We were also interested in whether individual differences in average look duration to a social stimulus are correlated with social communication abilities and autism symptom severity.
Objectives: Our objectives were to 1) determine the average look duration of children with ASD to social versus nonsocial elements of a complex dynamic stimulus, and 2) examine the relationships between two measures of social attention, namely, the proportion of time spent looking at social elements and the average look duration to social elements, and measures of social communication abilities and autism symptoms. We hypothesized that children with ASD would exhibit shorter average look duration to social as compared to nonsocial elements, and that shorter look duration to social elements would be associated with lower social communication abilities and more severe autism symptoms.

Methods: One hundred seventy-six participants 2-8 years meeting criteria for ASD based on the Autism Diagnostic Observation Schedule-2 (ADOS) and Autism Diagnostic Interview-R, participated in a clinical trial. An eye-tracking task, administered at baseline, consisted of a 3-minute video that included an episode involving a social bid by an actress (social condition) and an episode when toys were activated (nonsocial condition). Sixteen subjects were excluded due to non-compliance and calibration failures (n=160, M age=65.3 months, M FSIQ=70.6). To measure average look duration, we divided total viewing time by the total number of looks to both stimulus conditions. We also measured the proportion of time spent looking at the actor and her face during the social condition. Correlations with Vineland Adaptive Behavior Scales-3, Pervasive Developmental Disorder Behavior Inventory (PDDB-I), and ADOS severity score were examined using multivariable linear regression controlling for age and FSIQ with α=0.05.

Results: As predicted, average look duration during the social condition was significantly shorter than during the nonsocial condition (M=3.11 (±1.10) and 3.89 (±1.63) respectively, p<0.001). Lower proportion of time spent looking at the actor was correlated with more severe symptoms, based on ADOS severity score (p=0.04). Shorter look duration during the social condition was associated with more severe symptoms (PDDB-I Receptive/Expressive Social Communication Abilities (p=0.004), PDDB-I Social Approach Behaviors (p= 0.03), and PDDB-I Autism Composite (p=0.05)). Look duration during the nonsocial condition was not correlated with symptom severity.

Conclusions: Young children with ASD exhibit shorter average look durations when viewing social stimuli, as compared to nonsocial stimuli. Furthermore, longer average look durations to social, but not nonsocial, stimuli were associated with reduced autism symptoms. The ability to look at a complex social stimulus for longer periods may reflect more advanced self-regulatory skills and lead to enhanced engagement with and comprehension of complex, dynamic social stimuli.

Poster Session
202 - Clinical Genetics
5:30 PM - 7:00 PM - Room: 710

38 **202.038** A Diagnostic Journey in Neurodevelopmental Disorders: Toward Improving Comprehensive Care for Children with Neurodevelopmental Disorders and Neurogenetic Conditions.

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Background: Established medical practice parameters for genetic testing in Neurodevelopmental Disorders (NDDs) has led to the identification of numerous genetic variations associated with these conditions (Schaefer et al, 2013; Duffourd et al, 2016; Sawyer et al, 2016). However, families continue to face barriers in access of care and diagnostic evaluation (Basel & McCarrier, 2016). In addition, our ability to identify genetic etiologies of NDDs has far outpaced our ability to provide timely medical care. Families of patients with NDDs are often left to digest complex medical terminology and explore resources that may best guide them in the care of their child.
Objectives: Our team has established the Care and Research in Neurogenetics (CARING) Clinic to provide comprehensive multidisciplinary care to patients with a NDD and known genetic etiology. We have utilized a diagnostic journey interview (DJI) to identify the major barriers in access of care and gaps in subsequent medical support following a genetic diagnosis. This study highlights the major results from our collected data.

Methods: The medical team consisting of neurologists, geneticists, and psychiatrists developed the DJI based on clinical experience and literature review. After creation of the DJI, trained staff conducted the interview with families by phone. A total of 25 families completed the DJI. The interview consists of questions regarding initial developmental concerns for the child, time from initial concern to first clinical diagnosis and to genetic testing, and medical counseling and access to services after clinical and genetic diagnoses.

Results: Numerous themes emerged from the data. Greater than 70% of families had developmental concerns for their child in the first year of life. Greater than 70% of families noted there was no availability of specialized medical evaluation in their geographic area. 57% of families noted a considerable wait time to see a geneticist. If genetic testing was obtained before referral to specialist, 80% of families reported minimal genetic counseling when results were given. Families noted that the most useful and informative resources were provided by the specializing health care provider (86%) and patient advocacy groups (57%). Qualitatively, primary care providers did not always address developmental concerns by referring to specialized practitioners, and although there was initial “fear and anxiety” in awaiting the results of the genetic testing, ultimately having the results was worth it.

Conclusions: The DJI highlights several key themes in improving medical care for patients with NDDs and their families. Moving forward, our clinic will utilize these results to share with community providers regarding the process of obtaining genetic testing and providing subsequent counseling. In addition, it is imperative as we identify known genetic disorders associated with NDDs that we begin to identify treatments that target core symptoms of the disorder. Lastly, as indicated by this interview practitioners should aid in building family networks around these genetic disorders to help support these families.

39 **202.039** Bridging the Gap: Access to Genetic Testing in a Community Sample of Individuals with Autism Spectrum Disorder

A. Rouhandeh[1], *C. Honsberger*[2], *M. Mulhern*[1], *N. Shanok*[2], *N. Huda*[2], *E. Brooker Lozott*[2], *M. Sotelo*[2], *J. Buxbaum*[3], *A. Kolevzon*[1], *S. De Rubeis*[4], *J. Foss-Feig*[1] *and P. M. Siper*[1], *(1)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (2)Els for Autism Foundation, Jupiter, FL, (3)Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (4)Seaver Autism Center for Research and Treatment, Icahn School of Medicine at Mount Sinai, New York, NY*

Background: While genetic testing is recommended by the American College of Medical Genetics for individuals with autism spectrum disorder (ASD), access to testing and physician referrals remain limited. Testing for Fragile X syndrome and high-resolution chromosomal microarray are the first-tier genetic tests for individuals with ASD; however, the extent to which they are pursued varies widely. Recently, a medical-center based autism research center, which carries out comprehensive genetic and clinical evaluations, joined with a nonprofit organization, comprising two public charter schools and a foundation providing recreational, therapeutic, and adult services for several hundred individuals with ASD per year, in order to integrate research into a community setting. The joint institute provides genetic testing, facilitated by the research group, to individuals within the school and foundation community.

Objectives: To characterize and assess the likelihood of receiving recommended genetic testing in a community sample of individuals with ASD.

Methods: Between August and November 2018, 45 families were recruited; 15 were enrolled by November 2018, with the remainder expected to participate by March 2019. The 45 screened participants with ASD (17.78% female) ranged in age from 2 to 32 years and all carried Individualized Education Plan (IEP) classifications of ASD and/or a documented diagnosis from medical records. Results from previous genetic testing were obtained, and testing was ordered for those who had not had recommended testing. Saliva samples are collected at the local center, and DNA extraction and testing is facilitated by the research institute. Phenotyping data is being collected through parent report.

Results: Of the participants screened (n=45), 22% had previous genetic testing confirmed by reports. The average year of ASD diagnosis for those with previous genetic testing (n=10) was 2009, while that of the total population was 2008. Average age at diagnosis for those with past testing was 29 months and 36 months for the total population. In our screened sample, 17.78% of individuals were characterized as nonverbal (by parent report), and 4 of those 8 individuals received genetic testing. Of 10 individuals with past testing, 20.0% percent had an autism-related finding (Fragile X syndrome (n=1); STXBP1-associated epileptic encephalopathy (n=1)). Fragile X testing, chromosomal microarray and research whole-exome sequencing results are pending for those whose testing is being conducted through this study.

Conclusions: Preliminary results suggest that genetic testing and referrals in the community remain limited, and that neither year of diagnosis nor age at diagnosis significantly increases the likelihood of genetic testing. An important next step will be to examine additional phenotypes influencing referrals for genetic testing, including IQ, adaptive behavior, and medical and psychiatric comorbidity, as well as source of diagnosis. Future directions include identifying additional barriers to genetic testing and increasing access and ease in community settings where the majority of individuals with ASD are served.

40 **202.040** Clinical Phenotype of De Novo Mutations in CHD2

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Background: *De novo* mutations in *CHD2,* a chromatin-remodeling gene, are associated with increased risk for autism spectrum disorder (ASD) and epileptic encephalopathy (Carvill et al., 2013; O'Roak et al., 2014). Case reports have identified individuals with *CHD2* mutations who present with neurodevelopmental problems including ASD, intellectual disability (ID), seizures, and challenging behavior, but substantial diversity is present across phenotypes (Chénier et al., 2014; Kim et al., 2018). Mice with *CHD2* mutations present with reduced body weight and spinal curvature, and these features have been reported in some humans; however, a characteristic physical phenotype of *CHD2* mutations has not been established in humans (Chénier et al., 2014; Kim et al., 2018). Quantitative phenotyping of individuals with *de novo CHD2* mutations is necessary to understand how these events contribute to neurodevelopmental disorders and comorbid behavioral and medical problems.

Objectives: To characterize the human phenotype of *CHD2* mutations using quantitative data from medical and behavioral evaluations.

Methods: Participants were 10 individuals with disruptive *de novo CHD2* mutations: Four individuals drawn from an ongoing genetics-first study, two individuals from the Simons Simplex Collection (SSC), and four individuals from published studies identified through denovo-db (2018; Epi4K Consortium et al., 2013; O'Roak et al., 2014; Rauch et al., 2012; Willsey et al., 2017). Participants in SSC and the ongoing study completed diagnostic assessments, medical history interviews, and physical and dysmorphology exams.

Results: 70% of individuals with disruptive *de novo CHD2* mutations were diagnosed with ASD, 60% were diagnosed with ID, and 56% were diagnosed with an anxiety disorder. 75% reported seizures. Gastrointestinal problems were reported by 100% of participants who completed a medical history interview; sleep problems were also reported by 100% of participants with a medical history. Spinal problems were not reported in any cases. Internalizing behavior problems were in the clinical range, while externalizing problems were in the borderline range; a history of aggression toward caregivers is reported for 83% of participants. Substantial variability is present in verbal IQ, nonverbal IQ, and adaptive behavior. 83% of individuals presented with a body mass index (BMI) one or more standard deviations below the mean, and 50% had a BMI below the 5th percentile.

Conclusions: *CHD2* mutations in humans are characterized by low BMI, sleep and GI problems, internalizing and externalizing behavior problems, high rates of ASD and seizures, and variability in IQ and adaptive behavior. Significant sleep and GI problems are also reported in humans with *CHD8* mutations (Bernier et al., 2014), suggesting that the role of chromatin remodeling in ASD-associated sleep and GI disturbances should be further examined. Other features of the *CHD2* phenotype in humans, such as low body weight and elevated rates of internalizing disorders, differ notably from the *CHD8* phenotype (Bernier et al., 2014). Future research should evaluate associations between *de novo* mutations and comorbid

internalizing disorders as well as the impact of intron mutations in chromatin-remodeling genes.

41 **202.041** Comparative Analysis of ASD Gene Prioritization Strategies

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Background:
Identification of a core set of highly penetrant and causative ASD genes among the growing list of genes associated with the disorder has become a central goal in autism research. To that end, we have developed a gene-scoring algorithm that relies on ongoing curation of individual ASD-associated variants in the autism genetic database (AutDB). The assessment of ASD-associated variants is based on multiple parameters such as significance of genetic association, family structure, inheritance pattern, zygosity, variant type, and functional effect (Larsen et al., 2016).

Objectives:

Our gene-scoring algorithm is one of several prioritization strategies that have emerged to aid in the identification of a core set of likely pathogenic ASD genes. However, there are differences between the approaches by which these strategies identify their own unique gene sets. Here, we utilized a modified version of our gene-scoring algorithm and compared our findings to other available ASD candidate gene datasets.

Methods:

We analyzed a total of 13,120 individual variants in 1036 genes associated with ASD that were annotated from 3544 research articles (AutDB data freeze of September 2018) in order to prioritize ASD candidate genes and identify a set of high-confidence genes. We then compared the results of our prioritization analysis to five other available ASD gene datasets: the SFARI Gene Scoring Module (data freeze of September 2018); a dataset of 65 ASD candidate genes identified by TADA analysis of whole-exome sequencing data (Sanders et al., 2015); candidate genes identified by a human brain-specific functional interaction network (Krishnan et al., 2016); the Developmental Brain Database (Gonzales-Mantilla et al., 2016); and the 78 genes comprising the SPARK gene list (updated April 2017).

Results:

The majority of the highest ranking ASD genes identified by our gene-scoring algorithm were well represented in four out of five datasets analyzed in this study. However, we also observed significant differences between our results and the other datasets, in part due to the types of genetic evidence used in assessing the importance of a gene in ASD pathogenesis, as well as to the dynamic assessment of candidate genes made possible by real-time curation of ASD-associated variants in AutDB. Finally, we observed little overlap between our results and those reported in Krishnan et al., 2016, with only 5 of our high confidence ASD genes ranked within the top 100 genes identified by interaction networks.

Conclusions:

The gene prioritization strategies used here help to confirm the importance of a set of genes well-represented by other authors and other methodologies while also highlighting genes for which some strong evidence exists that is suggestive of their causative role in autism but which have been overlooked by other methods.

42 **202.042** Contactin-5 Copy-Number Variant Is an Inherited Risk Factor for Autism Spectrum Disorder

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Background: The genetic contribution of Autism is high with a heritability of 60%. Identifying the genetic factors associated with this disorder is limited by its polymorphic and genetic heterogeneity. Genetic research has focused on rare variants with very large effect size including deletions and duplications of the genome, known as copy-number variants (CNVs). CNVs with intermediate effect size also play a less understood role in the underlying genetic architecture of the disorder. A multiplex family with three affected children with Autism Spectrum Disorder (ASD), a sibling with a neurodevelopmental condition, and an unaffected father were reported to all be carrying a CNV in the *Contactin-5 (CNTN5)* gene. The protein products of *CNTN5* encodes a neuronal cell adhesion molecule and promotes neurite outgrowth, suggesting the gene's potential role in brain disorders, however, its impact has not yet been demonstrated.
Objectives: This study aims to determine whether CNVs in this gene contribute to the risk for ASD. We examine the penetrance and prevalence of *CNTN5* CNVs in affected individuals with ASD and their unaffected siblings, as well as the general population.

Methods: Bioinformatic tools were used to explore six distinct databases. Microarray data from the Simon Simplex Collection (SSC) (n=2587) was used to distinguish *CNTN5* CNV prevalence between probands with ASD and their unaffected siblings. A novel structural variant segregation script identified the variant's inheritance pattern. Generation Scotland and IMAGEN databases (n=7511) were used to compare the prevalence of *CNTN5* CNVs between probands and the general population. Copy-number variants from Montreal's Ste-Justine Hospital (n=16,000) were used to validate the SSC data findings. DECIPHER, a database of individuals (n=27,000) with rare genetic diseases, was used to determine the frequency of *de novo* CNVs. Database of Genomic Variants (DGV) was used to determine the frequency of *CNTN5* CNVs within the general population.

Results: A significant overrepresentation of deletion CNVs within the exonic region of *CNTN5* in the probands (n=4/2587) from the SSC, compared to the general population (n=1/7511) (Fisher test p=0.01, Odds Ratio:11.6), was identified. The prevalence of deletion *CNTN5* CNVs in ASD probands and their unaffected siblings in the SSC cohort is 0.15%. An identical incomplete penetrance pattern of *CNTN5* variants compared to the reported multiplex family was observed in the SSC database. All (n=4) of the deletion *CNTN5* CNVs in the probands from the SSC were inherited from phenotypically normal parents; none arose *de novo*. Incomplete penetrance was noted, as CNVs in *CNTN5* were observed in both probands and their unaffected siblings. Interestingly, analysis of the DECIPHER database suggests that 52.6% of the CNV deletions and duplications of *CNTN5* (n=10/19) seen in individuals with rare disorders, ranging from 41.64kB to 134.05Mb, arise *de novo*.

Conclusions: *CNTN5* CNVs contribute to an individual's overall risk for autism. Such variants with intermediate frequency and penetrance reveal part of the underlying genetic architecture of ASD that has been largely unexplored. By studying these intermediate variants, the total genetic profile of individuals with ASD can be better understood, leading to improved genetic diagnostic techniques and future therapeutics.

43 **202.043** Contribution of Multiple Inherited and Shared Rare Variants to Autism Spectrum Disorder (ASD) in a Family with 3 Affected Siblings

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Background: Familial rare mutations can be found in 3-5% of ASDs. However, how they contribute to ASD remains largely unknown. As part of the iTARGET Autism project (http://www.itargetautism.ca/) and the MSSNG project (https://www.mss.ng/), we have recruited multiple families with ≥3 affected children to address this question.

Objectives: To analyze the genotype-phenotype correlation of inherited rare mutations shared by affected children in a multiplex ASD family.

Methods: We used whole genome sequencing (WGS) and high resolution DNA microarray to detect inherited rare mutations (SNVs, Indels, and CNVs) in a multiplex family with 3 affected children.

Results:

(1). Clinical investigations: This family has 3 boys all affected with ASD. Boy-1 (14-54A, 15 y/o) has ADHD, anemia, decreased pain sense, and no outwardly syndromic features. Boy-2 (14-53A, 14 y/o) has slightly coarse facies, showing the most obvious cognitive deficits and greater severity of ASD, and no anemia (nor a thalassemia). Boy-3 ('14-55A, 8 y/o) has anemia since birth, astigmatism and no outwardly syndromic features. Family history: Dad is an α-thalassemia carrier; Dad's nephew has PDD-NOS. Mom is a β-thalassemia carrier. Mom's father is anemic with Asperger's syndrome. Mom's paternal aunt and uncle both exhibit symptoms of OCD and anxiety disorder (unconfirmed).

(2). CNVs findings: An 18Kb deletion involving *HBA1, HBA2, HBQ1* and *HBM* (alpha hemoglobin locus) was identified in Boy-1 by DNA microarray. WGS confirmed this deletion was from the father. Array results for Boy-2 and Boy-3 are normal.

(3). SNVs/Indels findings: Two inherited, likely pathogenic rare variants were found in all 3 affected boys: compound heterozygous variants in *RELN* (p.Val1153Ile and p.Ser630Arg) and a maternal missense variant in *SHANK2* (p.Pro1184Ser). They are each strong ASD risk genes with both de novo and inherited mutations frequently found in affected or unaffected parents, suggesting other genetic or epistatic factors may co-act to cause ASD. Further to this hypothesis, additional gene variants are shared by all 3 boys, including compound heterozygous variants in *SCN10A*, maternal variants in *DLG1*, and paternal variants in *KMT2C*. Although these individual variants are of uncertain clinical significance, their co-occurrence in all 3 boys with ASD add to the mutation burden potentially predisposing to the ASD in children of parents with positive family histories. We also found a maternal variant in an ASD candidate gene, *ASH1L* (p.Gln433Pro), unique to Boy-2. Whether this missense mutation may contribute to the more severe ASD phenotype in this boy needs further investigation. A maternal pathogenic LOF mutation in *HBB* (c.126_129delCTTT, p.Phe42Leufs) was identified in Boy-3 as his mother is a β -thalassemia carrier. A *HBA1/HBA2*-involved deletion was found in Boy-1 and his father (an α -thalassemia carrier). Both Boy-1 and Boy-3 have anemia, while Boy-2, without anemia, does not have either of these two mutations.

Conclusions: Multiple inherited rare mutations, each with subthreshold or subtle clinical impact, may collectively contribute an additive effect or provide a 2nd-hit, or multiple-hits to render pathogenicity in ASDs.

44 **202.044** Demographic and Clinical Characterization of Participants in the Australian Autism Biobank

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Background: The clinical and genetic heterogeneity within individuals diagnosed with Autism Spectrum Disorder (ASD) represents significant challenges to advancing knowledge about etiological pathways and clinical outcomes. Considerable progress in this area has been made through collaborative and large-scale projects, necessitating a similarly large resource to be established in Australia, a country with unique ethnic and cultural diversity. Established in 2014, the Australian Autism Biobank was initiated by the Cooperative Research Centre for Living with Autism (Autism CRC).

Objectives: To summarise the clinical and demographic features of participants recruited to participate in the Australian Autism Biobank.

Methods: Participants recruited were children with a diagnosis of ASD, aged between 2-17 years, at four data collection sites across Australia. Biological parents and siblings, both with and without ASD, were also invited to participate, as well as non-autistic children ('controls') recruited from the general community. A smaller group of children presenting to recruitment sites clinically referred for an ASD diagnostic evaluation but who did not meet diagnostic criteria were also invited to participate ('ASD-query'). No exclusion criteria regarding language level, cognitive ability, or comorbid medical, psychiatric or genetic condition was applied to children diagnosed with ASD. All children completed cognitive or developmental assessments, with probands and ASD-query children additionally completing ASD assessments. Parents/caregivers completed questionnaires about medical and developmental history. Physical measurements as well as blood, stool, urine, and hair samples were collected from children; physical measurements and blood samples were collected from both parents of probands.

Results: A total of 979 probands (first child in family diagnosed with ASD) participated (20.4% females, 83.4% Caucasian, 12.9% Asian, 1.7% Aboriginal, 2.0% Maori or Pacific Islander), with an average age of 7.4±3.9 years (mean±SD) at assessment. 173 autistic siblings were also recruited (7.8±3.5 years, 30.1% females), comprising 145 multiplex families (between 2-5 children diagnosed) and 27 twin pairs. 847 mothers (39.5±6.4 years, range 22-68 years), 548 fathers (42.1±7.5 years, range 19-82 years) and 263 non-autistic siblings (8.2±4.2 years, range 2-16, 51% females) also participated. 150 non-autistic controls (6.2±3.4 years, 2-15 years, 51% female) and 16 ASD-query children (6.1±2.6, 3-10 years, 50% female) were also included in the cohort. Within the proband group, age at diagnosis ranged from 12-211 months (55.7±34.7) and IQ scores ranged from 40-138 (79.5±23.3). Based on parent/caregiver reports, 31.4% of probands had a diagnosed Intellectual Disability or Global Developmental Delay (n = 311), 4.5% had epilepsy (n = 45), and 2.2% had a previously diagnosed genetic condition (n = 22).

Conclusions: This initiative has resulted in a valuable and detailed resource comprising clinical information alongside biological samples to help increase our understanding of the underlying mechanisms associated with an ASD diagnosis. Both phenotypic and biological data are now available for access requests from the research community.

45 **202.045** Diagnostic Whole Exome Sequencing in an Autism Research Population

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Background:

Whole exome sequencing (WES) is increasingly being used clinically to identify a genetic etiology for autism spectrum disorder (ASD). Studies have shown the diagnostic yield for WES in ASD is around 25% in the clinical laboratory setting, but can be as low as 3.1% for those with isolated ASD. At our ASD focused research center, research WES is offered to all participants who have a confirmed diagnosis of ASD without a known genetic cause, regardless of lack of co-morbid medical conditions or insurance coverage. As clinicians consider what genetic testing is appropriate for their patients and as professional organizations update guidelines around genetic testing for ASD, it will be important to consider results from broader ASD populations beyond those referred for clinical WES.

Objectives:

To assess the diagnostic yield of WES in a broad ASD population from a research center and to describe the genetic findings identified.

Methods:

Participants underwent gold standard diagnostic evaluations for ASD and met both clinical and research criteria for this condition. Informed consent was obtained, and research WES was performed on the trio (proband and both parents) or quad (including a sibling). Qualifying variants were reviewed by a multidisciplinary team of researchers based on guidelines provided by the American College of Medical Genetics, and those variants determined to be likely contributory to the participant's ASD phenotype were sent for confirmation in a CLIA-approved laboratory.

Results:

In eighty-nine families, six sequence variants were determined by the research team to be likely causal, for an overall diagnostic yield of 6.7%. Four *de novo* variants in the genes *MECP2*, *HIVEP2*, *SHANK3* and *CHD8* were classified by the CLIA-laboratory as likely pathogenic or pathogenic. A maternally inherited missense variant in the X-linked gene *IQSEC2* and a *de novo* missense variant in the recently described gene *MED13* were both classified as variants of uncertain significance (VUS). Including only clinically classified pathogenic and likely pathogenic variants, the diagnostic yield was 4.5%.

Conclusions:

Diagnostic yield in a general ASD research population is much lower than in those referred for clinical testing, likely because cases with ASD referred for clinical WES might be biased towards those with a more severe or complex phenotype. The results of this study are likely more representative of the general ASD population. Challenges highlighted in this study include interpretation of previously unreported missense variants in X-linked genes, as these will frequently be classified as VUS (e.g., *IQSEC2*). This challenge extends to providing meaningful genetic counseling to mothers who are found to be carriers for a VUS in an X-linked gene. Another challenge is interpretation of, and genetic counseling for, variants identified in newly described genes, such as *MED13*, where only 13 affected individuals have been described in one publication. On the other hand, with well-studied genes such as *MECP2* and *SHANK3,* a genetic diagnosis provides families the opportunity to connect with robust family communities and participate in clinical trials and research, and allows for thorough recurrence risk counseling.

46 **202.046** Diagnostic Yield of Chromosomal Microarray Analysis in Autism Spectrum Disorder

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Background: The genetic underpinnings of Autism Spectrum Disorder (ASD) are very heterogeneous and can range from monogenic and syndromic cases to oligogenic/polygenic forms. Rare and common copy number variants (CNVs) can contribute to the aetiology of the disorder and differences in CNV burden can contribute to the substantial clinical heterogeneity observed in ASD. For this reason, array-CGH have become a first-tier diagnostic test in the medical work-up of autistic individuals.

Objectives: The aim of this study is to identify pathogenetically-relevant CNVs in 254 ASD families (217 simplex and 37 multiplex) and to verify rates of *de novo* vs inherited pathogenic CNVs.

Methods: A total of 275 ASD subjects from 217 simplex and 37 multiplex families were consecutively admitted to the Service for Neurodevelopmental Disorders at Campus Bio-Medico University Hospital (Rome, Italy) and to the Interdepartmental Program "Autism 0-90" at the "G. Martino" University Hospital (Messina, Italy), between the years 2015 – 2017. Blood was drawn from patients and first-degree relatives, DNA was extracted from leukocytes and array-CGH analysis was performed using the Human Genome CGH SurePrint G3 Microarray 4 x 180K Kit (Agilent). Array-CGH outcomes were blindly classified by four authors according to five different categories ranging from "absence of functionally relevant CNVs" to "certainly causal CNV". Data were imported on a MySQL RDBMS instance and analyzed through SQL queries.

Results: "Certainly causal CNVs" and "probably causal CNVs" were detected in 22/275 (8.0%) and in 44/275 (16.0%) ASD patients, respectively. The frequency of duplications and deletions is comparable. However, "certainly causal CNVs" are significantly more often *de novo* (Chi sq. 8.46; 2 d.f., P<0.05), and in particular *de novo* deletions, as compared to inherited deletions (Chi sq. = 14.28; 2 d.f., P<0.001) or to *de novo* duplications which are not significantly increased in frequency compared to inherited duplications. On the other hand, rare duplications are significantly more often "certainly causal" than "probably" or "possibly causal" (Chi sq. 10.97; 2 d.f., P<0.01), regardless of being *de novo* or inherited. Furthermore, paternal transmissions of rare "certainly causal CNVs" are significantly enhanced compared to maternal transmissions of rare "certainly causal CNVs" and to paternal transmissions of less pathogenic CNVs (Chi sq. 7.58; 2 d.f., P<0.05). Finally, CNVs recurrent in ASD are present in 25/66 (37.9%) patients carrying "probably" or "certainly causal CNVs".

Conclusions: Array CGH identified certainly or probably pathogenic CNVs in 66/275 (24.0%) ASD patients in our sample, confirming their high diagnostic yield. Significant contributions to ASD risk come from *de novo* deletions, from rare recurrent CNVs, and from paternally transmitted CNVs, supporting the variable penetrance of many pathogenic CNVs, especially duplications, in the ASD spectrum. Recurrent CNVs, though explaining a minority of cases, may provide more reliable opportunities to elucidate disease-relevant mechanisms.

47 **202.047** Differences in the Genetic Background Contribute to Risk and Resilience to Autism

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Background: In the last 20 years, there was a tremendous progress in identifying genes associated to autism spectrum disorders (ASD). The genetic architecture of ASD is complex, ranging from apparently monogenic forms of the disorder to highly polygenic forms. However, if rare deleterious mutations affecting approximately 100 genes are now well accepted as risk factors for ASD, the role of the genetic background on their variable penetrance remains poorly understood.
Objectives: To identify resilient individuals, carrying rare deleterious mutations in ASD susceptibility genes without being diagnosed with the condition, and study the genetic factors influencing their clinical trajectories.

Methods: We designed a framework to assess the risk associated to more than 11,000 rare deleterious mutations in parents and children of 1,786 quadruplet families with one affected and one unaffected child of the Simons Simplex Collection. We investigated hallmarks of mutation intolerance (haploinsufficiency, probability of loss-of-function mutation intolerance, z-score for missense mutation or deletion intolerance) to discriminate mutations likely to affect gene function. We also used clinical records available for each family to focus on mutations identified in children displaying a clear discordance in ASD phenotype (SRS and VABS-II scores).

Results: The fraction of resilient individuals among siblings and parents was surprisingly high, with approximately 7% of individuals carrying rare deleterious mutations in ASD-associated genes without displaying ASD symptoms. By stratifying resilient children from other unaffected children, we confirm a significant role of polygenic risk in ASD etiology. In addition, we observe significant differences in polygenic risk between affected and unaffected children who inherited the same rare deleterious mutations and between affected children with rare inherited deleterious mutations and affected children without.

Conclusions: The genetic background significantly influences the clinical trajectory of siblings carrying similar deleterious mutations in ASD-associated genes. Our results highlight the importance of investigating rare deleterious mutations in ASD susceptibility genes in the context of the genetic background, as well as the clinical heterogeneity of both diagnosed and undiagnosed individuals. Understanding the genetic factors contributing to resilience to ASD provides new insights into the molecular mechanisms of ASD, ultimately allowing the development of novel therapeutic strategies.

48 **202.048** Enhancing Impact of Genomics Research in ASD through Integration of Research Results into Routine Care Pathways – a Case Series

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Background: When used in a research context, results from genetic tests, like microarray, whole exome sequencing (WES) and whole genome sequencing (WGS), accelerate discovery of new genetic variants associated with Autism Spectrum Disorder (ASD). However, the return of genetic results (RoR) to participants remains a complex and nuanced process. There are no specific recommendations on which research genetic results should be communicated, and their management with respect to the participants' healthcare. Furthermore, approaches may differ across different jurisdictions and institutions. Research teams may rely on clinical recommendations, which are limited in scope. This lack of practical recommendations for RoR from genetic research in ASD may result in variable practices by research teams.
Objectives: We empirically investigated the challenges of returning genetic research results to individual participants, enrolled in genomics studies in ASD. We used systematic guiding principles drawn from the existing literature to facilitate the RoR process and aide the integration of genetic research results into clinical care for participants.

Methods: We report a case series (n = 16) involving the return of genetic results to research participants in large genomics studies in ASD, who were enrolled as children. We convened a work group of specialists that drew on relevant literature and their expertise in devising principles that would guide RoR. We implemented the principles in our RoR process to return genetic research results to participants and to integrate these results into their healthcare.

Results: The case-series demonstrates the ethical, clinical and practical challenges of RoR in ASD genomic studies for participants enrolled as children. The average time between enrolment and availability of a genetic research result was 5.5 years. At the time of RoR, the age of the participants ranged from 6 to 24 years; 6 of the participants had reached adulthood by the time of RoR. The majority of the research genetic results (n = 11) were CNVs, one revealed aneuploidy, and the remainder were SNVs. Most genetic changes were identified to be on chromosomes 1, 15 and 16. The majority of genetic changes (n = 10) occurred *de novo*. In 4 or the 16 cases specific challenges emerged in terms of communication of the results and/or their integration in clinical care pathways.

Conclusions: Our findings highlight that optimal use of genetic research results relies on their integration into individualized care pathways for participants. Ultimately, this approach can bridge the existing gap between research and healthcare in the management of complex genetic research results in ASD.

49 **202.049** Examining the Broader Autism Phenotype in the Context of Genetic Etiology

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Background:
Considering the phenotypic heterogeneity within autism spectrum disorder (ASD), children's individual differences may relate to subclinical parental traits associated with ASD symptoms and social impairment, known as the broader autism phenotype (BAP; Bolton et al., 1994). However, the extent by which parents' genetic contributions interact with BAP contributions is unclear. One hypothesis is that parents with an ASD-

associated genetic event (e.g., disruptive single gene mutation, rare copy number variations) will present with an elevated rate of BAP and other social problems, and their child's ASD symptoms will be more severe.

Objectives:

We examined the extent to which parental BAP is associated with children's genetic etiology, specifically as it pertains to rare inherited genetic events relative to children with other disruptive *de novo* genetic events.

Methods:

Local participants (*N* = 105) were parents of a child with an ASD diagnosis who completed either the Simons Simplex Collection (*n* = 77) and/or a genetics-first study ("TIGER", *n* = 28) in which a parental phenotyping battery included three measures related to ASD symptoms of social impairment (see Table 1). Parents were grouped based upon their child's genetic etiology. Given the aim of investigating clinical observations of BAP, we focused on the Broader Phenotype Autism Symptom Scale (BPASS, Dawson et al., 2007), a clinical interview capturing social motivation and flexibility, as well as nonverbal social behaviors such at expressiveness and conversational skills. ANOVAs tested group differences (Tukey correction for planned comparisons). Pearson correlations tested for BAP parent-child associations with critical ASD symptoms.

Results:

There were no group differences in age, full-scale IQ, BPASS total, or BAPQ total, *p*'s > .62. Regarding clinical observations, all parents were observed within the normal range in expressiveness and conversational skills, with good to moderate facial expressions. Group differences indicated that the De Novo group exhibited elevated problems with sociability in groups, $F(2,82) = 3.22$, $p = .045$, relative to the Inherited group. Low or abnormal parents' group sociability was related to similar problems in probands' social and adaptive abilities (see Figure 1), as noted by SRS-II subdomains, VABS-III composite, and VABS-III subdomains, but not the SRS-II overall t-score. Of note, the De Novo group exhibited weaker associations between parental BAP and proband ASD symptomology relative to the Inherited group (e.g., VABS-II composite: De Novo $r = -.11$, Inherited $r = -.21$).

Conclusions:

Contrary to hypotheses, parents in the Inherited group that share a rare ASD-risk genetic event with their child did not exhibit elevated BAP symptoms. Yet, parental sociability in groups was associated with proband ASD symptomology to a greater extent for Inherited relative to De Novo parents, aligned with our initial prediction of more severe ASD symptoms for children whose parents have both BAP symptoms and are the source of that child's genetic etiology. A better understanding of the severity of specific genetic events (Woodbury-Smith, et al., 2018) combined with this work in understanding individual BAP differences may elucidate appropriate identification and treatment options (Gerdts et al., 2013).

50 **202.050** Habituation to Social Information Is Associated with Repetitive Behavior in 16p11.2 Deletion and Duplication

ABSTRACT WITHDRAWN

Background: Recurrent copy number variations (CNVs) at the 16p11.2 locus (Weiss et al., 2008) are associated with autism spectrum disorder (ASD) and ASD symptoms (Hanson et al., 2015), including social difficulties and increased restricted and repetitive behaviors (RRBs). At the neural level, individuals with 16p11.2 CNVs exhibit atypical social information processing such that rapid habituation to social information is evident in 16p11.2 deletion and duplication carriers, opposed to the pattern of rapid nonsocial habituation in typical populations (Hudac et al., 2015). Rapid habituation may indicate lower salience of related stimuli. Lower salience of social information and increased relative response to nonsocial motion in those with 16p11.2 CNVs lead us to hypothesize an increased prevalence of RRBs which may be related to habituation patterns. Objectives: Determine the extent by which social and nonsocial information habituation is associated with RRBs in individuals with 16p11.2 deletion and duplication.

Methods: Participants (N = 329, see Table 1) completed phase 1 of the Simons Variation in Individuals Project (Simons VIP, https://simonsvipconnect.org/), which included in-person clinical, behavioral, and medication characterization. A subset of individuals with 16p11.2 CNVs (N = 21; the majority with fluent verbal skills) also completed neural characterization via electroencephalography in which habituation was established as changes in neural response over time to social and nonsocial stimuli (i.e., moving hands vs tubes). First, we quantified RRBs in 16p11.2 CNVs as reflected by the ADOS scores including calibrated severity score (CSS; total, social affect, restricted and repetitive behavior) and compared between individuals with 16p11.2 deletion (DEL) and 16p11.2 duplication (DUP). Second, we extended prior analyses by investigating the relationship between RRBs and social habituation using multilevel analyses with Tukey correction for multiple comparisons.

Results: As a group, DEL carriers and DUP carriers did not demonstrate significant differences in CSS scores; however, when considering only those without fluent speech (*n* = 81), the DEL carriers showed a significantly higher ratio of repetitive behavior relative to their social difficulties compared to DUP carriers, $p = .002$. Regarding habituation, DUP carriers with more RRBs habituated more rapidly to social motion (i.e., positive slope in Figure 1), $r = .71$, $p = .031$, while DEL carriers with more RRBs sensitized to social motion (i.e., negative slope in Figure 1), $r = -.59$, $p = .046$. Habituation to nonsocial motion was not related to RRBs in 16p11.2 carriers, *p*'s > .66.

Conclusions: Distinct social habituation patterns related to RRB severity were found for those with 16p.11.2 deletions and duplications. Sensitization to social motion, as found for the DEL carriers may indicate either an initial delay in processing social information or potentially increasing engagement with social information over time (Hudac et al., 2015; 2017; Jones et al., 2016). Individuals with deletions and without fluent speech language also show increased relative severity of RRBs; habituation studies may help to explain differing rates.

51 **202.051** Identification of Multiple Candidate Variants in a Family with Autism Spectrum Disorder through Whole Genome Sequencing Analysis

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Background: Whole genome sequencing (WGS) has been more widely used as a tool in the clinical diagnosis and it helps increase the diagnosis rate up to 20% in autism spectrum disorders (ASDs). Thus far, more than 100 genes and CNV loci have been reported to be associated with ASD suscpeptibility. However, none are found in >1% of cases with ASDs, suggesting a diverse genetic heterogeneity of the disorders.
Objectives: To identify a putative genetic cause of an individual's ASD.

Methods: WGS in a trio ASD family in combination with internal bioinformatics pipelines and a commercial software VarSeq.

Results: We identified 4 inherited rare damaging missense single nucleotide variants (SNVs) in 4 genes (DNMT3A, PHF2, NRXN2, and SNRPN), and one rare copy number variant (CNV). The CNV is a paternally inherited 14 Kb microdeletion in ZNF517, which is also confirmed by DNA microarray.The variants in DNMT3A and SNRPN were also confirmed by Sanger sequencing. Clinically, the male proband has ASD, moderate intellectual disability, developmental delay, verbal apraxia, post-natal macrocephaly, large stature, adult-onset epilepsy (age 22 years), and mild facial dysmorphism (round facies, bitemporal narrowing, narrow palpebral fissures, low-set and protuberant ears, hypotonia, high arched palate). Neither parent has intellectual disability or ASD, though the father has macrocephaly and over-growth. All of the genes involved in these rare variants and CNV are reported to be ASD-related and involved in brain/neuron development. De novo mutations in the above SNV genes and a recurrent deletion in ZNF517 gene have been identified in cases with ASDs. In our proband, mutations in DNMT3A, PHF2, and SNRPN are paternally inherited while NRXN2 is maternal. DNMT3A is a newly identified ASD candidate gene and its mutation is associated with Tatton-Brown-Rahman Syndrome. Some of the phenotypes are shared in our proband. Functional analysis is in progress including whole transcriptome analyses.

Conclusions: DNMT3A is likely the most relevant gene accounting for both ASD and features concordant with Tattan-Brown-Rahman syndrome. Alternatively, our subject's ASD phenotype reflects a collection of quantitative phenotypic traits associated with each of the multiple ASD risk genes identified and its complex genetic origins.

52 **202.052** Parents' Perceived Utility of Biological Testing Prior to Clinical Genetic Testing Is Associated with Child Emotional and Behavioural Functioning, Family Functioning, and Family-Centered Care

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Background:
Chromosomal microarray (CMA) testing has been integrated into routine clinical workup in Autism Spectrum Disorder (ASD) based on improved diagnostic yields. However, its *clinical utility* is unclear considering that results have not led to improvements of health outcomes for all. Establishing the clinical utility of CMA would thus require evaluating the value of information expected from the test as perceived by individuals receiving the test and their families.

Evidence provides a mixed picture of parents' perspectives on genetic testing in ASD, with indications that perceived utility prior to testing and experienced impact following results to be distinct constructs. Given the heterogeneous nature of the target population, the inconsistency of findings can also be attributed to underpowered studies with issues in sampling. Most importantly, a valid measure of perceived utility and its predictors are missing.

Objectives:

We aimed to examine the association between the parents' perceived utility of biological testing and its potential predictors: child's severity of symptoms and functioning, parent stress, family functioning, and appraisal of family-centered care, while controlling for sociodemographic factors within a representative sample of families around the time of their child's diagnosis using a new quantitative measure of perceived utility.

Methods:

Families were invited to participate in an ongoing prospective cohort, *ASD Genome to Outcome,* following their child's diagnosis. Prior to undergoing clinical genetic testing, families completed the Perceived Utility of Biotesting questionnaire along with self-reported measures (n = 75).

Results:

We entered the following as predictors of interest in a stepwise regression model predicting perceived utility: respondent age, education, household income, child gender and age, child severity of social symptoms, child emotional and behavioural problems, parent stress, family functioning problems, and family-centered care. The best-fitting model accounts for 25% of the variance in perceived utility of biotesting, $F(3, 68) = 8.95$, $p < 0.001$, R^2-*adjusted* = 0.25. Lower child emotional and behavioral functioning, higher family functioning, and lower levels of family-centered care significantly predict greater perceived utility. No other factors were associated with perceived utility.

Conclusions:

Our results suggest that perceived utility of biotesting is determined by families' unmet needs: families who have a child with more emotional and behavioural problems, and who are receiving lower levels of family-centered care, may be more likely to expect testing to address these needs. By identifying how characteristics of each child, family, and their reported experience with routine health services affect the perceived clinical utility of genetic testing, we demonstrated how the current and future potential of genetic testing in particular and biological testing in general can be systematically assessed in the context of *routine care pathways*. We conclude that establishing the clinical utility of biotesting requires family input, not only to improve the impact of current biological tests but also to determine the readiness of potential biological tests for clinical use. This would allow for engagement of families in biotesting development and implementation, and subsequently towards improving the relevance and impact of research and care for families.

53 **202.053** Phenotypic Effects of Loss of Function CNTNAP2 Variants

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Background: *CNTNAP2* is an autism spectrum disorder (ASD) candidate gene that encodes CASPR2, a large protein expressed in the nervous system. Heterozygous *CNTNAP2* variants have been reported in individuals with ASD and speech-language disorders; however, these variants are frequently inherited, making it difficult to interpret their functional relevance. We have the unique opportunity to study Mennonite and Amish families that harbor a truncating, loss of function (LoF) mutation in *CNTNAP2*. Individuals who are homozygous for this variant present with cortical dysplasia-focal epilepsy syndrome (CDFE), characterized by epilepsy, intellectual disability, and ASD. No studies to date include a detailed assessment of the behavioral phenotype of CDFE in homozygotes nor the potential neurocognitive effects of this *CNTNAP2* variant in their heterozygous carrier relatives.

Objectives: In the current study, we conducted behavioral assessments to phenotype individuals who are homozygous and heterozygous for *CNTNAP2* LoF variants and compared results to their homozygous relatives without the variant. By advancing our understanding of the effects of rare LoF variants in *CNTNAP2*, we hope to elucidate an important mechanistic pathway in ASD.

Methods: We completed phenotypic batteries on four Old Order Amish and Mennonite families consisting of at least one child with CDFE. The phenotypic battery included developmental/cognitive assessment using the Mullen Scales of Early Learning (MSEL), Differential Ability Scales (DAS-2), or the Wechsler Abbreviated Scales of Intelligence (WASI-2). Speech assessments were also completed and included the Goldman-Fristoe Test of Articulation (GFTA-2) and the non-word repetition task of the Comprehensive Test of Phonological Processing (CTOPP-2). The non-word repetition task is robust measure of language impairment which reliably discriminates between individuals with and without a history of language impairment, including bilingual children from diverse language backgrounds. All children above a chronological and developmental age of 12 months were given the Autism Diagnostic Observation Schedule (ADOS-2) by a research reliable examiner.

Results: Children with CDFE scored in the moderate to profound range of intellectual disability. All verbal children with CDFE had significant phonological disorders as measured by the GFTA, providing new evidence for discrete language pathology in CDFE. Notably, carrier children and adults also performed significantly worse on the CTOPP non-word repetition task compared to non-carrier children (p = .02), providing additional evidence for a mild, intermediate language phenotype in heterozygous *CNTNAP2* carriers. Several carrier siblings had a moderate level of ASD symptoms, as measured by the ADOS-2. Non-carrier siblings did not present with elevated ADOS-2 scores, and their social engagement was judged to be within the typical range.

Conclusions: Using a well-controlled experimental paradigm, we provide compelling evidence of mild language impairment and ASD symptomatology in individuals haploinsufficient for *CNTNAP2,* underscoring the fundamental role of this gene in the development of human language and social behavior.

54 **202.054** Returning Clinical Genetic Results on a Large Scale to Research Participants in SPARK

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Background: A common issue in genomic research is whether investigators have a responsibility to return individual genetic research results to research participants. The National Academy of Medicine Report on Returning Individual Research Results to Participants recommends returning such information when feasible. Returning individual research results builds partnerships with participants, provide them with valuable information, and connects them to communities of individuals with similar characteristics. However, returning results requires additional resources from sponsors and researchers and is particularly challenging for large studies. Understanding the benefits and challenges of these processes is important as the number and size of genomic research studies increase.

Objectives: We sought to build a scalable process for returning genetic results related to the participants' autism spectrum disorder (ASD) diagnosis in participants in SPARK, a large recontactable research cohort of tens of thousands of individuals with ASD and their first-degree family members. Using an online platform and a telehealth genetic counseling service, we have returned individual genetic findings to 21 participants and plan to return approximately 200 results by May 2019.

Methods: 457 families were recruited to SPARK online (https://sparkforautism.org) and provided consent to receive genetic results. Individual genetic results related to autism that met ACMG pathogenic or likely pathogenic criteria were identified in 10.8% of families. A committee of medical geneticists reviewed variant and phenotypic information for all families, and results were confirmed in a CLIA (Clinical Laboratory Improvement Amendments) certified laboratory. Participants were notified that they had a genetic result by email and were given the option of receiving their results through their own medical provider or a study-provided geneticist/genetic counseling service by telephone. Educational materials about receiving a genetic diagnosis and their specific genetic condition were provided with a copy of the clinical genetic report prior to the result disclosure appointment. Participants provided feedback to the study team about the importance of receiving their results and satisfaction with the process.

Results: As of November 2018, we returned genetic results to 21 participants, including 20 parents with dependent children and 1 independent adult. Nineteen of the results were *de novo* and 2 were inherited from unaffected mothers. Six of the participants chose to receive the result through their own medical provider and 15 used the SPARK-provided geneticist or genetic counselor. On average, participants completed authorizations to receive results 8 days (SD= 16.0) after notification, and the 15 who received results through SPARK had appointments with the geneticist/genetic counselor 13 days (SD= 10.5) after completing their authorization. Participants indicated that they understood the next steps to take with their results and that they felt positively about having received a genetic cause for their child's autism and participating in SPARK.

Conclusions: We are able to return clinical genetic results using efficient, scalable processes. This is an effective way to engage participants and increase satisfaction with SPARK research participation. There are challenges to returning individual genetic results at scale, including but not limited to communication of inherited findings and ensuring that participants understand with the implications of the results.

55 **202.055** Routine Clinical Genetic Testing in Patients with Autism Spectrum Disorder and Related Developmental Disorders Has a Diagnostic Yield up to 40%, Improves Medical Management, and Significantly Alters Recurrence Risk Counseling

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Background: Genetic testing, via chromosomal microarray (CMA) for copy number variants (CNV) and whole exome sequencing (WES) for single gene sequence-level variants, has proven highly useful for identifying genetic etiologies of autism spectrum disorder (ASD) and other developmental brain disorders (DBD), such as intellectual disability and global developmental delay (ID/GDD). However, fewer than a third of U.S. children with DBD currently undergo recommended genetic testing (Kiely et al., 2016). In fact, a survey of child neurologists and developmental pediatricians found that 40% did not order genetic testing for children with ASD (Tchaconas et al., 2017).
Objectives: As part of our multidisciplinary autism and developmental medicine clinic, we have incorporated a genetics-first approach to routine care for all patients with ASD, ID/GDD, epilepsy, and/or congenital anomalies, including dysmorphic features. We report the diagnostic yield of clinical genetic testing in this patient population and the impact on medical management.

Methods: Patients were typically offered a testing cascade, starting with *FMR1* analysis for fragile X followed by CMA and WES. Single gene tests/panels were offered alternatively if there was a strong clinical suspicion for a particular disorder. We compared the diagnostic yield in patients with ASD only, ASD+ID/GDD, and ID/GDD without ASD.

Results: We used genetic cascade testing to evaluate 764 patients and identified a genetic diagnosis to explain their DBD in 159 (21%): 2% had fragile X syndrome, 14% had a pathogenic CNV, and 24% had a pathogenic single gene sequence variant(s). Since not all patients have completed WES testing yet, we used our initial dataset to estimate a combined diagnostic yield of up to ~40% if WES had been completed for all eligible patients. In the 159 patients with a genetic etiology, 15 (9%) had ASD only, 31 (19%) had ASD+ID/GDD, and 80 (50%) had ID/GDD without ASD, with the remaining including other testing indications. Identifying a genetic etiology has had important implications for medical management. For example, identifying a patient's 17q12 deletion informed the need to monitor for renal cysts/dysplasia and maturity-onset diabetes of the young. In addition, knowing a genetic etiology can significantly alter genetic counseling by providing more accurate recurrence risks. We identified a *de novo* pathogenic sequence variant in *SCN2A* which provided the family with a medical explanation for their child's ASD+ID diagnoses and, importantly, lowered their recurrence risk estimate from the ~10% quoted risk with one affected child down to the background population risk of ~1.5%. In another family, a maternally inherited 15q13.3 deletion was identified, resulting in a recurrence risk of 50%.

Conclusions: This genotype-first testing approach in a pediatric developmental medicine cohort illustrates the diagnostic power of genomic testing, as we can now provide a genetic etiology in up to 40% of patients, including a significant proportion who only had an ASD diagnosis. Given recent advances in WES, a single test can now be used to identify single gene variants and CNVs, providing an efficient testing mechanism for use in routine clinical care to provide vital information for medical management and family counseling.

56 **202.056** Sex Ratios in Autism, an Analysis of 8,167 Participants in the International Autism Mapping Project

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Background: Estimates of autism spectrum disorder in the US are currently 1 in 59 children, with male to female ratios approximating 4:1. Autism spectrum disorder (ASD) includes a diversity of causal factors such as birth prematurity, Fragile X, single gene mutations, CNS infection and injury at birth. The reasons for the male predominance aren't clear. A more granular look at sex ratios may help.
Objectives: This study aimed to understand and characterize medical and genetic issues in children with a diagnosis of ASD, in an international sample of 8,167 children.

Methods: An archival dataset from the International Autism Mapping Project was examined. All parents who participated had a child with a confirmed diagnosis of autism born in the year 2000 or later and valid consent. This study nests within a larger study examining environmental factors in ASD. Within the environmental health questionnaire, parents were asked if their child had other genetic or medical diagnoses. Answers to that question were broken down into one of five categories, 1) single gene mutations, 2) multiple gene mutations, 3) known medical conditions or chromosomal disorders, 4) reported medical conditions or genetic conditions which lacked full specificity and 5) children who have multiple syndromes or conditions. Tables 1, 2, 3 include the number, gender, general inheritance pattern, and association to emotional-behavioral health. Sex ratios were examined, with X-linked conditions removed and treated separately.

Results: Of 8,167 records, 105 parents reported single gene mutations. The male to female ratio for this group is 2.62:1. Here, methylenetetrahydrofolate reductase (MTHFR) gene mutations were the most common genetic issue with 14 males and 8 females. Another frequent diagnosis was 22q11.2 deletion syndrome, with 15 males and 5 females. In the multiple gene mutation group, there were 52 children, with an overall male to female ratio of 3:1. In our 3rd grouping, of known medical conditions or chromosomal disorders, there are 177 children, with a general male to female ratio of 2.76:1. Here an unexpected finding involved Down syndrome, with 20 males and 4 females. Premature birth, defined as <32 weeks gestation, was reported for 27 children, with male to female ratio of 2.37:1. In our 4th grouping of 29 children, parents had reported issues not specific enough for full categorization; the male to female ratio for the group 3.83:1. In the 5th group, those with multiple conditions or syndromes, were 29 children, and here the male to female ratio is 4.6:1.

All tables will be presented.

Conclusions: The commonly reported sex ratio for children with autism is 4:1, with males predominating. In a more granular examination, this ratio varied considerably. Further, we found that in conditions thought to occur more or less equally between the sexes, the ratio was unexpectedly strongly biased towards males. Ratios were 3:1 in 22q11.2 deletion syndrome, 5:1 in Down syndrome, and 2.37:1 in prematurity. To what extent these striking asymmetries reflect bias in diagnosing ASD or sex-biasing genetic factors is unknown.

57 **202.057** The Differential Effect of Gene Dosage on Autism Risk and General Intelligence

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Background:

Whole-genome analysis have estimated that rare mutations in over 1,000 genes may contribute to autism risk. Several studies have identified robust associations between rare Copy Number Variants *(CNVs)* and the diagnosis of Autism Spectrum Disorder (ASD). More specifically, a recent publication has shown that *de novo* mutations are associated with lower Intelligence Quotient (IQ) and a blunted autism profile. But almost nothing is known on cognitive and behavioral traits affected by rare CNVs and how these alterations lead to a diagnosis of autism.

We hypothesize that classes of mutations such as haploinsufficient ones versus duplications, have differential impacts on cognitive and behavioral traits, thus leading to a diagnosis of ASD by different mechanisms. To better understand the effect of CNVs, our laboratory recently developed models trained in the general population to estimate their effect size on non-verbal IQ (NVIQ) using constraint scores.

Objectives:

Understand the differential effect of haploinsufficiency and duplications on cognition, behavior and autism risk using autistic and general populations.

Methods:

We identified all CNVs ≥ 50Kb in 2,590 simplex ASD families in the Simon Simplex Collection and in 2,702 individuals from general population (Imagen and Saguenay Youth Study cohorts) following detection standard detection pipelines. We used statistical models integrating genomic and functional annotations (such as probability to be Loss of function Intolerant (pLI) score) to estimate the effects of deletions and duplications on autism risk and NVIQ.

Results:

We demonstrate that genome-wide deletions and duplications have a quantifiable effect on NVIQ and autism risk. Our model estimates that deletions and duplications decrease NVIQ respectively by 2.6 points per unit of pLI score (SE=0.42; P=7×10-10) and by 0.9 points per unit of pLI score (SE=0.29; P=2×10-3). This effect is identical in autistic and general populations for deletions but not for duplications.

We also show that deletions are significantly overrepresented in autistic probands compared to unaffected siblings or general population (both OR=1.3 per unit of pLI, 95%CI=[1.2;1.5], P=8×10-5). However, after adjusting for the effect on NVIQ, deletions are no more enriched in autism compared to general population. Conversely, duplications are significantly overrepresented in autism when comparing to unaffected siblings and general population (both OR=1.2 per unit of pLI, 95%CI=[1.1;1.4], P<4×10-5). This excess of duplications remains after NVIQ adjustment.

Conclusions:

Although deletions are highly overrepresented in individuals with a diagnosis of autism, it is probable that the general effect of haploinsufficiency is unrelated to core symptoms of ASD. Instead, our results suggest that haploinsufficiency increases the probability of clinical referral due to a pervasive impact on IQ. In contrast, the association between duplications and autism diagnosis is not explained by their effect on intelligence. To understand mechanisms underlying this association, we are investigating the effect of duplication on ASD severity, social responsiveness, and other measures of psychopathology. This study represents a new framework to study variants in ASD and better characterize the heterogeneity observed in clinic.

58 **202.058** The Prevalence of Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD) in Tuberous Sclerosis Complex (TSC). a Comparison of Prevalence in Patients with TSC1 and TSC2 Mutations.

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Background:

Tuberous Sclerosis Complex (TSC) is an autosomal genetic disorder caused by mutations in the TSC1 or TSC2 genes. Several reports indicate that compared with TSC2 mutations, TSC1 gene mutations present with less severe physical phenotype. However, although TSC is well established as a cause of ASD and ADHD, it is not known if the risk of ASD or ADHD also differs according to whether the TSC1 or TSC2 gene is mutated.

Objectives:

To determine the prevalence of ASD and ADHD based on mutation type (TSC1 or TSC2 gene) and to investigate the correlates of the psychopathological manifestations in TSC1 and TSC2 cases (e.g. tuber count, epilepsy severity etc).

Methods:

This study uses data from the TS2000 study, the first population based, longitudinal study of the natural history of TSC. 125 children aged 0-16 years diagnosed with TS were ascertained. Baseline measures of epilepsy severity, intellectual ability, cortical tuber count and genetic testing were undertaken. Participants were followed up and assessed using standardised and semi-standardised measures of ASD and ADHD. This include Autism Diagnostic Observation Scale (ADOS), Autism Diagnostic Interview- Revised (ADI-R) for ASD, Strength and Difficulties Questionnaires (SDQ), The Development and Well-Being Assessment (DAWBA), Diagnostic Interview for ADHD (DIVA) or Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS) for ADHD.

Results:

1. a) Of the 125 participants, 19 had TSC1 mutations and 77 had TSC2 mutations.
2. b) 42.9% of patients with TSC2 mutation met stringent diagnostic criteria for ASD, a further 24.5% met criteria for probable ASD and

another 12.2% for more broadly defined ASD . Amongst patients with TSC1 mutations, 25% met stringent diagnostic criteria for ASD, 37.5% probable ASD and 18.8% met criteria for the more broadly defined autism spectrum disorder phenotype. The difference in prevalence between TSC1 and TSC2 cases was not statistically significant (p= 0.77).

3. c) Patients with TSC1 mutation had a slightly higher rate of definite ADHD diagnosis (27.3%) as compared to patients with TSC2 mutation (20.8%). A further 22.9% of participants with TSC2 mutation met criteria for probable ADHD as compared to 9.1% of TSC1 mutation cases. Again, the differences were not statistically significant (p=0.70).

Conclusions:

Mutations in both the TSC1 and TSC2 genes are associated with an increased risk of ASD and ADHD compared to the general population, but in this small sample, the prevalence of ASD and ADHD in TSC1 and TSC2 cases was not significantly different.

Poster Session
203 - Clinical trial design
5:30 PM - 7:00 PM - Room: 710

59 **203.059** Safety and Tolerability of GWP42006 (Cannabidivarin) in Subjects with Drug Resistant Epilepsy and Autism Spectrum Disorder

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Background: Epilepsy and autism have been estimated to coexist in 20-30% of patients with either disorder. The wide prevalence and association of these two disorders suggest common genetic factors and pathway correlations along with an increased predisposition for other pathologies. Lack of evidence-based recommendations for people afflicted by both these disorders suggest that insights into the common signaling systems of both disorders is needed. Phytocannabinoids may be a good class of compounds to search for modulators of both excitability and behavioral/cognitive phenotypes.

Objectives: To determine the safety and tolerability of GWP42005 (Cannabidivarin: CBDV) in autism and epilepsy subjects.

Methods: An expanded access protocol was developed via collaboration between the University of Louisville Autism Center and GW Pharmaceuticals. Although planned for 30-50 subjects, an initial pilot cohort of 5 subjects (ages 6-18 years) with documented autism and epilepsy was recruited. Autism spectrum disorder (ASD) was verified via Autism Diagnostic Observation Schedule (ADOS) testing and treatment resistant epilepsy (defined as 2 or more countable seizures per month) was verified via clinical history, initial 28-day seizure diary, and sleep eeg/polysomnogram. Clinical phenotyping by a senior psychologist and research team included seizure diary, actigraphy, Children's Sleep Habit Questionnaire, Children Behavioral Checklist, Vineland scales, Mean Length Utterance, Differential Ability Scales, Social Communication Questionnaire, ADOS Severity Score, Pervasive Developmental Disorder Behavioral Inventory (PDD-BI), and motor battery. Subjects were titrated from 1 mg/kg/day to 10mg/kg/day cannabidivarin (CBDV) (GWP42006; GW Pharmaceuticals) divided BID. Safety profiles for side effects, antiepileptic drug levels, liver function, basic metabolic panel, amylase/lipase, CBCs, ECG, and Columbia Suicide Scale were monitored.

Results: ADOS severity score was an average of 7 (range 4-10) and the baseline 2 week seizure frequency was 15 (range 2-50). Safety profiles of all 5 subjects suggest that CBDV is well tolerated at 10 mg/kg/day dosing through 44 weeks. No major laboratory abnormalities were noted. Gastroesophageal reflux, aggression, and sedation were the most common adverse events upon CBDV initiation and were likely related to elevated AED levels.We report seizure and cognitive/behavioral data at the 44 week time point when all 5 subjects were treated with 10 mg/kg/d CBDV. Three subjects with generalized epilepsy are seizure free. Caretakers of all subjects report consistent gains in social engagement and communication regardless of seizure frequency. Initial testing at 8 (6 mg/kg/d) and 24 weeks (10 mg/kg/day) suggest statistically significant reductions in the generalized seizure frequency (from 22 to 6 per 2 week epoch) at $p<0.0001$. Suggestions of impact on communication and core autism symptoms were documented by the increased Mean Length Utterance score, increased DAS nonverbal IQ, and a decreased ADOS-CSS ($p=0.09-0.18$).

Conclusions: The initial data suggest that CBDV 10 mg/kg is well tolerated and certainly has potential as an AED in the autism/epilepsy population. Interestingly, the initial cohort suggest CBDV may impact communication, social interactions, and core autism symptoms. Our current plan is to expand our cohort to all autism subpopulations and increase CBDV dosing up to 20 mg/kg/day in children 6 years of age and older.

60 **203.060** Efficacy and Safety of Bumetanide ORAL Liquid Formulation in Children and Adolescents with Autism Spectrum Disorder: Study Protocol of Two Randomised, Double-Blind, Placebo Controlled Phase III Trials

S. Kyaga[1], *V. Crutel*[2], *C. Albarran*[2], *Y. Ben-Ari*[3], *D. M. Ravel*[4] *and B. Falissard*[5], *(1)Servier Medical Affairs, Suresnes, France, (2)Institut de Recherches Internationales Servier, Suresnes, France, (3)Neurochlore, Marseille, France, (4)R&D, Neurochlore, Marseille, France, (5)Centre de Recherche en Epidemiologie et Santé des Populations, Paris, France*

Background:

Autism Spectrum Disorder (ASD) encompasses a heterogeneous set of neurodevelopmental conditions, characterized by core symptoms of abnormal social interactions with impaired communication abilities and repetitive or stereotypical behaviours. Although ASD can cause significant emotional and economic burden on people affected and their families, evidence-based treatment options are limited. Recent studies suggest that GABAergic neurons and circuits may be altered in ASD. Bumetanide is a loop diuretic which may reinstate GABAergic inhibition. A previous phase IIb study involving 88 children and adolescents (2-18 years) with ASD demonstrated a statistically significant improvement with bumetanide in the Childhood Autism Rating Scale (CARS) at day 90 compared to placebo. We here report the international clinical development for bumetanide in moderate to severe ASD, with two simultaneous similar phase III trials in two age subsets (2-7 years; 7-18 years).

Objectives:

The primary objective is to demonstrate the efficacy of bumetanide 0.5 mg (or 0.02 mg/kg for children with a weight<25 kg) twice daily as oral

liquid formulation compared to placebo on ASD core symptoms using the CARS-2 after 6 months of double-blind treatment.

Methods:

Both phase III trials are international, randomized, double-blind, placebo-controlled with a 6-month parallel-group design, followed by a 6-month open-label treatment period and a 6-week discontinuation period after treatment stop. Children and adolescents (N = 200 in each study, diagnosed according to DSM5 and fulfilling ADOS-2 and ADI-R criteria), with confirmed moderate or severe ASD (CARS-2 ≥ 34; CGI–S ≥ 4) will be randomised to bumetanide or placebo. An adaptation of the oral solution volume according to the weight of the patients will be performed at different pre-specified visits. The primary efficacy outcome measure is the CARS-2 total raw score at 6 months. Main secondary efficacy endpoints include individual CARS-2 domains, Social responsiveness Scale (SRS-2) total raw score, CGI-I and the Vineland Adaptative Behaviour Scale II. Efficacy endpoints will be expressed as changes from baseline to the 6-month visit and 12-month visit, respectively. Safety of bumetanide will be assessed throughout the study using adverse events recording, clinical examination, laboratory evaluation, ECG and renal ultrasound. Suicidality will be assessed using the Columbia-Suicide severity scale Children's version. A Data Monitoring Committee will be responsible for periodic review of patient's safety data. Pharmacokinetics measurements will be performed at several time points.

Bumetanide will be compared to placebo using a general linear model with baseline and stratification factors (country and gender) as covariates.

Results:

Recruitment was initiated in October 2018. The completion date of the two phase 3 trials will be in 2021/2022.

Conclusions:

This phase III program will provide further data on long-term efficacy and safety of bumetanide oral solution in children and adolescents with moderate to severe ASD. If positive, the outcome of these studies could contribute to the first available pharmacological treatment for core symptoms in ASD.

61 **203.061** Family Cognitive-Behavior Therapy for Psychoeducation in Multicenter, Aware and Care for My As Traits for High-Functioning Autism Spectrum Disorders in Adolescence: Study Protocol

Y. Iwama[1], *F. Oshima*[1], *W. Mandy*[2], *M. Hongo*[3], *M. Seto*[1], *Y. Hirano*[1], *C. Suto*[1], *M. Kuno*[1], *J. Takahashi*[1], *T. Ohtani*[3], *D. Matsuzawa*[1], *A. Nakagawa*[1] *and E. Shimizu*[1], *(1)Research Center for Child Mental Development Chiba University, Chiba, Japan, (2)University College London, London, United Kingdom of Great Britain and Northern Ireland, (3)Chiba University, Chiba, Japan*

Background: Adolescents with Autism Spectrum Disorder (ASD) are especially sensitive to stigma（Luisa, 2012). Generally, stigma is a barrier to gaining practical support（Wright et al., 2011; Yap et al., 2011) and psychoeducation for ASD, which works to counter effects of stigma, is important (Luisa, 2012). However, there are few approaches targeting psychoeducation on core ASD symptoms after childhood, many of which seek to treat various psychiatric disorders as co-morbidities in ASD (Sepúlveda, 2017; Sze, 2007). Gordon et al. (2015) showed that psychoeducation for ASD symptoms improved self-understanding and noticing of ASD symptoms, in both parents and children. We developed a psychoeducational program by using cognitive behavior therapy, Aware and Care for my AS Traits (ACAT) to adolescents with high-functioning ASD and their parents in Japan. Objectives: This study aimed to clarify whether ACAT can improve an adolescent's own understanding of their own ASD features and help improve their resilience for ASD.

Methods: The study was multi-centered and was conducted as a randomized controlled trial. Forty-eight adolescents, who were diagnosed with ASD, and their parents were recruited as participants through our research center's website. Twenty-four participants were assigned to the treatment as usual（TAU）group and the rest to the ACAT group. The ACAT group received a 100-minute session once a week for 6 consecutive weeks and one follow-up session in addition to regular medical care. The TAU group only continued regular medical care. In both the groups, effectiveness evaluation was conducted during pre-intervention, post-intervention, and follow-up session. The entire trial design is illustrated in Figure 1.

Results: This clinical trial is ongoing. Approximately 50% (23 pairs of patients) have participated until now, of which 15 have finished the trial. We will compare scores of measures between the two groups during the pre- and post–intervention. The primary outcome measure was the Autism Knowledge Questionnaire and the secondary outcome measures were Barriers to Access to Care Evaluation 3rd Edition, the Strengths and Difficulties Questionnaire, Vineland Adaptive Behavior Scales Second Edition, Parenting Resilience Elements Questionnaire, the General Health Questionnaire 12, Depression Self-Rating Scale for Children, and Electroencephalogram.

Conclusions: It is expected that participants of the ACAT group will significantly increase their self-understanding and noticing of for ASD symptoms compared to the TAU group. Additionally, it is expected that the ACAT group will improve in social adaptation and mental health significantly if children and parents can understand the characteristics of their own ASD features through their sessions. This intervention will contribute to the establishment of an effective treatment strategy based on evidence for adolescents with ASD.

Trial Registration：This clinical trial study registered on the UMIN Register No.000029851

62 **203.062** Feasibility and Design Challenges for a 10-Year Treatment Follow-up Study Examining the LONG-TERM Effects of EARLY Intensive Behavioral Intervention

L. Silverman[1], *E. Fischer*[2], *R. E. King*[1], *S. Iadarola*[1], *L. A. Oakes*[1], *M. Benham*[1] *and T. Smith*[1], *(1)University of Rochester Medical Center, Rochester, NY, (2)Developmental and Behavioral Pediatrics, University of Rochester Medical Center, Rochester, NY*

Background: In 2008 we conducted a novel, prospective study testing predictors of developmental outcome (IQ, adaptive behavior, ASD severity) after 12/24-months of early intensive behavioral intervention (EIBI) in a community-based sample of 71 children with ASD (age 20- 59 months). Predictors included social engagement and sensory-motor rituals. Generally, children with higher IQs had better outcomes. After controlling for age/ IQ/ EIBI site, social engagement but not sensory-motor rituals predicted IQ and adaptive functioning at exit. These data had implications for predicting short-term outcomes and better developmental trajectories in preschool. However, little is known about the long-term impact of EIBI, and whether early predictors continue to predict outcomes in adolescence (IACC, 2013). To address this gap, we conducted a 10-year longitudinal follow-up study designed to evaluate and compare the outcomes of children who originally received EIBI versus treatment as usual (TAU).

Objectives: 1) Report the feasibility of a 10-year follow-up study that was not planned a priori; and 2) Discuss the unique design challenges and experimental decisions that were made to help guide future research. We will address recruitment challenges, selection of assessment measures, and unique features of test administration.

Methods: From the initial pool of 136 participants (71 EIBI, 65 TAU), 110 met eligibility criteria for the 10-year follow-up study, at age 14-18 years. Recruitment letters were mailed; some participants did not have valid contact information and did not return calls (invalid numbers or 'lost to follow up'). Additional recruitment methods were utilized (social media, flyers, last letter, data pull from EMR). Enrolled participants completed measures of cognitive ability, academic achievement, language proficiency, and autism diagnostic status. These included adolescent measures, parent-report measures, and teacher-report measures. Enrollment is ongoing until June 2019.

Results: To date, thirty-eight of the original 70 EIBI participants, and 22 of the original 65 TAU participants enrolled in the study (see CONSORT diagram). Feasibility outcomes: so far, we met goals and recruited approximately 54% (EIBI) and 34% (TAU). Recruitment barriers were addressed using a wide range of strategies, including letters, flyers, social media, and word of mouth. We conducted assessments in the home to minimize transportation barriers, and scheduled visits during vacations that brought participants to our region. Assessments were selected to maximize the validity of comparisons to our original study, without overwhelming participants.

Conclusions: A 10-year follow-up study can provide important information about long-term treatment outcomes. In the literature on follow-up studies in the US, re-enrollment rates are highly variable; with many studies reporting percentages in the low sixties to low eighties. Although we are still enrolling, our current rates may reflect inherent challenges for parents and children with ASD, who are reported to have more stressors and daily hassles than parents of other populations. To promote successful longitudinal studies, specific methodological challenges must be addressed proactively (e.g., recruitment, visit accessibility, selection of measures). Lessons learned from the current study can help to guide future researchers in preparing proactively for design challenges that may arise

63 **203.063** Preliminary Results of Therapeutic Potential of Multiple Sessional Intermittent Theta Burst Stimulation over the Bilateral Posterior Superior Temporal Sulci in Children and Adolescents with Autism Spectrum Disorder

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Background:

Accumulating studies have demonstrated the therapeutic potential of the repetitive trans-cranial magnetic stimulation (rTMS) on improving the core symptoms of autism spectrum disorder (ASD). However, the accurate and consistent stimulation targets and protocols remained elusive.

The posterior superior temporal sulcus (pSTS) is an important brain region for the social brain network and theory of mind. Further, several studies have demonstrated the abnormal activation of pSTS in ASD. Therefore, pSTS may serve as another potential therapeutic target of rTMS in ASD.

Theta-burst stimulation (TBS) is a modified rTMS and is capable of producing excitatory or inhibitory aftereffects on cortical excitability as traditional rTMS. Moreover, TBS is more advantageous than the traditional TMS in being more efficient to produce the similar after-effects in a much shorter duration with fewer total stimulus pulses at lower stimulus intensity. TBS is considered more implementable in the clinical practice.

Objectives:

The aim of this study is to investigate the therapeutic impacts of intermittent TBS (iTBS) to the bilateral posterior superior temporal sulci (pSTS) in children and adolescents with ASD.

Methods:

The study was implemented as an randomized, double-blinded, sham-controlled and parallel trial. 80 children and adolescents with ASD were randomly assigned to the pSTS or sham-control group. In phase 1, the participants received either iTBS or sham stimulations twice per week for 4 weeks. In phase 2, after completing the first 4-week interventions in phase 1, all of the participants were invited to receive real iTBS twice per week for another 4 weeks. After completing phase 2, all of the participants will be followed up 4 weeks later. We measured the clinical symptoms and neuropsychological functions at baseline, at 4 weeks (post 4w, phase 1), 8weeks (post 8w, phase 2) and 12weeks (post 12w, follow-up). The clinical symptoms were measured with the Autism Spectrum Quotient (AQ), the Social Responsiveness Scale (SRS) and the Repetitive Behavior Scale-Revised (RBS-R) as rated by parents, respectively. The neuropsychological functions were assessed with the Frith-Happe animations and Eye tasks.

Results:

Hitherto, there were 74 participants enrolled in the trial. 5 participants were excluded from this study because of personal reasons (n=2), somatic discomforts (dizziness and insomnia, n=2) and abnormal MRI findings (brain tumor, n=1). Overall, the preliminary analyses showed trend-level decreases in total scores of the AQ, SRS and RBS-R at post 4w and post 8w in the pSTS group. The improvement was more obvious in post 8w than post 4w and persisted at post 12w. Among the clinical symptoms, the improvement in the social communication domain was most obvious. Preliminary analysis revealed that the improvement was not associated or mediated by intelligence, gender or age. As for the results in the neuropsychological functions, the interpretation of social intention during the Frith-Happe animations task improved in the pSTS group at post 4w.

Conclusions:

Our preliminary results suggest that the bilateral pSTS may be a potential therapeutic target of rTMS in ASD, especially for improvement in social function. Besides, the therapeutic effects may be more prominent with longer duration of interventions.

64 **203.064** The Landscape for Recruitment of Pre-School Aged Children with Neurodevelopmental Conditions in Scotland.

E. J. Hutton[1], *L. Millar*[2], *P. Rowe*[3] *and J. Delafield-Butt*[1], *(1)Laboratory for Innovation in Autism, University of Strathclyde, Glasgow, United Kingdom, (2)Faculty of Engineering, University of Strathclyde, Glasgow, United Kingdom, (3)Department of Biomedical Engineering, University of Strathclyde, Glasgow, United Kingdom*

Background: Recruitment of children with neurodevelopmental conditions presents a challenge in research. Many caregivers, educators and clinicians can be protective and have excessive time demands. This can create barriers to recruitment. In Scotland, despite a unified health service ethics system and complementary university ethics board, many local approval processes are additionally required. Different processes with different values and expectations are required, and these are not readily apparent.

Objectives: We sought to determine the most efficient recruitment pathways for children with neurodevelopmental conditions to aid the development of recruitment strategies in future research in Scotland.

Methods: This work is part of a Phase III diagnostic trial to assess the sensitivity of iPad games to detect autism spectrum disorder in preschool aged children (Clinical trials Gov. ID NCT03438994). Groups included: typically developing (TD), diagnosis of autism spectrum disorder (ASD) and diagnosis of another neurodevelopmental condition that is not autism (OND). Each health board, clinician, local authority, nursery, and educational team lead approached was recorded and approval rate calculated. For those approved, the number of information packs distributed was noted by pathway (NHS health board, local authority council, or private nursery) and site. Returned consent forms and final participant participation was recorded. These data were stratified by pathway and local authority within each pathway.

Results: 5 NHS health boards, 10 local authorities and 14 private nurseries were approached for approval; of which, 3, 6 and 13, respectively, gave approval. Percentage return was best in private nurseries (37%), however was limited to TD participants. Results demonstrated that the council pathway yielded the highest number of participants across all groups (171). Stratified by pathway, NHS yielded 17 ASD from 10 sites; local authority yielded 112 TD, 16 OND and 43 ASD from 17 sites and private yielded 159 TD from 13 sites. In all cases the number of consent forms returned matched the number of assessments which took place.

Conclusions: These results indicate that successful recruitment is more likely to occur via local council pathways. Although the return of participants was low in comparison to the number of information packs distributed, this may be due to the high volume of packs distributed in this pathway. The high percentage return from private nurseries is likely due to good relationships between staff and parents. The lowest return was observed in the NHS pathway, this may be due to high time pressures on clinicians, leaving them unable to dedicate time to research or time to the clinical assessment pathway for neurodevelopmental conditions. Until pressure on clinicians is lifted and local health boards develop a unified method for assessment and treatment of children, recruitment in NHS facilities will remain an undesirable option for research studies. While local authority and private nurseries remain the most effective route to recruitment, development of effective strategies is hindered by the lack of transparency and over complication of differing values between local authorities, nurseries, and schools. A consistent, cohesive application process within the NHS and local authority pathways would be of great benefit.

Poster Session
204 - Clinical trial endpoints
5:30 PM - 7:00 PM - Room: 710

65 **204.065** Initial Severity of Autism Symptoms Moderates the Effect of Intensity on Expressive Communication in Children with ASD

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Background:

When intensity levels have been compared in other populations, differences between two intensity levels of the same treatment tended to vary by characteristics of the children prior to treatment (i.e., moderators).

Objectives:

To determine whether initial severity of autism moderates the effect of intensity of treatment on expressive communication.

Methods:

The measure of expressive communication was derived from 12 monthly six-minute semi-structured communication samples administered by an examiner who was blind to intensity group assignment using toys not used in the treatment sessions. These sessions were coded by an observer who was blind to intensity group using a timed event sampling method. The metric from this procedure was the weighted frequency of intentional communication. Weights varying from 1 to 3 were assigned for nonverbal, single word, and multi-word communication acts, respectively. The measure of ASD severity was the calibrated severity score from the ADOS.

The mixed level model of growth in expressive communication was described by Dr. Rogers. Slope was used as the parameter of interest.

Results:

Time was centered at study entry; thus, intercept could be interpreted at level at study entry. There were a nonsignificant interaction between ASD severity and Intensity Group on the intercept. There was significant gain in weighted frequency of intentional communication in both intensity-level groups, but no main effect of intensity level.

There was an interaction between autism severity and intensity level on weighted frequency of intentional communication growth rate (pseudo R square change = .07; Cohen's *d* = .55) with higher intensity affecting communication more than lower intensity in the mildly affected children only (CCS 3 – 7).

Conclusions:

This is the first study to show that intensity of treatment affects only mild to moderately affected children with ASD. This is analogous to a finding Dr. Rogers reported on: the least affected children benefited from more hours of treatment per week. Additionally, this study showed that a particular method of briefly assessing communication called individual growth and development index (IGDI, Carta, Greenwood, Walker, & Buzhardt, 2010) is sensitive to treatment effects (a type of validity).

66 **204.066** The Effects of Pivotal Response Training on Reciprocal Vocal Contingency in Children with Autism Spectrum Disorder

P. Yoder[1], *J. McDaniel*[1], *M. Crandall*[1], *M. E. Millan*[2], *C. Ardel*[2], *G. W. Gengoux*[2] *and A. Y. Hardan*[3], *(1)Department of Special Education, Vanderbilt University, Nashville, TN, (2)Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, (3)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA*

Background: Pivotal response treatment (PRT) is a naturalistic developmental behavioral intervention for children with autism spectrum disorder (ASD) that targets "pivotal" skills (e.g., motivation and responsivity) to facilitate broad changes across functional skills. Combining clinician-delivered and parent-implemented pivotal response training as a package treatment (PRT-P) may increase the program's effectiveness for children with autism spectrum disorder (ASD). Reciprocal vocal contingency (RVC), an automated measure of vocal reciprocity, may provide more internally-valid evidence of the effects of PRT-P relative to parent report and parent-child interaction session measures, which are at risk for over-estimating children's skills in the PRT-P group relative to the control group. Due to its automatic derivation, RVC is at low risk of bias and feasible for clinical use. Additionally, RVC is designed to be independent of chance sequencing of events. The more frequently children and adults vocalize, the more their vocalizations will be adjacent by chance. In children with ASD, past studies have shown that RVC continues to be construct valid as a measure of reciprocity, even after controlling for base rates of child and adult vocalizations. In contrast, its primary competitor as a putative measure of "vocal reciprocity" (i.e., number or rate of vocal turn-taking) ceases to show convergent validity after controlling for the base rates of child and adult vocalizations.

Objectives: To examine whether participants in the PRT-P group have higher ranked RVC values than participants in the control group after 12 and 24 weeks of intervention.

Methods: Forty-eight children with ASD (29 to 71 months old) were randomly assigned to either the PRT-P or business as usual control group. Data for the current analysis were available for 40 participants. The PRT-P included weekly individual parent training sessions and 10 hours per week of in-home intervention for 12 weeks, followed by 12 additional weeks of monthly parent training sessions and 5 hours per week of in-home intervention. For each participant at each of three measurement periods (pre, mid-intervention phase, and posttest, separated by 12 weeks each), we quantified RVC from two daylong vocal samples using a computer program to organize the data for subsequent three-event sequential analyses that calculated the degree to which children responded to adult vocal responses to children's immediately preceding vocalizations.

Results: Although the group differences were non-significant at baseline (Time 1; p = .12) and after 12 weeks of intervention (Time 2; p = .25), children in the PRT-P group had higher ranked RVC scores than children in the control group after 24 weeks of intervention (Time 3; U = 125, p = .048). The percentage of all possible pairwise comparisons for which the PRT-P group exceeded the control group was 69%, which is a moderate effect size.

Conclusions: These findings support the effectiveness of PRT-P on vocal reciprocity of children with ASD, which may be a pivotal skill for language development. Continued investigation is required to determine the specific time range and developmental level for which RVC is most useful.

67 **204.067** Objective Measurement of Initiations to Peers Following Behavioral Social Skills Treatment

G. W. Gengoux[1], *J. Hopkins*[2], *A. A. Ruiz*[2], *M. E. Millan*[1], *R. K. Schuck*[1], *Y. Weng*[3], *J. Long*[3] *and A. Y. Hardan*[4], *(1)Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, (2)Palo Alto University, Palo Alto, CA, (3)Stanford University School of Medicine, Stanford, CA, (4)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA*

Background: Studies of children with Autism Spectrum Disorder (ASD) have repeatedly documented low rates of initiations especially to peers, even among children without intellectual disability. Young children typically start peer interactions either 1) by making requests or 2) by initiating to share a social experience. Children with ASD often struggle with both types of initiations. Given that requesting often results in greater tangible reinforcement in natural environments, it is hypothesized that systematic teaching of requesting could motivate children to initiate for social purposes (i.e., sharing social experiences).

Objectives: This presentation reviews data from a randomized controlled trial of a social group intervention aimed at motivating children with ASD to initiate by systematically teaching and reinforcing requesting. Video recorded observations of free play with peers are used to evaluate changes in initiation frequency and type.

Methods: Participants included 44 children with ASD from 4-6 years old. Participants were randomly assigned to the Social Initiation Motivation Intervention (SIMI; n=22) or control group (n=22). Participants in the SIMI condition received 8 weekly 75-minute social group sessions with typically-developing peers, during which therapists arranged cooperative activities to teach and reinforce initiations to request items from peers. Participants in the control group continued stable community-based services. Trained raters blinded to treatment assignment and time point scored video recordings of free play with peers. Frequency of requests to peers were recorded and provided evidence of progress with skills directly targeted in treatment, while frequency of joint attention and social interaction initiations provided evidence of generalization to other initiation types.

Results: Following the 8-week treatment, children in the SIMI intervention showed enhanced motivation to initiate to peers. Not only did they show greater improvement than controls in initiating to make requests during videotaped free play interactions (p = 0.029), they also showed greater generalization to other types of spontaneous social initiations compared to controls (p = 0.007). Results also indicated greater improvement on measures of global social functioning, including the Clinical Global Impressions-Improvement Scale (CGI-I; p=0.026) and Vineland-II Socialization scale (p=0.049).

Conclusions: Findings suggest that behavioral treatment focused on teaching initiations shows promise for enhancing social motivation in children with ASD and improving broader aspects of social functioning. Objective rating of treatment response and generalization can be obtained from review of video recorded interactions with peers. Implications for design of effective inclusive social skills programming and remediation of core social deficits in ASD will be discussed.

68 **204.068** The Sensory Domain As a Target for Treatment in ASD Clinical Trials: Electrophysiological and Behavioral Markers of Therapeutic Change

P. M. Siper[1], *T. Tavassoli*[2] *and A. Kolevzon*[1], *(1)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (2)Centre for Autism, School of Psychology & Clinical Language Sciences, University of Reading, Reading, United Kingdom*

Background: Sensory symptoms represent a core feature of autism spectrum disorder (ASD) and a novel domain to target in clinical trials.
Objectives: This study piloted the utility of electrophysiological and behavioral measures for assessing change in sensory reactivity during a clinical trial of insulin-like growth factor-1 (IGF-1) in children with Phelan-McDermid syndrome (PMS). PMS is one of the most common single-gene causes of ASD and sensory hyporeactivity is a prominent feature of the syndrome.

Methods: Participants included six children with PMS 5-12 years of age enrolled in an ongoing placebo-controlled, double-blind, crossover design study. Transient visual evoked potentials (VEPs) and the Sensory Assessment for Neurodevelopmental Disorders (SAND) were collected at baseline and week 12 of each study phase of the crossover. VEPs reflect the sum of excitatory and inhibitory postsynaptic potentials and provide a window into the brain to examine excitatory/inhibitory balance. The magnitude squared coherence statistic (MSC) was used to examine coherence of high-frequency oscillatory responses. The SAND is a clinician-administered observation and corresponding caregiver interview that quantifies sensory reactivity according to DSM-5 criteria for ASD (hyporeactivity, hyperreactivity, seeking).

Results: There was a significant increase in low gamma (30-36 Hz) activity following IGF-1 relative to baseline (p=.048). Notably, MSC increased in 5 of 6 patients. Significant clinical improvement was observed on the SAND Hyporeactivity Domain following IGF-1 treatment (p=.037).

Conclusions: Data collection is ongoing and preliminary results suggest that VEPs and the SAND represent two novel outcome measures for use in clinical trials for individuals with ASD and related conditions.

69 **204.069** Using fMRI to Identify Neural Mechanisms of Response to Cognitive Behavioral Therapy for Anxiety in ASD

D. G. Sukhodolsky[1], *K. Ibrahim*[1], *C. Kalvin*[2], *J. Eilbott*[1] *and K. A. Pelphrey*[3], *(1)Yale Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Child Study Center, Yale University, New Haven, CT, (3)University of Virginia, Charlottesville, VA*

Background: Cognitive Behavioral Therapy (CBT) can be helpful for anxiety in ASD but, little is known about the neural mechanisms of this potentially effective intervention.
Objectives: This presentation discusses a randomized-controlled trial to identify neural mechanisms of CBT efficacy for anxiety treatment in children with ASD, and to present the results of an open study of fMRI correlates of emotion regulation before and after CBT for anxiety in ASD.

Methods: Our ongoing, randomized-controlled study has been designed to test the effects of CBT on the fMRI signatures of fear processing and emotion regulation in children with ASD. Children are randomized to CBT conducted using the CBT manual or to a supportive therapy control condition and anxiety outcomes are assessed by the Pediatric Anxiety Rating Scale administered by an independent evaluator. Children also complete neurocognitive tasks of emotion regulation and socio-emotional processing before and after treatment. Prior to initiating the randomized trial, we also conducted an open study with 10 children with ASD (age rage 10 to 12; 3 girls, 7 boys) who completed the face perception and emotion regulation tasks during fMRI before and after CBT for anxiety. During the fMRI tasks children were required to view faces and shapes and to either passively look at the emotional or neutral images or to decrease their emotional response to aversive emotional images.

Results: A whole-brain fMRI analysis of the emotion regulation task revealed *increased activation* in vmPFC, vlPFC, and dlPFC after CBT. We also observed *reduction of left amygdala* and bilateral insula activation in the look-negative vs. look-neutral contrast (emotional reactivity) after treatment. The magnitude of the effects of CBT on the levels of BOLD activation in the contrasts of interest calculated as the Cohen's *d* effect size for the difference in post- to pre-treatment activation divided by the pooled standard deviation ranged from 0.68 to 1.23, indicating moderate to large effect sizes. Mean differences between faces vs shapes condition of the face perception task were computed from beta values extracted from the structurally defined left and right amygdala and vmPFC for the pre- and post-treatment scans. Paired-samples t-test indicated that there was a decrease in activity in the bilateral amygdala (Cohen's d=0.66 and 0.51 for left and right amygdala, respectively) and an increase in activity in the vmPFC (Cohen's d=0.51) relative to baseline.

Conclusions: CBT can engage the neural circuitry of emotion regulation in children with ASD and co-occurring anxiety. Clinical implications of understanding neural mechanisms to enhance the effectiveness of CBT for anxiety symptoms in ASD are discussed.

70 **204.070** Using the Boscc As Primary Outcome of the German A-FFIP Multicenter RCT

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Background: The *Frankfurt Early Intervention Program for preschool children with ASD (A-FFIP)*is a manualized low-intensive therapist-delivered and parent-supported early intervention program, which is currently studied for efficacy by a German multi-center randomized controlled trial (target sample N = 134 preschool-aged children at four study sites). The primary outcome measure is the *Brief Observation of Social Communication Change*(*BOSCC*). Several additional secondary outcome measures as well as mediating mechanisms are studied.
Objectives: To (1) present data on the feasibility to standardize the BOSCC assessment with an independent professional at the different study sites; (2) explore concordance of BOSCC (Version December 2017) results based on video-based coding of differently structured interaction scenes; (3) explore concurrent validity with the ADOS-2 based comparison score and ESCS based joint attention measures.

Methods: Cross-sectional data of N = 15 children, aged 2-5.5 years old are reported.

(1) Feasibility questionnaires were completed by all BOSCC-testers and descriptive data are reported. (2) The BOSCC coding system was applied to 4 different 12-minute video scenes: BOSCC, ADOS-2, DCMA, and ESCS. Mean scores were compared by rANOVA. (3) Pairwise correlation of BOSCC, ADOS-2, and ESCS derived measures was calculated.

Results: The BOSCC implementation was highly feasible; still, some errors had to be corrected during the training phase. BOSCC coding results did not differ by the structure of the scene or interaction. Similar to previous studies, medium correlations of BOSCC and ADOS-2 scores were replicated and medium to high correlations of BOSCC and different ESCS joint attention measures were found.

Conclusions: The BOSCC is a feasible and promising outcome measure to study change in core ASD symptoms in preschool aged children, which can be rated by blinded raters from different video scenes and also allows the re-coding of existing video-based material. The implementation of the BOSCC in several early intervention studies will allow a direct comparison of effect sizes between studies. The final analyses will include a

larger sample.

71 **204.071** A Lifespan Approach to Patient-Reported Outcomes and Quality of Life for Autism Using Nih Promis®

L. Graham Holmes[1], *C. J. Zampella*[2], *C. C. Clements*[1], *B. B. Maddox*[1], *J. McCleery*[3], *J. Parish-Morris*[1], *R. T. Schultz*[1] *and J. S. Miller*[2], *(1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (3)The Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA*

Background:

Patient-reported outcomes (PRO) and quality of life (QoL) are subjective patient perspectives of everyday functioning and subjective well-being (SWB). Incorporating PRO measures with clinical data can inform research, healthcare delivery, and policy. The utility of these constructs is limited for autism due to lack of well-validated, widely available, and comprehensive yet feasible measures. To address this gap, we curated a National Institutes of Health PROMIS® Autism Battery (PAB) for children, teens, and adults. PROMIS® item banks (4-8 items each) cover physical (e.g., sleep), mental (e.g., emotional distress), social (e.g., social support, social isolation) and global health. The results of our survey of people with autism and their families illustrate both the utility of PROMIS® and how lifespan QoL and functioning in autism compare to the general population.

Objectives:

(1) Describe the development and validation of the PAB.

(2) Compare PAB scores for children (parent report), teens (parent and self-report), and adults (self-report) with autism to the general population.

(3) Examine gender differences across the life course.

(4) Examine age effects for young, middle, and older adults with autism.

Methods:

Participants had a medical diagnosis of autism and were recruited via Interactive Autism Network and other research registries. Parents of children (ages 5-13, *n*=211, 77% male), parents of teens (ages 14-17, *n*=246, 69% male), teens (*n*=141, 71% male), and adults (ages 18–65, *n*=227, 47% male) completed an online survey about health and QoL. A subset (*n*=62) completed qualitative follow-up interviews. In the parent datasets, half of children and one-third of teens were reported as functioning below grade level. T-tests and ANOVAs were used for norm, gender, and age comparisons, α=.01.

Results:

(1) Participants rated the PAB as feasible and acceptable and provided suggestions for improvements.

(2) Statistically significant symptom elevations were reported for children (all domains), for teens (all domains except anger, *p*=.025), for teen self-report (all domains except anger and family relationships, *p*'s>.243), and adults (See Tables).

(3) No gender differences were reported for children, or via teen self-report. Compared to boys, parents reported that teen girls were more stressed (*p*=.008), anxious (*p*<.001), and had poorer sleep (*p*'s<.009). Compared to adult men, women reported more symptoms in global health (*p*=.008), sleep disturbance (*p*=.001), social isolation (*p*=.009), and lower self-efficacy (*p*=.003).

(4) Middle and older adults reported more symptoms than young adults for sleep issues (*p's*<.008), social issues (*p's*<.001), anger (*p*=.001), and subjective well-being (*p's*<.001).

Conclusions:

Ideally, interventions and services are designed such that they have measurable, positive impacts on health, well-being, and/or QoL. The current findings indicate that a battery of PROMIS® measures for these constructs was both acceptable and effective for quantifying these domains for children, teens, and adults with autism and their families. Furthermore, the current results indicate impairments in relationships, physical and mental health, and well-being in children, teens, and adults with ASD, with adults also reporting poorer functioning and increased social isolation with age. Using these measures as part of research and routine care may help prioritize high-impact services and improve service delivery across the life course.

72 **204.072** Effects rTMS-Based Neuromodulation Dosage on Event-Related Potentials and Evoked and Induced Gamma Oscillations in Children with Autism Spectrum Disorder

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Background: Autism is defined as a spectrum of behavioral disorders that have in-common impairments in social interaction and communication skills, language deficits, and a restricted repertoire of interests and stereotyped activities. There are several theoretical models of the neuropathology of autism spectrum disorders (ASD), and one of them suggests the presence of an excessive cortical excitation/inhibition (E/I) ratio that affects functional connectivity. This model explains atypical event-related potential (ERP) and evoked and induced gamma oscillations observed in ASD during task performance. Repetitive transcranial magnetic stimulation (rTMS), especially using low frequency inhibitory stimulation, can be considered as a method of modulating the E/I bias.

Objectives: In our prior exploratory studies we used different schedules of rTMS to investigate outcomes of rTMS in ASD. In this study, 124 high functioning ASD children (IQ>80, <18 years of age) were recruited and assigned to either a waitlist group or one of three different number of weekly rTMS sessions (i.e., 6, 12, 18) to investigate effects of dosage on functional and behavioral outcomes. The project was aimed at selection of more effective length of rTMS course.

Methods: TMS consisted of trains of 1.0 Hz pulses applied over dorsolateral prefrontal cortex. The experimental task was a three-stimulus visual oddball with illusory Kanizsa figures. Behavioral response variables included reaction time and error rate along with EEG indices such as ERP and evoked and induced gamma oscillations. One hundred and twelve patients completed the assigned number of rTMS sessions.

Results: We found significant positive changes from baseline to post-TMS treatment period in motor responses accuracy (lower percentage of

committed errors, restored normative post-error slowing), in ERP indices and in evoked and induced gamma responses. Parental reports showed significant reductions in aberrant behavior scores as well as decreased scores of repetitive and stereotypic behaviors. The gains of outcomes increased with the total number of treatment sessions. Behavioral questionnaires (ABC,RBS-R, SRS-2) showed significant improvements in ratings of autism symptoms both post 12- and 18-session rTMS course.

Results of our clinical research study showed most significant changes from baseline in functional measures of performance in oddball task and in behavioral symptom ratings following 18 sessions of rTMS treatment. Several measures showed a difference from baseline and waitlist in reaction time and ERP/EEG variables after 12 sessions of rTMS, but only a few of them reached statistical significance post-6 session rTMS course.

Conclusions: Our results suggest that rTMS, particularly after 18 sessions, facilitates cognitive control, attention and target stimuli recognition by improving discrimination between task-relevant and task-irrelevant illusory figures in an oddball test. Improvement in executive functions and behavioral symptoms of autism further suggests that TMS has the potential to target core features of ASD. The results of this dosage-response study could serve as important pre-requisites that could inform the planning of a blinded randomized clinical trial. Among potential implications of the study should be considered potential of combining rTMS with neurofeedback training aimed at reinforcement of neuromodulation effects using operant conditioning.

73 **204.073** Psychometric Properties of a Novel Vineland-II™ 2-Domain Composite Score to Assess Social Communication and Social Interaction in Autism Spectrum Disorder

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Background: Challenges in socialization and communication are core symptoms of autism spectrum disorder (ASD) and need to be addressed by new treatments for ASD. However, there is a lack of consensus on appropriate outcome measures for evaluating core symptoms of ASD in clinical trials of new treatments.
Objectives: The Vineland Adaptive Behavior Scales, Second Edition (Vineland™-II) Socialization and Communication domain scores are both reliable and valid scales used as endpoints in ASD clinical trials. To explore the measurement properties of a novel Vineland-II 2-domain composite (2DC) score, which combines these 2 independently validated scales, we conducted a psychometric analysis of this new scale using data from the VANILLA phase 2 trial of balovaptan, a 12-week study in adult males with ASD and intelligence quotient (IQ) ≥ 70 (NCT01793441).

Methods: The Vineland-II 2DC score is calculated as the arithmetic mean of the Vineland-II Socialization and Communication domain standard scores. The measure was administered by experienced raters. Test-retest reliability was assessed using interclass correlation coefficient (ICC) in patients with no change in their clinical status at day 84 on the Clinical Global Impression–Improvement (CGI-I) scale. Sensitivity to change (baseline to day 84) was assessed by comparing mean scores on Vineland-II 2DC between subjects with CGI-I scores of "minimally improved" or better versus "no change" or worse using analysis of covariance. Convergent and discriminant validity, as well as known-group validity, were also explored with baseline Vineland-II 2DC, age, and IQ as covariates.

Results: The Vineland-II 2DC demonstrated very good test-retest reliability with an ICC of 0.83 (N = 88). The 2DC score correlated with (0.97 Pearson correlation coefficient) and demonstrated similarly robust psychometric properties to the Vineland-II Adaptive Behavior Composite score. Correlations with symptom-oriented scales that measure attributes different to those measured by Vineland-II 2DC were weak, as hypothesized. Known-group validity was strong, with significant difference in scores between Clinical Global Impression–Severity groups (nominal $P < 0.05$); and sensitivity to change for the Vineland-II 2DC score was significant across groups (nominal $P < 0.05$).

Conclusions: Challenges in socialization and communication are among the most important symptoms that need to be addressed by new treatments for ASD. However, there is a lack of validated measures of these core symptoms established in ASD clinical trials. In adults with ASD and IQ ≥ 70, the novel Vineland-II 2DC score shows evidence of reliability, validity and sensitivity to change, and enables a comprehensive assessment of socialization and communication abilities in people with ASD. These findings support the use of the Vineland-II 2DC score as an outcome measure for assessing the core deficits of socialization and communication in future ASD phase 3 clinical trials. Replication of these findings in other datasets is required to further validate the Vineland-II 2DC score.

74 **204.074** Significant Increase in Power in Clinical Trials with Use of the Newly Available Vineland-3 Growth Scale Values

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Background: Although adaptive behavior is relevant due to its clinical significance, it is used rarely as a primary outcome measure in clinical trials. This may be because adaptive behavior scores are often expressed as scaled or standard scores. Scaled scores, which provide information about a child relative to their peers, may remain unchanged even as a child's ability level increases or decreases. Further, scaled scores may decrease even if ability increases, if the rate is slower than chronological-age expectations. Thus, studies adequately powered to detect changes in scaled scored require relatively large and potentially unobtainable sample sizes. The third edition of the Vineland Adaptive Behavior Scales (VABS-3) includes growth scale values (GSV), which are an index of ability derived through item response theory. GSV quantities change within individuals, including small changes. Given its recent publication, the VABS-3 GSV should be explored as a potential outcome measure in studies of neurodevelopmental disorders.
Objectives: The goal of this study was to demonstrate the advantage of VABS-3 GSV for use as an outcome measure in clinical trials of neurodevelopmental disorders. Using data from an ongoing natural history study of creatine transporter deficiency (a rare, X-linked, metabolic condition associated with autism spectrum disorder and other neurodevelopmental disorders), we quantified change over 6 months in three types of scores (scaled score, age equivalent, and GSV). Post-hoc power calculations yielded estimates for sample sizes (per group) required to detect the observed effects with 80% power in future studies.

Methods: The interview form of the VABS-3 was administered to parents during study visits spaced at 6-month intervals. Here, we used data from the 14 participants with histories of global developmental delay and varying degrees of autism symptomatology who completed baseline and 6

month visits (age M=7.1, SD=3.6, range 3 – 13 years; VABS-3 Adaptive Behavior Composite Score M=47.9, SD=15.6, range 20-69). Linear mixed models were used to estimate mean change and the standard error of that estimate.

Results: Preliminary data indicate that for most subdomains, effect sizes were largest for GSV scores (see Figure 1). In some cases, the V-Scale effect size was the largest; however, V-scale in these cases indicated a worsening of relative standing, while the GSV indicated slight improvement or stability (e.g., Playtime). Where both the V-Scale and GSV indicated improvement over 6 months, the decrease in required sample size associated with use of GSV ranged from 43% to 83%. For example, the required sample size for Receptive Language GSV was n=26, compared to n=42 and n=46 for AE and V-scale, respectively.

Conclusions: Scaled or standard scores are poorly suited for use as outcomes in clinical trials because detectable changes in relative standing require proportionally larger changes in ability. The VABS-3 contains GSV, which index ability and are therefore explicitly designed for the assessment of within-person change. Using data from a natural history study of CTD, we demonstrated that studies which use GSV rather than scaled scores will require significantly fewer participants and will be less likely to mistake slower-than-expected growth as decline.

75 **204.075** Vineland™-II Adaptive Behavior Scales for Autism Spectrum Disorder: An Electronic Version Is Conceptually Equivalent to the Standard Paper Version

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Background: The Vineland Adaptive Behavior Scales, Second Edition (Vineland™-II) is a semi-structured interview-based clinical outcome assessment (COA) that is administered by a trained healthcare professional to the individual's caregiver/study partner. It assesses core domains of adaptive behavior and is recognized as an appropriate primary outcome measure for clinical trials in autism spectrum disorder (ASD). The Vineland-II is traditionally administered in paper format, but an electronic, tablet-based version has recently been developed for multicenter clinical trials.

Objectives: Regulatory guidance requires that whenever a COA is administered in a new mode, evidence is required to demonstrate that the COA's measurement properties are equivalent or superior to the data produced from the original version. Thus, the objective of this study was to explore conceptual equivalence and usability of the electronic version of the Vineland-II compared with its original paper format.

Methods: Qualitative, face-to-face interviews were conducted with 10 healthcare professionals in the United States who had experience administering the paper version of the Vineland-II and treating patients with ASD. Interviews were split into 4 sections: training the healthcare professional on the use of the electronic Vineland-II; a mock-administration exercise; and 2 debriefing sessions, 1 for each mode of the Vineland-II. All interviews were digitally recorded and transcribed verbatim. Qualitative analysis was conducted on all transcripts by sorting quotes into concepts using thematic analysis methods using a qualitative data analysis and research software (ATLAS.ti).

Results: All 10 participants were able to successfully use the electronic version of the Vineland-II on a tablet and experienced no significant issues in completion. There were no apparent differences between levels of understanding of the instructions and items for the paper and electronic versions. No participants reported differences in how the items on the paper and electronic versions of the Vineland-II were displayed or suggested ways in which the items could be displayed better on the electronic version. No notable differences were identified between calculating and interpreting scores on the electronic and paper versions of the Vineland-II, and both modalities were considered equally acceptable and easy to use. All participants reported that they would complete both versions in the same manner, and that they would be comfortable completing the electronic version in a clinical trial setting.

Conclusions: This qualitative research with healthcare professionals provides strong evidence that the newly developed electronic version of the Vineland-II is conceptually equivalent to the original paper version. The evidence from this study supports the use of an electronic version of Vineland-II in multicenter clinical trials for ASD.

76 **204.076** 'Play As You Do at Home': Using the Who Adapted Joint Engagement Rating Inventory (JERI) to Measure Caregiver-Child Interaction

E. Salomone[1,2], *M. Settanni*[1], *F. Ferrara*[1], *G. Foletti*[3], *C. Servili*[2], *K. Suma*[4], *R. Bakeman*[4] *and L. B. Adamson*[4], *(1)Department of Psychology, University of Turin, Turin, Italy, (2)Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland, (3)University of Turin, Torino, Italy, (4)Psychology, Georgia State University, Atlanta, GA*

Background: Recent literature has highlighted the need for comprehensive instruments to measure targets for early intervention for developmental disorders and delays, including autism spectrum disorder (ASD). The WHO adaptation of the Joint Engagement Rating Inventory (WHO JERI, Adamson, Bakeman & Suma, 2018) is a 12-item inventory developed to measure relevant intervention targets (Table). Items rate a child's engagement states as well as aspects of the child's behavior, their caregiver's behavior and the dyad's shared activities.
Objectives: to examine observers' agreement, accuracy, and construct validity of the WHO JERI

Methods: The sample consists of 86 children with ASD (67 males) aged 28-60 months recruited for a randomized controlled trial of the WHO Caregiver Skills Training program. Autism severity (ADOS-2), cognitive abilities (Griffiths-III) and vocabulary (MCDI) measures were collected at baseline. A free play caregiver/child interaction with a standard toy kit suitable for a range of developmental play levels was videorecorded. Ten consecutive minutes were rated both with a measure of social communication (BOSCC) and the WHO JERI by two reliable raters blind to the study's hypotheses. Rating procedures were applied as per the manual for both measures. For the BOSCC, averaged scores were obtained for two 5-min scenes that were scored separately. For the WHO JERI, ratings of child engagement state (e.g., joint engagement); child behavior (e.g., initiation of communication, expressive language); caregiver behavior (e.g., following-in, affect); and the dyadic interaction (fluency and connectedness, shared routines) were applied to the entire 10-min scene in three separate viewings. Preliminary analysis were conducted on a partial sample (n=22, 17 males). To check agreement, 50% of the corpus was independently rated by a second observer. Estimated observer accuracy was computed using the KappaAcc program (Bakeman & Quera, 2011; Bakeman, 2018). Construct validity of the WHO JERI was investigated by examining the associations of the WHO JERI item scores with theoretically associated variables on other assessments.

Results: Observers' agreement was reasonable: the range of weighted Kappas for ratings within 1 point on the 7-point rating scale was .64–1. Observer accuracy was acceptable, with 8 out of 12 items showing accuracy higher than 99%. JERI Unengaged and Joint Engagement items show

strong (> .5) positive and negative correlations with BOSCC and ADOS composite scores and items covering similar constructs (Spearman r's range= .68 to .89 and -.76 to -.97, respectively). Correlations between JERI child items and corresponding BOSCC items (range = -.75 to -.85) were higher than correlations with expressive vocabulary or developmental level. Caregiver behavior items were weakly correlated with child skills, with the exception of expected relationships: e.g. Following-in was negatively correlated with repetitive behaviors (r=-.67). Interaction items were strongly correlated with the BOSCC engagement item (range = -.71 to -.86).

Conclusions: The WHO JERI shows reasonable inter-rater agreement. Examination of correlations supports the tool's construct validity, as the patterns of both the direction and size of correlations shown among WHO JERI items and other study variables are consistent with previous studies and theoretical expectations.

Poster Session
205 - Cognition: Attention, Learning, Memory
5:30 PM - 7:00 PM - Room: 710

77 **205.077** Looking at the Ceiling: Eye-Tracking Data Indicate a Restricted Range of Reactivity to Threat in Autism

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Background: High levels of anxiety in autism have been linked to a number of mechanisms including the idea of reduced emotional awareness described as "alexithymia". In a previous fMRI study of classical fear conditioning, we found less differentiation of threat and safe contexts in autism. We suggested one possible reason for this could be a "ceiling effect" in which autistic participants were already so physiological elevated (whether from everyday life or the context of the experiment, or both) that further reactivity to our threat task is limited. For this experiment, a similar fMRI study of fear conditioning with a less variable reinforcement schedule, we additionally collected eye tracking data as fast (millisecond response, as opposed to a multiple second time course for fMRI BOLD data) measure of threat reactivity, and we also added a non-task baseline condition to examine initial tonic pupil size.
Objectives: We explored non-task "baseline" data for evidence of hyperarousal in autism *before* the onset of our fear conditioning experiment, and subsequent changes in pupil size during the experiment. We explicitly explored the possibility of a "ceiling effect" that influences the possible range of response in autism.

Methods: Sixty young adults (28 autism, 32 neurotypical) with average- to above-average IQ completed a classical fear conditioning task that used visual cues as conditioned (threat versus safe) cues and a burst of air on the neck as the unconditioned threat stimulus. Using Eyelink 1000 Plus eye-tracking system we collected tonic pupil size while participants stared at a fixation cross in the center of the screen for 60 seconds, and change in pupil size following the onset of each cue (threat or safe) during the fear conditioning task.

Results: The autism group demonstrated significantly elevated tonic pupil size compared to matched neurotypical participants, before the test even started. During the fear conditioning task, the autism group demonstrated a restricted range of response, including decreased responses to both safe and threat conditions and a decreased difference between safe and threat in the autism group.

Conclusions: While there are several possible explanations for this reduced reactivity during the fear conditioning task, we suggest that a "ceiling effect" arising from the elevated baseline arousal is parsimonious. The experimental threat of the air burst to the neck was not enough in thautism group to overcome existing arousal, which could be due to pressure or anxiety from the MRI environment and/or from everyday arousal. this latter possibility suggest the need to study physiological activity and response over the course of days or weeks using ecologically-valid methods. In the meantime, treatment for anxiety in autism should acknowledge difficulties latching on to "safe" contexts and possibly an elevated everyday physiological arousal which could interfere with relationships, work/school performance, and therapy.

78 **205.078** Luminance- and Texture-Defined Visual Perceptual Processing in Children and Adolescents with Asd; Comparison with Other Neurodevelopmental Conditions

M. Miseros, *D. Tullo and A. Bertone, McGill University, Montreal, QC, Canada*

Background: Individuals with Autism Spectrum Disorder (ASD) possess unique capacities related to visual perception (Mottron et al., 2006). Their capabilities can be defined by performance on behavioural tasks assessing low-level, basic visual information processing. An increasing trend in autism research has been defining the perceptual phenotypes in ASD and other neurodevelopmental conditions (NDCs) by conceptualizing atypical visuo-perceptual processes usingtwo models; the dorsal stream vulnerability hypothesis (Braddick et al, 2011) and the complexity-specific (CS) hypothesis (Bertone et al., 2005). Whereas the former is defined by findings of less efficient dynamic information processes across NDCs, the latter suggests neuro-integrative dysfunction leading to decreased sensitivity to complex visual information. Despite progress in defining visuo-perceptual profiles in ASD and other NDCs, findings are often inconsistent due to the use of different tasks across clinical groups, and participant groups in the literature are predominantly adults with average or above average cognitive abilities.
Objectives: Thepresent study (i) assessed visuo-perceptual profiles (processing of static and dynamic stimuli of varying complexity) in youth with ASD and other NDCs, and (ii) explored the extension of the CS hypothesis to a non-adult ASD population.

Methods: This study employed a single interval, two alternative (spatial) forced-choice orientation-discrimination paradigm to assess the processing of luminance- (simple) and texture-defined (complex) gratings presented in both static and dynamic states for 101 children and adolescents (aged 5 to 17 years). Participant groups either had a primary diagnosis of ASD (n=32), a non-ASD NDC (i.e., ADHD, ID and LD; NDC; n=26) or were typically developing (TD; n=43); groups were matched for mental age (MA), (p=.10), defined by an assessment of cognitive ability using the Wechsler Abbreviated Scale of Intelligence (WASI-II). Orientation-discrimination thresholds (luminance- and contrast-modulation thresholds) were calculated for each condition across groups; performance was assessed in relation to MA.

Results: The performance of the ASD group was comparable to the TD group, whereas the NDC group demonstrated reduced performance for second-order dynamic stimuli, suggesting that the CS hypothesis can define perceptual abilities of younger individuals with a non-ASD NDC. While results are not consistent with the adult-based CS hypothesis, significant correlations were found between MA and ASD perceptual discrimination

thresholds in all conditions: r [-.49, -.41, -.55], with the exception of the luminance-defined, dynamic information condition.This relationship, demonstrating that discrimination thresholds decrease with increasing mental age, suggests the visuo-perceptual *profile* of individuals with ASD changes with MA.

Conclusions: This study provides valuable information regarding the respective maturation of both dynamic and static early perceptual abilities across childhood and adolescence in ASD compared to MA-matched NDC and TD groups. Findings extend the literature by evaluating the integrity of the dorsal and ventral visual streams in clinical groups, and contribute to the developmental and condition-specific conceptualization of visuo-perceptual processing in ASD. Overall, the results support the applicability of the CS hypothesis to other NDCs, and highlight the relationship between visuo-perceptual profiles and overall cognitive abilities (i.e., MA) in ASD. Future research should assess perceptual abilities in ASD and other NDCs within a developmental context.

79 **205.079** Modulation of Task-Evoked Pupil Dilations Differs in Individuals with Autism Spectrum Disorders: Implications for Noradrenergic and Cholinergic Dysfunction in ASD

M. C. Granovetter[1,2], *C. S. Burlingham*[3], *D. J. Heeger*[3] *and M. Behrmann*[1], *(1)Carnegie Mellon University, Pittsburgh, PA, (2)University of Pittsburgh School of Medicine, Pittsburgh, PA, (3)New York University, New York, NY*

Background: It has been posited that cognitive deficits among individuals with autism spectrum disorders (ASD) are a consequence of an imbalance in cortical excitation and inhibition. The noradrenergic and cholinergic systems have been implicated in globally modulating the homeostasis of excitatory and inhibitory neural activity and, accordingly, regulating cognitive processes such as attention, memory, and learning. Importantly, the noradrenergic system is critical for attending to task-relevant stimuli, a behavior that can be challenging for individuals with ASD. Whether there are inherent differences in the release of norepinephrine and/or acetylcholine in individuals with ASD, and the potential impact of these differences on their behaviors, remains unclear.

Objectives: The goal of this study was to determine whether, relative to matched typically developed participants, individuals with ASD exhibit differences in task-evoked pupil dilations under conditions of cognitive load. Any such difference might implicate atypicalities in the regulation of the noradrenergic and cholinergic systems in ASD.

Methods: 17 participants with ASD (15 males, 2 females; mean ± SD age = 32 ± 7.6 years) and 14 neurotypical controls (12 males, 2 females; mean ± SD age = 27 ± 4.5 years) performed a one-back working memory letter detection task (with stimuli presented every 0.5 s), while pupil size was measured at a rate of 1000 Hz. In half of trials, participants were also exposed to distractor auditory tones played at random intervals throughout the block. Feedback on hits and false alarms was displayed to participants in real time.

Results: A repeated-measures ANOVA revealed no significant group differences on either sensitivity indices or reaction times, indicating comparable performance between the two groups. A support vector machine was trained using cross-validation on the impulse response function (IRF) of pupil size in response to hits and was able to classify the two groups on diagnosis with above-chance accuracy. To evaluate differences in the magnitude of pupil size fluctuations between the two groups, a repeated-measures ANOVA was performed on the response amplitudes of the pupil size IRFs in response to hits, false alarms, and misses, for both task conditions (with/without distractor stimuli). There was a significant main effect of group on pupil response amplitudes, as well as a significant interaction of group by task condition. Post-hoc analyses indicate that whereas the pupil response amplitudes are not different across conditions for controls, for participants with ASD, the pupil response amplitudes were significantly lower when distractor stimuli were present compared to when they were absent.

Conclusions: These findings suggest that measurement of task-evoked pupil dilations allows for classification of individuals with ASD from neurotypical controls. Notably, when individuals with ASD successfully perform a cognitive task, the extent of pupil size fluctuation is nonetheless smaller when distractor stimuli are present. It is thus possible that individuals with ASD might exhibit atypical activity of the noradrenergic and cholinergic systems when attempting to attend to task-relevant stimuli.

80 **205.080** Patterns of Learning in Young Children with Autism Spectrum Disorders

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Background:

Understanding the cognitive profile of children with autism spectrum disorders (ASD) is important to determining whether there is a pattern that is unique to this learning style, potentially informing prognosis and targeting appropriate interventions.

Objectives:

The purpose of this pilot study was to examine the pattern of language and nonverbal intelligence in young children with ASD as measured on standardized developmental and achievement testing as a way to guide future therapeutic and educational interventions.

Methods:

The study design was a retrospective chart review of 168 children with ASD (median age 4.11 years; SD=1.08) evaluated at Lurie Children's Development Clinic from 8/1/11 to 8/1/16. The following data was extracted from the electronic medical record: date of visit, date of birth, sex, race and ethnicity, educational and therapeutic interventions, and testing results.

Statistical analyses utilized included Student's t-test and paired t-test, Chi-squared tests and the use of the Bonferroni correction when appropriate. A two-sided p value ≤ 0.05 was considered statistically significant.

Results:

Of the 168 children, 80% were male and 20% were female. In regards to ethnicity, 56% were Caucasian, 26% Hispanic, 13% African American, and 5% responded as "other" or did not report ethnicity.

Sixty-six percent of the sample attended school. Ten percent attended a general education preschool classroom with the remaining in special

education settings. Forty-three percent received school based therapy services. Sixteen percent participated in applied behavior analysis therapy (ABA).

Fifty-three participants were evaluated using the *Bayley Scales of Infant Development- Third Edition* due to lower developmental attainment. They were significantly younger when first diagnosed with ASD (x=4.27, SD=0.9, p<0.0005), suggesting that they required increased levels of support.

One hundred nineteen children completed all of the subtests on the *Differential Abilities Scales, Second Edition***.** The mean GCA score was 77; the mean verbal score was 73; the mean nonverbal score was 82; the mean spatial score was 83. A significant difference was found between verbal and nonverbal reasoning scores, with nonverbal skills being higher (mean difference 7.5, p<0.0005).

Eighty-five children completed all of the subtests on the *Bracken School Readiness Assessment*. Composite scores fell in the average range (mean 93, SD=16.7). Significant differences between subtests on the *Bracken* were found. Identifying colors, shapes, letters and numbers were strengths in our population as all fell in the average range. Understanding of size/set comparisons (B-R-S/C), a more language based skill, fell significantly below the mean (x=4.17, SD= 3.736). Performance on this subtest was found to be significantly higher among subjects attending school (mean 4.53, SD=3.836, p=0.004).

Conclusions:

School attendance correlated with more flexible thinking as indicated by improved scores on the set comparisons subtest of the *Bracken*. Children with ASD display a unique learning style characterized by strengths in visual learning and memory. Future research is required to understand the effects of school and socioeconomic status on learning performance.

81 **205.081** Patterns of Nonsocial and Social Cognitive Functioning in Adults with Autism Spectrum Disorder: A Systematic Review and Meta-Analysis

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Background: Despite similar Autism Spectrum Disorders (ASD) prevalence rates of 1% in children and adults, and clear challenges that persist into adulthood, research and treatment efforts have been largely dedicated to children. A critical question that has remained largely unaddressed concerns the identification of cognitive domains that are most severely impaired in adults with an ASD diagnosis. A detailed evaluation and comparison of (social) cognitive deficits in adults with ASD will advance knowledge about the expression of ASD in later life, and may help pinpoint targets for (social) cognitive intervention.

Objectives: The present review and meta-analysis aims to systematically map the severity of impairments across domains of non-social and social cognitive functioning in adults with ASD compared to the neurotypical adult population. To help explain any variability between studies, potential moderators of impairments observed in these individuals will be evaluated.

Methods: The literature search was conducted in PubMed, PsycINFO, EMBASE and MEDLINE databases. The search was limited to studies published between 1980 (first inclusion of Autism diagnosis in the DSM-III) and July 2018. Studies were included if they were published as primary peer-reviewed research paper in English, included individuals with Autism Spectrum Disorder (ASD) aged 16 or over and assessed at least one domain of neurocognitive functioning or social cognition using standard measure(s). In total, 9829 potentially eligible papers were identified and screened, 75 studies met inclusion criteria for meta-analysis.

Results: Most of the 75 studies included in the meta-analysis were conducted in Europe (n=50, 67%), followed by studies from the USA and Canada (n=16, 21%). The sample sizes varied greatly, ranging from 18 to 3907 participants (including neurotypical adults) with 66 (88%) studies using samples between 20 and 100 participants. All the included studies had a combined sample of 3361 individuals with ASD and 5344 neurotypical adults. Adults with ASD showed large impairments in theory of mind (Effect size (ES) g=-1.09, 95% CI=-1.25 to -0.92; number of studies=39) and emotion perception and knowledge (ES=-0.80, 95% CI=-1.04 to -0.55; n=18), followed by medium impairments in processing speed (ES=-0.61, 95% CI=-0.83 to -0.38; n=21) and verbal learning and memory (ES=-0.55, 95% CI=-0.86 to -0.25; n=12). The relatively spared cognitive domains were working memory (ES=-0.23, 95% CI=-0.47 to 0.09; n=19) and attention and vigilance (ES=-0.30, 95% CI=-0.81 to 0.21; n=5). Meta-regressions confirmed robustness of the results.

Conclusions: This comprehensive review and meta-analysis of impairments in non-social cognitive functioning and social cognition of verbal adults with ASD showed that despite having an intact IQ, there are medium to large deficits observed in four key-domains of social and non-social cognition (Theory of Mind, Emotion perception and knowledge, Processing speed and Verbal learning and memory). While our findings support the key social cognitive theories of ASD, they also stress deficits in non-social cognitive areas. These results highlight the importance of a broader approach when studying cognition, also as potential mechanism underlying symptoms and treatment outcomes.

82 **205.082** What Strategies Do Autistic Children Use When Learning New Categories? an Eye-Tracking Study

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Background: Autistics have shown a range of performance on category learning tasks (Gastgeb et al., 2012; Schipul et al., 2012; Soulières et al., 2011), possibly associated with differences in how they process learned material (e.g., reduced attention to social elements, attend to fewer elements). Recent studies have tried to understand how and when autistics learn efficiently (Foti et al., 2015), including by spontaneously extracting regularities from large arrays of information (Mottron et al., 2013). Such findings suggest that how information is presented may affect the way autistics explore their visual environment, ultimately affecting leaning.

Objectives: To study how autistic and typically-developing children process new information during a probabilistic categorization task, and specifically; 1) Do autistics attend to the same stimulus elements and show the same pattern of preferences compared to typical children?, and 2) Do the learning strategies used by the autistic children differ according to the way material is presented?

Methods: 38 autistic (M_{age} 10.1 years, SD 1.9; $M_{WISC\text{-}IV\ PRI}$ 102.5, SD 22.7) and 43 typically-developing (M_{age} 9.4 years, SD 1.4, p>.05; M_{PRI} 111.6, SD 20.9, p>.05) children completed two sets of probabilistic categorization tasks (*Nader et al., 2018*) using a Tobii T120 eye tracker. Fourteen artificial stimuli varying across 4 features had to be classified into 2 categories based on 5 different probabilities. Each stimulus was probabilistically

associated with an outcome. Tasks varied in the way information was presented; (1) one item at a time with feedback (sequentially), or (2) a non-feedback version of the task with the observation of the items-outcome association (simultaneously). A 200-trial learning phase preceded a test phase in which each stimulus was presented twice (total 28 trials), and eye tracking data collected. All stimuli were partitioned into 4 areas of interest (AOI) (4 main features of the stimuli), which could be either present or absent on a given stimulus. Analyses were conducted on the length and the frequency with which children attended to the different AOIs on items containing most of the AOI (i.e. presence of 3 features out of 4). Further analyses are ongoing.

Results: Consistent with Nader et al. (2018), performance of autistic children was better -and similar to that of typically-developing children- when information was presented simultaneously, and decreased when presented sequentially. Collapsed across conditions, both groups attended to the same features, but with autistics having shorter and reduced number of fixations on AOIs than typically-developing children. Interestingly, autistic displayed less (F (1, 37) 6.2, p=.02) and shorter (F (1, 37) 7.7 p=.009) fixations than typical children when information was presented simultaneously during learning, while the length and the frequency were similar for both groups when information was presented sequentially (p>.05).

Conclusions: In a probabilistic category learning task, autistic children based their learning using the same features as typically-developing children, but were more efficient when information was presented simultaneously, resulting in a reduction in information processing time. These findings suggest increasing access to information (i.e., simultaneous) while learning may be beneficial for autistic children.

83 **205.083** Possible Mechanisms for Elevated Pupil Size in Autistic Adults

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Background: Increases in pupil size dilation has been associated with emotional salience and greater cognitive load. A series of studies by Tsukahara, et al. (2016) have reported a positive correlation between tonic pupil size and higher fluid intelligence and working memory performance, suggesting that persons with high tonic pupil size also have a higher capacity or cognitive load. Studies of autistic samples have found higher tonic pupil sizes in autism (AUT) compared to neurotypical (NT) samples, which could be due to cognitive factors but could also be due to elevated emotional arousal. To date, there has not been a study examining the relationship between tonic pupil size, cognitive functioning, and emotional distress in an autism sample.

Objectives: To explore the relationship between tonic pupil size, cognitive ability, and emotional distress in both neurotypical and autistic adults.

Methods: Participants were autistic (n=26) and neurotypical (n=24) adults who were part of a larger study on emotion learning in autism. We collected tonic pupil size using using Eyelink 1000 Plus eye-tracking system while participants stared at a fixation cross in the center of the screen for 60 seconds. We administered the WAIS-IV to all participants to identify cognitive ability using standard subtests and domains. We measured emotional distress using the Depression, Anxiety, and Stress Scale Short Form and the Penn State Worry Questionnaire. We calculated differences between the AUT and NT groups using t-tests in all measures, and also examined possible correlations between variables using a Pearson's correlation.

Results: Analyses confirmed previous findings of larger tonic pupil size in AUT compared to NT group participants (p= .011). The AUT group also had a higher emotional distress scores on the DASS (p<.001) and PSWQ (p<.001). Groups were evenly matched for Verbal Comprehension and Perceptual Reasoning domains of the WAIS-IV but the AUT group scored lower on the Working Memory (p=.011), and Processing Speed (p<.001) domains. However, there were no significant correlations between pupil size and cognitive ability or emotional distress, for either group separately or for the combined samples.

Conclusions: At least in this small sample, the higher pupil size in AUT does not seem to be related to increased cognitive abilities as extrapolated from Tsukahara, et al. (2016). However, we also found no correlations with emotional distress. Cognitive and emotional reactivity--how one responds to a challenging task--may be interesting to study in relation to pupil size. At present, however, we do not have an explanation for the consistent physiological difference of larger tonic pupil size in autism and future studies of both physical and psychological factors are needed to shed light on this phenomenon.

84 **205.084** Proactive Control Preserved but Related to Internalizing Psychopathology in Adolescents and Young Adults with Autism Spectrum Disorder

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Background:

Autism spectrum disorder (ASD) is characterized by deficits in cognitive control (Solomon, Hogeveen, Libero, & Nordahl, 2017). However, recent work has shown that proactive control, defined as preparatory, goal-directed cognitive processing, may be preserved in children with ASD, and its implementation negatively associated with attention problems (Hogeveen, Krug, Elliott, & Solomon, 2018). Proactive control has not yet been investigated in adolescents and young adults with ASD, nor have its associations with anxiety and depression, which are commonly comorbid in ASD (Leyfer et al., 2006), increase in prevalence during adolescence (Mayes, Calhoun, Murray, & Zahid, 2011), and are associated with impaired cognitive control in typical development (Eysenck, Derakshan, Santos, & Calvo, 2007; Joorman & Tanovic, 2015).

Objectives:

1. Determine whether proactive control is intact in adolescents and young adults with ASD compared to age and IQ-matched typically developing individuals (TYP).
2. Determine whether implementation of proactive control is negatively associated with symptoms of attention deficit and hyperactivity (AD/H), anxiety, and depression.

Methods:

44 ASD (Age=17.6 (2.9); FSIQ=104.2 (12.7)) and 44 TYP participants (Age=17.2 (3.2); FSIQ=107.6 (11.9)) performed a picture-word Stroop task (Gonthier, Braver, & Bugg, 2016; Figure 1a). Participants were instructed to name the animal pictured while ignoring a superimposed response-congruent (C) or response-incongruent (I) word. Two blocks of the task were performed: a mostly congruent (MC) block, where most of the trials were C, and a mostly incongruent (MI) block, where most of the trials were I. For MC and MI blocks, response time (RT) interference effects were calculated (I RT–C RT). If many I trials are encountered, as in the MI block, participants should adopt a proactive control strategy, whereby they focus more on the picture and ignore the word, resulting in decreased RT interference. Proactive Control Benefit was calculated as a reduction in interference on the MI block in comparison to the MC block (MC_I–C RT) – (MI_I-C RT).

Psychopathology (DSM scales for AD/H, Depression, and Anxiety) was assessed with the parent-report Achenbach System of Empirically Based Assessment (ASEBA) (Achenbach & Rescorla, 2001; 2003).

Results:

ASD and TYP did not differ in MC interference (F=.150, p=.700), MI interference (F=.875, p=.352), or Proactive Control Benefit (T=.403, p=.688) (Figure 1b). In the ASD group, MC interference, MI interference and Proactive Control Benefit were not associated with AD/H symptoms. However, MI interference was positively correlated with anxiety (rho=.307, p=.043) and depression symptoms (rho=.360, p=.016) (Figure 2a) and Proactive Control Benefit decreased as symptoms of depression increased (rho=-.320, p=.034)(Figure 2b).

Conclusions:

Proactive control is not impaired in adolescents and young adults with ASD, replicating findings in children. However, anxiety and depression are associated with increased interference in proactive control-demanding contexts, and depression is associated with reduced implementation of proactive control. Thus, while some important underlying mechanisms of cognitive control may be intact in those with ASD, the presence of co-morbid psychopathology can negatively affect cognitive functioning in these individuals, and should be considered when diagnosing and treating their challenges in social, academic, and general adaptive functioning.

85 **205.085** Reading Abilities of Hebrew Speakers with ASD

ABSTRACT WITHDRAWN

Background:

Studies of reading in ASD mainly focused on text reading and comprehension. They report that children with ASD read at their age-level, but exhibit reading comprehension difficulties and difficulties in reading in context.

Objectives:

This study is the first to test reading abilities at the word level and analyse error types in ASD. Its aim was to assess their reading in the framework of the Dual Route Model and if they show difficulties, identify the locus of impairment within the reading process.

Methods:

Participants were 70 Hebrew speakers with ASD aged 8-27 (M=15.8, SD=4.8; 9 female, 61 male). All were diagnosed with ASD prior to the study. Control groups for each ASD participant were age-matched individuals with no known developmental disorders.

The participants' reading was evaluated using the TILTAN reading screening task, which includes reading of 136 single words, 40 nonwords, and 60 words presented in pairs. Correct responses were counted and in-depth error analysis was made to detect different types of dyslexia.

Results:

The analysis of accuracy and error types yielded three reading profiles : Intact reading (n=36), dyslexia (n=22), and reading deficits as a result of an impairment in lexical retrieval (n=12). Namely, for half of the participants, reading itself was unimpaired.

Of the ASD participants with dyslexia, the most common pattern was that of reading via grapheme-to-phoneme conversion, instead of reading through the lexical route (which may also explain their semantic difficulties in text reading); 9 other ASD participants with dyslexia had impairments in orthographic-visual analysis, mainly in letter position encoding (letter position dyslexia) or letter-to-word binding (attentional dyslexia).

Conclusions:

This study was the first to assess the reading abilities of Hebrew-speaking participants with ASD. More than half of the participants had age equivalent reading abilities. Three main types of dyslexia's were found, an important finding when considering educational and intervention programs.

86 **205.086** Real-World Social Problem-Solving in ASD: The Influence of Executive Functions

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Background: Social communication impairments in individuals with autism spectrum disorder (ASD) are associated with executive function deficits. However, much of this work relies on standardized assessments. The current study utilized a task designed to elicit spontaneous language between two speakers; the task has high ecological validity; we argue that it is more representative of real-world language skills than performance on the item-by-item probes of a standardized assessment.

Objectives: This work examined diagnostic differences in a novel measure of accuracy on a social communication task, and associations between task performance and executive function, social communication, and verbal IQ skills. We hypothesized that adolescents with ASD would underperform in a social problem-solving task, and that their difficulties would reflect individual differences in executive function (especially planning, working memory and inhibition).

Methods: A total of 29 adolescents (15 TD, 14 ASD) completed a social communication task in which participants collaborated verbally with an undergraduate research assistant (RA; naive to study hypotheses) to navigate a series of maps (Anderson et al., 1991). Participants alternated between “Tourist” and “Guide” roles, completing six maps. “Guide” maps (Figure 1a) contained a route drawn from a starting point through a

series of landmarks to a finish point; the corresponding "Tourist" map contained similar landmarks without the route. There were three non-shared landmarks on each map. Guide and Tourist routes were converted to digital format for analysis in Photoshop (Figure 1b). Route accuracy was operationalized as the number of pixels contained within the area formed by the spatial difference between correct and drawn routes (Figure 1c). Participants also completed the Stanford Binet Vocabulary subtest; parents completed the BRIEF parent report form, as a measure of executive skills, and the Social Communication Questionnaire (SCQ) and the ADOS (ASD group only) as measures of symptomatology.

Results: Route accuracy was lower for ASD+RA pairs, F=8.61, p = .007, suggesting less efficient route-drawing. Group differences held whether the participant or RA was drawing the route, indicating that group differences were not due to fine motor control. Correlational analyses across groups revealed that route accuracy was associated with global executive functions (BRIEF GEC scores), r = .55, p = .002, and with Vocabulary scores, r = -.38, p = .04 (correlations were similar within each group). When the participant was the Guide, route accuracy for ASD+RA pairs was associated with ADOS communication domain scores, r(14)=.60, p=.02; this was not the case when the RA was the guide, p =.46.

Conclusions: When describing navigational routes to a study-naïve RA, adolescents with ASD had greater difficulty in communicating about those routes; individual differences reflected both executive skills, and also ASD symptom severity (as indexed by the ADOS). Route accuracy was apparently influenced by communication strategies. Task discourse analyses (currently underway) of **turn-taking**, **shared vocabulary**, and **clarification of misunderstandings**, can reveal specific aspects of communication that promote or inhibit more effective communication. As such, findings will assist in identifying optimal targets for intervention, to support better communication.

87 **205.087** Recognition of Event Information By Children with Autism Spectrum Disorders

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Background:

General event representations (GERs, aka *cognitive scripts* or *event schemas*) consist of the actors, props, and spatiotemporal sequences of expected actions that occur during familiar events (Slackman, Hudson, & Fivush, 1986; Hudson & Mayhew, 2009). GERs are important for predicting the progression and outcomes of future experiences and planning for social interactions.

Children with ASD typically exhibit deficits in social communication and their narratives are often disorganized, have limited causal connections, and reveal lack of understanding of the main idea. Therefore, the question arises as to whether children with ASD are able to recruit GERs for these activities. Prior research examining children with ASD has been inconsistent regarding whether they successfully use GERs similarly to neurotypical (NT) children (Trillingsgaard, 1999; Loth, 2007; Volden & Johnston, 1999).

Objectives:

This study investigated whether high-functioning (FSIQ ≥80) children with ASD, ages 6-12, can effectively recruit GERs for common, social events. The current study improved on previous methodological and procedural techniques by employing more stringent matching procedures based on chronological age and overall cognitive abilities.

Methods:

- Participants
  - The total included 19 matched pairs of NT children (6 males; 13 females) and children with ASD (18 males; 1 female). Participants were matched within one year of their ages (6.8 to 12.6 years) and on overall cognitive abilities (FSIQ scores 81-122).
- GER Recognition Task (Replicating Volden & Johnston, 1999)
  - Children were shown a sequenced set of drawings portraying 3 familiar events (restaurant, supermarket, movie theater). Twice per sequence a drawing was shown that disrupted the script. As each drawing was shown, the experimenter asked, "*Are things happening as they should?*" Responses were audiotaped and coded to determine children's correct identification of script disruptions, omission errors, commission errors, and types of commission errors.

Results:

	Correct Disruption Identification	**Commission Errors**	**Omission Errors**
Group			
Restaurant GER	**M(SD)**	**M(SD)**	**M(SD)**
ASD	1.32(.58)	1.89(1.10)	0.79(.63)
NT	1.37(.76)	1.53(1.35)	0.63(.76)
Supermarket GER			
ASD	1.37(.60)	0.89(.74)	0.63(.60)
NT	1.37(.60)	1.05(.78)	0.63(.60)
Movie Theater GER			
ASD	1.21(.71)	1.00(.82)	0.79(.71)
NT	0.95(.62)	1.32(.67)	1.05(.62)

A 2(Grp)X3(EventType) ANOVA revealed no effect of Group (F(1)=.24, p=.629) and no effect of Event Type GER on Correct Disruption Identification (F(2)=2.90,p=.060.

A 2(Grp)X3(EventType) ANOVA revealed no effect of Group (F(2)=0.04, p=.856), a main effect of Event Type GER on Commission Errors (F(2)=6.97, p=.002.

A 2(Grp)X3(EventType) ANOVA revealed no effect of group ($F(1)=0.05$, $p=.819$), no main effect of Event Type GER on Omission Errors ($F(2)=2.69$, $p=.075$. There is also an association of Group with Commission Error Type (*misunderstandings*, *confusions*, or *missing actions*). The ASD group incorrectly reported more *missing actions*($X^2[1,N=31]=5.45$, $p=.020$), but there was no difference between the groups for reports of *misunderstandings*or *confusions*.

Conclusions:

In contrast to previous results, the current study indicates that young children with high-functioning ASD are just as capable as their NT counterparts at identifying script disruptions for common, social events. Additionally, more commission errors were made regarding the restaurant scenario as the ASD sample identified more missing actions that were not explicitly depicted in the script.

88 **205.088** Relationship between Executive Function and Language Skills in Youth with Autism Spectrum Disorder

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Background: One of the most important skill sets for youth to master is executive functioning (EF). Strong EF skills are related to social competence, academic achievement, and positive life outcomes (Center on the Developing Child, 2011). Many EF processes are dependant upon language which plays an integral part in top-down processes that allow for the regulation of thoughts, feelings and behaviour (Vygotsky, 1978; Zelazo, 2015). For example, consider the critical importance of using self-talk to help calm yourself down when you're upset instead of yelling and throwing things. Among typically developing (TD) children, language consistently predicts the development of EF (Faja et al., 2016). However, only two studies have examined this relationship in ASD. Joseph et al. (2005) found no relationship between EF and language concluding that perhaps youth with ASD are not using language to support EF. However, Akbar and colleagues (2013) demonstrated that 62% of the variability in working memory ability was explained by language in their sample of youth with ASD. Therefore, more research into the relationship between EF and language in youth with ASD is necessary.

Objectives: We examined relative impact of language ability to predict variability in EF skills across a sample of youth with ASD.

Methods: Twenty-five youth with ASD, aged 6 to 16 years (M=10 yrs) completed a measure of receptive language, *Peabody Picture Vocabulary Test-Fourth Edition* (PPVT), and a measure of their expressive language skills, Expressive Language Index (ELI) from the *Clinical Evaluation of Language Fundamentals- Fifth Edition*. Set-shifting, working memory and inhibition were each assessed using subtests from the *NIH Toolbox* and *Weschler Intelligence Scale for Children-5th Edition*. Additionally, parents completed the *Behaviour Rating Inventory of Executive Function- Second Edition* as a measure of participants' EF-related behaviour.

Results: To examine how well language ability predicted EF, we created regression models of EF using our language measures as predictors. Our first model explained 61.1% of the variance in our working memory task with ELI making the only unique contribution to the variability in scores. In contrast, our second model predicted 36.2% of the variance in inhibition with PPVT-4 making the only unique contribution. Finally, while the third model explained 20.4% of the variance in our set-shifting task, neither ELI nor PPVT made unique contributions. However, language did not predict EF when the parent-reported measure of EF was used in the model.

Conclusions: Our results lend further support to the hypothesis that language ability predicts EF skills for youth with ASD. This suggests that youth with ASD are capable of using language in service of EF processes. While many students with ASD may not have strong EF skills (Demetriou et al., 2017), these findings suggest that they seem to use language in EF process in the same way that TD kids do. More importantly, this work may suggest that parents, clinicians and educators may need to focus on strengthening the language-based strategies used during EF processes to support the development of these skills.

89 **205.089** Second-Order Joint Attention: Children with Autism Spectrum Disorder Showed Abnormal Eye Movements in Response to Others' Gaze Following

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Background: Considerable empirical evidence shows that children with Autism Spectrum Disorder (ASD) have an intact ability to follow others' gaze direction, which seems to contradict clinical observations that children with ASD have difficulty with joint attention. In real-life, joint attention has an interactive and reciprocal nature and may involve a multi-order process—we don't merely respond passively to others' gazes, but also interpret others' responses to the our own gaze direction and modify our attention accordingly.

Objectives: We propose a multiple-layer concept of joint attention that defines first-order joint attention as attentional responses to others' gazes and second-order joint attention as gaze responses to others' first-order joint attention. In the present study, we focused on the second-order joint attention in children with ASD compared with typically developing (TD) children. Specifically, we aimed to explore how children with and without ASD respond to others' gaze-following when they have initiated joint attention, such as gaze duration on the object followed or not followed by others.

Methods: Twenty-four children with ASD and 24 age- and IQ-matched TD children completed a computer-based gaze-contingent eye-tracking task. In the task, children had to choose one of two objects to look at (first-looked-at object, FLO) and a computerized face would follow children's gazes towards the FLO (congruent condition), unfollows the gazes towards the other object (incongruent condition), or close the eyes (closed-eyes condition). Novel data-driven temporal-course analyses were used to explore how children with ASD and TD children allocated their visual attention according to others' gaze responses. Furthermore, novel data-driven correlation analysis was used to explore whether looking at eyes would influence subsequent looking time on objects the computerized face gazed at.

Results: TD children, but not children with ASD, were sensitive to others' gaze responses, as evidenced by their higher proportional FLO-looking time in the congruent condition than in the incongruent and closed-eyes conditions, and also higher proportional NFLO-looking time in the incongruent condition than in the congruent and closed-eyes conditions. Such sensitivity occurred around 1700 ms after the computerized face shifted its gaze (Figure 1A & 1B). Also, children with ASD looked at eyes less than TD children during 875-1700 ms after the computerized face shifted its gaze (Figure 1C). Furthermore, we found that TD children, but not children with ASD, who looked more at eyes during around 100-1300

ms tended to look more at the object the computerized face gazed towards during around 1500-4000 ms in the incongruent condition (Figure 2).

Conclusions: Our study bridges a significant gap in the literature by examining the second-order joint attention in both children with and without ASD. We found that TD children, but not children with ASD, showed sensitivity to others' gaze responses to their own gaze. The absence of the sensitivity in children with ASD was possibly due to their reduced eye-looking time caused by their diminished social motivation relative to TD children. Our study provides insights into our understanding of abnormal social cognition in the context of ecologically valid social interactions in children with ASD.

90 **205.090** Short-Term Memory Integration in Adults with Autism Spectrum Disorder

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Background: Adults with Autism Spectrum Disorder (ASD) show difficulties in long-term memory, which are assumed to result from altered relational binding (Bowler et al., 2011). Relational binding is the process that forms a coherent episodic representation out of the elements of an experience. Recently, two studies suggested additional difficulties in short-term memory in ASD, when autistic adults were asked to remember the temporal order of the presentation of digits and words (Poirier et al., 2011) or dot locations in a grid (Bowler et al., 2016). However, so far it is not clear how well ASD participants can form associations between letters and grid locations using colour coding. Moreover, patterns of strength and difficulties in short-term and long-term memory in ASD would help elucidate the different brain regions affected in ASD.
Objectives: This task aimed to test 3-way (object, colour, location) short-term memory binding in ASD. Because of their known difficulties with long-term memory binding, it was predicted that ASD adults would show difficulties with short-term memory binding compared to matched TD adults. In addition, it was of interest to investigate the types of errors made by participants.

Methods: Fifty-three ASD and 52 typically developing (TD) participants matched on gender, chronological age (CA; M_{CA} = 43.03), and intelligence quotient (IQ; M_{FIQ} = 111) were tested on a task asking them to memorise the positions of letters in the cells of a grid. The letters were presented in different colours in the centre of the grid and participants were asked to imagine the letter in the grid cell with the cross of the same colour as the letter. For a subgroup of 33 TD and 34 ASD individuals, still well-matched in terms of gender, chronological age (CA; M_{CA} = 43.14), and intelligence quotient (IQ; M_{FIQ} = 113), we investigated which types of errors they made.

Results: ASD individuals showed significantly lower accuracy rates (M = 0.79, SD = 0.16) compared to TD individuals (M = 0.86, SD = 0.14) in forming the letter-location associations via colour coding ($t(103) = 2.55$, $p < .05$, Cohen's d = 0.50). Groups did not differ significantly in terms of the types of errors they made.

Conclusions: This study suggests that 3-way relational binding difficulties also occur in short-term memory in addition to long-term memory in ASD. A direct comparison of short-term memory and long-term memory in ASD is a task for future research. However, the current study suggests that next to the frontal lobes and the medial temporal lobes, specifically the hippocampus, parietal brain regions might also be involved in atypical memory functioning in ASD, given their role in visual short-term memory (Sheremata et al, 2018).

91 **205.091** Similarities and Differences in Cognitive Control to Motivating Cues in Autism and (co-morbid) ADHD

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Background: Previous work has shown that children with autism show a bias in cognitive control to their interests. However, one of the most frequent comorbidities in autism is ADHD, which is associated with attention problems and impulsivity. It is unknown how the presence of ADHD symptoms influences the bias towards specific motivating cues in autism.
Objectives: We investigated similarities and differences in interference of social and non-social cues with cognitive control in children with ADHD and/or ASD, compared to typically developing children. We expected 1) reduced cognitive control towards interests in ASD, irrespective of ADHD comorbidity, and 2) reduced overall cognitive control, specifically to social stimuli, in ADHD.

Methods: 127 children, aged 6-11 years, who had ASD (with/without comorbid ADHD), ADHD, or were typically developing (TD), performed a go-nogo paradigm with social and non-social cues. For the social conditions, participants were presented with happy and calm faces. For the interest conditions, participants chose their favorite (interest) and least favorite hobby/activity (non-interest) from 23 options. There were 5 different runs of go-nogo pairs (blue vs. yellow rectangles, happy vs. calm, calm vs. happy, interests vs. non-interests, non-interests vs. interests). Participants were instructed to press to the target cue (go) when it appeared on screen and not press to the distractor cue (nogo). Using Linear Mixed-Effects models group differences in hit rate, false alarms and the sensitivity index d-prime were tested.

Results: In the non-social condition, there was an interaction effect betweentask condition and diagnostic status on d' ($F_{(4,192)} = 2.9$, $p = .024$). Children with ASD showed reduced cognitive control towards their interests as compared to their own non-interests ($p = .044$) or colored shapes ($p = .003$)(Figure 1A). The presence of comorbid ADHD did not change this pattern in children with autism. Further, typically developing children showed increased cognitive control to colored shapes, compared to interests ($p < .001$) or non-interests ($p < .001$), whereas children with ADHD did not show any differentiation between stimuli (all p's > .05). In the social condition, there was a main effect for task condition ($F_{(2,171)} = 66.0$, $p < .001$)(Figure 1B), where all children performed better to colored shapes, as compared to happy or calm facial expressions (both p's < .001). Latent profile analyses grouped participants in three independent classes, that showed differentiating patterns of performance across condition, regardless of primary diagnosis (Figure 1C&D).

Conclusions: These findings suggest the affective salience of interests interferes with cognitive control in children with ASD, regardless of the presence of comorbid ADHD. Children with ADHD do not show cue-specific sensitivity during cognitive control to non-social cues, but they do show reduced cognitive control to social stimuli, as do children with autism and typically developing children. Future work in this still growing sample will confirm how affective salience drives individual differences in cognitive control in children with ASD and/or ADHD.

92 **205.092** Social Attention and Language in Siblings of Individuals with Autism Spectrum Disorder

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Background: Previous research has demonstrated that individuals with autism spectrum disorder (ASD) exhibit atypical visual attentional patterns that might contribute to the clinical-behavioral features that define ASD (e.g., Frazier et al., 2017). Studies of parents of individuals with ASD have demonstrated subtle differences in gaze patterns (Nayar et al., 2018; English et al., 2017) and social communication (e.g., Landa et al., 1991; Landa et al., 1992; Losh et al., 2008). Differences in attentional strategies evident through eye-tracking methodology might represent a promising avenue for identifying ASD-related endophenotypes (i.e., heritable characteristics that map more closely to underlying biology than the full clinical phenotype). The present study investigated gaze atypicalities as a candidate endophenotype in both individuals with ASD and siblings of individuals with ASD, examining the intersection of visual attention and social communication across two narrative tasks.
Objectives: To examine visual attentional patterns during narration as a potential contributor to social-communication differences in individuals with ASD and their siblings.

Methods: Sixty-three individuals with ASD, 54 siblings of individuals with ASD, and 52 controls completed two narrative tasks presented on an eye tracker: a structured 24-page wordless picture book (PB) task (Mayer, 1969), and an unstructured, more emotionally evocative narrative task using six images from the Thematic Apperception Test (TAT; Murray, 1943). Proportions of fixations to animate and inanimate information were calculated. Emotion, cognitive, and social words during narration were measured using Linguistic Inquiry Word Count (LIWC; Pennebaker et al., 2001) software. Global pragmatic abilities were assessed during a semi-structured conversation using the Pragmatic Rating Scale (PRS; Landa, 1992) or Pragmatic Rating Scale-School Age (Landa, 2011). Analyses controlled for IQ.

Results: Siblings of individuals with ASD allocated more attention to animate stimuli (ps<.05) than individuals with ASD and controls. Siblings also used fewer emotion words than controls. In siblings, greater attention to animate information was associated with less frequent use of emotion and cognitive words (p<.05, r = -.32; p<.05, r = -.28) and more global pragmatic language violations (p<.05, r = .28), while in individuals with ASD, greater attention to animate information was associated with more frequent use of social words (p<.01, r = .41). Analyses of the less structured TAT task are underway, and will be reported in the full presentation.

Conclusions: Results revealed subtle visual attentional differences during narration among siblings, which related to broader narrative and pragmatic differences. Increased gaze to animate information related to poorer narrative and pragmatic skills in siblings, suggesting that siblings may not adequately capitalize on social information to support narrative production. These attentional differences may reflect genetic liability measurable in clinically affected and unaffected individuals. Ongoing work assessing gaze patterns and narration during a less structured task may provide additional insights into the full range of visual attentional differences across contexts and their relationship to social communicative differences in siblings.

93 **205.093** Strengths and Weaknesses of Memory in Autism Revealed By a Meta-Analysis

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Background:
The literature on memory in Autism Spectrum Disorder (ASD) shows an inconsistent pattern of results.

Objectives:

To address this variability, we report the first ever meta-analysis of short-term (STM) and long-term (LTM) memory in ASD, evaluating the role of the type of material (verbal, visual, visuospatial, neutral faces), type of memory retrieval (free recall, cued recall and recognition), and the organization of items (serial, associative, semantically related).

Methods:

We included 61 studies, comparing individuals with typical development (TD) and ASD or Asperger syndrome, confirmed by ADI and/or ADOS method for diagnosis, and/or DSM-4, DSM-5, or ICD-10 diagnostic criteria, corresponding to a total of 2788 participants (1373 with and 1415 without ASD). We computed effect sizes (Cohen's d) using RevMan 5.3, and linear regressions using SAS 9.4.

Results:

Results revealed an overall memory decrement in ASD with a small to medium overall effect size (d= -0.42 [-0.52; -0.31], p<.001), with greater difficulties in STM (d= -0.50, [95%CI -0.65;-0.34], p<0.00001, I^2=51%), compared to LTM (d= -0.36, [95%CI -0.49;-0.22], p<0.0001, I^2=38%). Analyses on the type of material identified a relative preservation of verbal LTM (d= -0.15, p=0.09), contrasting with impaired LTM for visual material (d= -0.38, p=0.006) and neutral faces (d= -0.79, p<0.00001) in ASD compared to TD individuals, but any subgroup difference for STM. We found a general free recall impairment compared to cued recall and recognition (LTM, free recall: d= -0.31, p=0.0006, cued recall: d= -0.08, p=0.58, recognition: d= -0.15, p=0.08; STM, free recall: d= -0.56, p<0.00001, recognition: d= -0.33, p=0.07) in ASD compared to TD individuals. We identified diminished serial (d= -0.58, p<.00001) and non-serial STM performance, and associative (d= -0.38, p=0.0005) and non-associative LTM. Regression analyses revealed that memory impairment increased with the ADOS symptoms severity (β= -0.17, p=.014).

Conclusions:

Overall memory difficulties in ASD suggest the involvement of common processes such as executive dysfunction associated with atypical connectivity. Based on neurobiological data in ASD, we suggest that alterations in low and high frequency oscillations may alter the maintenance and rehearsal processes associated with STM storage that may also impact LTM functioning. Dissociation in LTM suggest that intact verbal LTM, mainly conceptually-driven, may rely more on the global preservation of semantic knowledge in ASD, while difficulties in visual LTM may be due to abnormally elevated left-over-right connectivity ratio in ASD supporting a more local processing of visual items. Finally, the general free recall

impairment may emerge from difficulties in adequately searching retrieval cues, associated with executive and electrophysiological specificities, limiting the memory search process. This hypothesis may also account for intact cued recall and recognition, in accordance with the Task Support Hypothesis, and argues in favor of using memory support.

Finally, we suggest that atypical oscillatory activity arising from neurophysiological abnormalities in ASD rather than a specific alteration of a brain region or a memory system may explain this pattern of results. Preserved verbal LTM and supported retrieval constitute important findings for therapists and caregivers of individuals with ASD, providing opportunities for memory rehabilitation.

94 **205.094** Structural Learning in Children with Autism Spectrum Disorder and Reduced Language

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Background: Characteristic memory impairments in Autism Spectrum Disorder (ASD) include free recall of semantically related items (Tager-Flusberg, 1991; Bowler et al., 1997) and recognition of combinations of features (Bowler, Gaigg & Gardiner, 2014). These findings suggest a difficulty with relational binding, which is defined as the ability to process the relations among items and events, and which is mediated by the hippocampus and fronto-hippocampal processes (Opitz, 2010).

Objectives: Previous research has focussed on verbally-able participants with ASD, using verbalisable stimuli (e.g. lists of words or nameable pictures). The current study aimed to measure relational binding using a non-verbal paradigm, to investigate whether the relational memory profile of less verbally-able individuals with ASD is comparable to those with ASD without language impairments. A test of configural learning was adapted, in which hippocampally-lesioned rats showed impairments only when awareness of the structural aspects of the stimuli (e.g. left-right arrangement) was necessary for success (Sanderson et al., 2006). The prediction was that individuals with ASD would display similar patterns of performance as was observed in rats with hippocampal lesions.

Methods: Twenty-five children with ASD and reduced language (AD group) and twenty-six typically-developing children (TD group) were matched on non-verbal ability. One of two configural learning tasks was presented: a biconditional task, in which success was dependent upon awareness of the elements of each stimulus, or a structural task, in which success was dependent upon, in addition, awareness of the spatial arrangement of each stimulus' components. Pairs of stimuli were presented on a touchscreen laptop and participants learnt through onscreen reinforcement which were the correct choices. After the training phase, a test block was presented; this included novel trials consisting of re-paired training stimuli.

Results: Performance during training for both tasks was > 70% for all participants, indicating successful learning of the stimuli. During the test phase of the biconditional task, the TD group performed significantly more accurately overall ($F(1, 23) = 9.02$, $p = .01$, $\eta_p^2 = .28$), although both groups performed significantly above chance for all trials (all *p*s < .05). No overall group difference was found during the test phase of the structural task, and the TD group performed significantly above chance for all trials (*p*s < .05). However, the AD group performed significantly above chance only for the familiar trials ($p = .01$), performing at chance for the novel trials ($p = .08$).

Conclusions: These findings indicate that individuals with ASD and reduced language ability can effectively complete a test of configural learning in which success is solely dependent upon awareness of the elements of the stimuli. They perform less well however, when awareness of the spatial arrangement of the stimuli is also required. These findings align both with earlier work on verbally-able adults with ASD (Ring et al., 2017) and previous research from non-human animals with hippocampal lesions. This therefore strengthens the view that the relational memory difficulties seen in ASD are likely to occur as a result of compromised hippocampal function.

95 **205.095** Successful Imitation of Atypical Biological Kinematics Following Observational Practice in Autism Spectrum Disorders.

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Background: Although sensorimotor processes subserving automatic imitation are operational in autism spectrum disorders (henceforth autism) (Sowden et al., 2016), similar underlying processes function less effectively in a voluntary context where the goal is to observe and imitate biological kinematics performed by a human model (De Myer et al., 1972). This difficulty is suggested to be related to sensorimotor processing activity during direct perception-action matching of biological motion (Stewart et al., 2013). To this end, we used an observational practice (OP) protocol as it enabled the active contribution of the peripheral sensorimotor system during motor execution to be systematically controlled (limited) in an imitation context. Therefore, by controlling this contribution, and based on the automatic imitation work, we expect to show functional movement reproduction of biological kinematics in autism.

Objectives: (1) to examine the direct perception-action matching processes responsible for encoding biological motion during observational practice in autism.

Methods: Twenty autistic (mean age: 25(7); 2 female) and twenty matched non-autistic (mean age: 25(7); 2 female) adults volunteered for the study that was approved by the local ethics committee. Participants completed a 10-trial pre-test where they observed and physically imitated a point-light model displaying typical biological motion with a movement duration of 1700ms. During an observational practice phase, participants performed 30 trials where they only observed a point-light model displaying atypical biological motion with a duration of 1700ms. In a 10-trial post-test, participants were instructed to recall and execute the observed atypical stimulus on each trial. Eye movements were recorded during action-observation. Data for *constant error* (*CE*), *variable error* (*VE*), and *percentage-time-to-peak-hand-velocity* (*tPHV*) were analysed in separate 2 group (autism; control) x 2 phase (pre-test; post-test) mixed design ANOVAs. *Percentage-time-to-peak-smooth-eye-velocity* (*tPSEV*) data was submitted to a 2 group (*autism; control*) x 3 phase (pre-test, early-OP, late-OP) mixed design ANOVA.

Results: Both groups were more accurate at reproducing the observed movement duration following OP (*CE*: $p < 0.05$). However, the movements performed by the autism group were more variable (*VE*: $p < 0.05$). Importantly, both groups represented the observed atypical biological kinematics with *tPHV* ($p < 0.05$) reducing from pre-test (Autism: 41% ± 9; Control: 43% ± 8) to post-test (Autism: 31% ± 7; Control: 30% ± 13). Eye

movement behaviour was similar for both groups ($p > 0.05$).

Conclusions: Although autistic participants performed more variable movements, they imitated the temporal duration of the observed model to a similar level of accuracy as matched-controls. Whilst previous research (Hayes et al., 2016) reported that autistic individuals show attenuated imitation of biological kinematics, the present findings indicated that autistic volunteers observed, encoded and successfully imitated a model displaying atypical biological kinematics following OP. Importantly, this shows that the lower-level perception-action processes responsible for encoding biological kinematics during the action-observation phase of imitation are operational. As the task-specific engagement of the peripheral sensorimotor system was controlled during OP, the aforementioned imitation difficulties in autism are likely to be underpinned by processes engaged to integrate efferent and (re)afferent sensorimotor information during trial-to-trial motor execution.

96 **205.096** The Fractal Structure of Gaze Patterns for Young Children, and Its Relationship to Visual Social Engagement.

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Background: Visual exploration is one of the earliest ways infants learn about the social world. Guided by both bottom-up stimulus properties and top-down motivations, infants' visual attention is thought to be self-organizing and increasingly complex over time. Given the large body of evidence indicating atypical visual social engagement in infants later diagnosed with autism, understanding this self-organization of the attentional system is critical for understanding the early etiology of autism.

We propose that clarifying the *fractal* properties of children's gaze patterns will provide meaningful insights into the emergence of these complex systems. Specifically, complex, non-linear processes often carry organizational structures known as *fractals*—repeated, self-similar patterns across a variety of scales (Mandelbrot, 1977). This mathematical approach has been used to characterize the temporal and spatial structure of adults' gaze behavior (Stephen & Anastas, 2010).

Previously our lab has shown that infants' visual engagement exhibits a fractal structure indicating optimal flexibility when viewing social scenes, and that their gaze becomes more self-organized over developmental time. To follow-up, we investigated whether fractal complexity changes as a function of what infants spontaneously visually engage with onscreen.

Objectives: To investigate how 5- to 36-month-old infants' attention to faces predicts the fractal complexity of their eye-gaze. We hypothesized an Age x Face-looking interaction: for younger infants, attention to the face will be associated with higher fractal complexity. As infants gain competency in visual social engagement, face-looking will be less predictive of fractal complexity.

Methods: Eye-tracking data were collected as participants watched four 20-second movies. Each movie included 3 females performing child-friendly actions, and was divided into 3-4 movement-based segments. Time-series, comprised of amplitude changes between consecutive gaze coordinates, were used for analyses (**Fig. 1a**).

We calculated the fractal complexity of each movie segment for each child (N=137 sessions, 1,076 segments), using detrended fluctuation analysis (DFA; Ihlen et al., 2015). DFA produces a parameter called the Hurst exponent (H), an index of the overall fractal structure of the time-series, on a continuum from *white noise* (more random; ~0.5); to *pink noise* (optimal flexibility; ~0.7-1.0); to *brown noise* (more rigid; ~1.5).

Results: H values for children's gaze behavior were normally distributed (M=0.85, SD=0.10; **Fig.1b**). Preliminary results suggest that in segments during which infants looked at a face, H increased by .05 (p=.004) **(Fig. 2)**. H also increased linearly with age by .002 per month (p=.06), but remained within the pink noise range for all ages. There was a trending Age x Face-looking interaction (p=.09).

Conclusions: Results suggest that, similar to findings in adults, infant gaze patterns exhibit a fractal micro-structure. Moreover, this fractal structure is partially determined by what infants spontaneously fixate on; infants' gaze patterns have higher H values – indicating optimal flexibility – when they look at faces compared to non-social information. This suggests that H values may be used as an index of subjective salience, and could be a critical tool for assessing the subjective value of social information for infants at-risk for ASD. Future work will include longitudinal data to probe within-person changes.

97 **205.097** The Importance of Executive Function for the Social Competence of Boys with ASD

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Background: While many studies have argued that cognitive processes are associated with social functioning deficits in ASD, little research has explicitly examined the associations between executive functioning and social competence. There has been even less comparative research exploring the differences in these associations between neurotypical children and children with ASD.

Objectives: The purpose of this study was two-fold. First, we sought to explore the similarities and differences in performance on standardized executive function (EF) measures between school-aged boys with high functioning autism and a control group of neurotypical boys. Second, we explored the relationship between EF and parent ratings of child social competence.

Methods: A sample of 97 boys, aged 8-13 years and their parent(s) participated in this study. The clinical group consisted of 49 boys with ASD recruited from three provincially-based Autism support programs and a social media forum for parents of children with ASD. Parents provided diagnostic reports or their consent to access health records to confirm diagnoses. The control group consisted of 48 boys without mental health diagnoses or learning disabilities recruited from the local community. Children were administered a measure of intellectual functioning to estimate IQ and 5 standardized EF measures. Parents completed 2 standardized measures assessing their perceptions of their child's social competence.

Results: The control group's performance was statistically better than the ASD group on the IQ estimate, auditory attention, visual working memory, auditory inhibition reaction time and auditory inhibition errors. Unsurprisingly, children in the control group were rated by their parents as significantly more socially competent than children in the ASD group. To examine predictors of parent-rated social competence, first, a single social competence composite was derived by combining the 2 social competence scales. Second, to ensure EF measures were assessed using the

same metric, z-scores were calculated. Hierarchical regression analyses were conducted for the ASD and control group separately. Age and estimated IQ were entered on the first block and the 5 performance based EF scores were entered on the second block. For the control group, the regression was not statistically significant, accounting for only 11% of the variance. In contrast, the regression equation for the ASD group was statistically significant and accounted for 61% of the variance in social competence ratings. Significant predictors of better social competence were younger age, higher auditory attention, higher visual working memory, higher visual inhibition and lower auditory inhibition speed.

Conclusions: Boys with ASD demonstrated significantly poorer executive and social functioning than their similar aged neurotypical peers. For typically developing children, executive function abilities do not predict parent ratings of social competence. However, for boys with ASD, these same EF abilities had a substantial influence on parent perceptions of social competence. Our findings highlight how cognitive differences may underpin observed social impairments in those with high functioning ASD and have potentially broad implications for the conceptualization and implementation of interventions.

98 **205.098** The Mediating Role of Executive Functioning in Problems Behaviors in Autism Spectrum Disorder

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Background: Increased problem behaviors (such as lethargy and irritability) are commonly observed comorbidities in children with Autism Spectrum Disorder (ASD; Emerson, 1995). In the typically developing population, executive functioning (EF) deficits have been linked to problem behaviors (Hughes & Enor, 2008). It has been proposed that individuals with ASD have a different cognitive profile (Kenworthy et al., 2008). Additionally, prototypical EF deficits in ASD have been linked to alternate brain topographies (Voelbel et al., 2006), suggesting that individuals with ASD may demonstrate unique EF deficits which in turn may lead to increased problem behaviors. However, no studies have investigated the direct relationship between EF deficits, as assessed through validated, researcher administered measures, and problem behaviors.
Objectives: This study examines the relationship between EF, as measured by the NIH-Toolbox Cognition Battery (NIH-TCB), and problem behaviors, as measured by the Aberrant Behavior Checklist (ABC).

Methods: Children with ASD, ages 3-17, years and typically developing (TD) children matched on age are currently being recruited. Data from 143 children and adolescents with ASD (mean age = 9 years; SD= 4 years) and 92 TD controls (mean age = 8 years 5 months; SD = 3 years) is included in this preliminary analysis. TD children demonstrated a significantly higher intelligent quotient (IQ) as indexed via the Stanford-Binet Intelligence Test, Fifth Edition (SB-5; TD mean IQ = 111.6; ASD mean IQ = 91.93; p=.01); therefore, the analysis controlled for IQ. Parents completed the ABC. Four separate path analyses were conducted to test the following hypothesized mediation model: Diagnostic status -> mediator variable (cognitive inhibition and flexibility) -> outcome variable (lethargy or irritability). Both direct and indirect models were tested.

Results: For lethargy, the hypothesized model mediated by cognitive inhibition and direct paths were tested for differences. Both the indirect model (mediated by cognitive inhibition) and the direct model were significant (indirect: Beta= -0.53, p=0.06; direct: Beta= 7.66, p<0.01). However, the hypothesized model mediated by cognitive flexibility was non-significant (indirect: Beta= -0.05, p=0.18). In the case of irritability, the hypothesized model mediated by either cognitive flexibility or inhibition presented non-significant results (p=.40, p=.10, respectively).

Conclusions: These preliminary findings replicate previously observed pathways between cognitive inhibition and problem behaviors (lethargy) in children, while extending these findings to children with ASD using performance-based measures. These findings suggest that interventions targeting EF deficits in cognitive inhibition may also mediate lethargic problem behaviors. However, other problem behaviors such as irritability may not be mediated by EF in the ASD population.

99 **205.099** Underlying Factor Structure of the Brief-2 in a Clinical Sample of Children and Adolescents with ASD

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Background: Children and adolescents with autism spectrum disorder (ASD) often struggle with executive functioning (EF) skills, which can lead to social mistakes and challenges with making decisions, as well as problems with initiating, following, and organizing plans. Given that EF deficits have a significant impact on adaptive functioning of youth with ASD, the measurement of EF skills has become an important component of their neuropsychological assessments. The *Behaviour Rating Inventory of Executive Function* (BRIEF-2) is a standardized questionnaire that assesses the extent to which a child regulates and guides their behaviours in everyday environments (Gioia et al., 2015). The BRIEF-2 contains nine scales that form three indexes (Behavioural Regulation Index, Emotional Regulation Index, and Cognitive Regulation Index) and one composite score (Global Executive Composite). This is different than the previous version of the questionnaire, which contained eight scales across two scales: Behavioural Regulation Index and Metacognition Index. Despite the adoption of the second edition of the BRIEF within current ASD literature and in clinical settings, there has been no published research to date addressing the psychometric properties of the BRIEF-2 for youth with ASD.
Objectives: We investigated the underlying factor structure of the BRIEF-2 in a clinical sample of youth with ASD.

Methods: The BRIEF-2 parent form was completed by parents of 58 youth with ASD (52 males), ages 5 years to 16 years of age (M=9.64 years, SD=3.47). All participants had a community diagnosis of ASD, which was confirmed by parent report of ASD symptomatology on the *Social Responsiveness Scale-2*.

Results: BRIEF-2 scale scores (T-scores) were subjected to principal axis analysis (Direct Oblimin Rotation with Kaiser normalization). The rotated solution found two factors, based on eigenvalues greater than 1 rule and examination of the scree plot (Figure 1), which explained 49.39% of the variance with factor 1 contributing 39.54% and factor 2 contributing 9.86% (see Table 1). Factor 1 primarily contained variables related to cognitive regulation, whereas factor 2 included variables related to emotional and behavioural regulation. As well, self-monitoring (which should load onto behavioural regulation according to BRIEF-2) loaded on both factor 1 and 2.

Conclusions: Despite the fact that the BRIEF-2 manual reports a 3-factor structure for this measure in non-ASD youth, our results revealed a 2-factor structure instead. As such, evidence to support the validity of the three-factor structure of these constructs in youth with ASD was not found. Specifically, the results from our sample did not support distinct emotion regulation and behavioural regulation indices. In other words, our data did not support the underlying theoretical model as described in the BRIEF-2 manual. Therefore, conclusions about cognitive regulation, emotional regulation and behavioural regulation should be made cautiously and differential comparisons of these skills may not be warranted.

100 **205.100** Physiological Responses to Circumscribed Interests, Non-Social and Social Stimuli in Adults with Autism and Neurotypical Controls

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Background:
Autism has been characterized as reduced social motivation and an enhanced drive towards non-social processing, which includes repetitive behaviours and circumscribed interests. These behaviours may be related to the employment of different mechanisms for processing and orienting towards non-social stimuli (e.g. a car) and social stimuli (e.g. a face). Previous research with a neurotypical (NT) sample has found that a higher number of subclinical autistic-like traits was related to more pronounced physiological responses to non-social stimuli, but not social stimuli or stimuli related to individual circumscribed interests. The greater emotional arousal to items of circumscribed interest were interpreted as reflecting greater salience for these items in people from the general population with higher autism traits, but no study has reported about this in adults diagnosed with autism and matched controls.

Objectives:

To investigate physiological responses to social and non-social stimuli, including stimuli related to participants' individual circumscribed interests in an autism group and neurotypical controls.

Methods:

17 participants with an autism diagnosis (10 male, 7 female) and 16 NT controls (10 male, 6 female) were recruited and were matched by age, sex and education level. Participants viewed 24 images that included 6 social images of human faces and 6 of cartoon faces, and 6 non-social images of various objects (e.g. a train or car) and 6 non-social images relating to each participant's particular interest or hobby. Skin conductance responses (SCR) were recorded as the images were passively viewed. A mean SCR magnitude was calculated for each condition and group differences were explored.

Results:

A Mann-Whitney U test revealed that SCR to the social-faces (U=117, z=1.691, p=.51) social-cartoon (U=104, z=-1.19, p=.26) and non-social (U=117, z=.689, p=.51) conditions were not statistically different between the two groups. However, there were significant differences between autism (Mdn=48.42) and NT (Mdn=47.20) groups in SCR to the non-social of interest condition (U=80, z=-2.023, p=0.043), with the ASD group exhibiting larger responses to images of their individual circumscribed interests than the NT group.

Conclusions:

The findings show a heightened emotional arousal response to items of special interests in adults with autism compared to adult controls, similar to the effects found with nonclinical adults with higher autism traits. However, no group differences were found in emotional arousal response to social stimuli in the adults with autism. These results suggest that items of circumscribed interest have enhanced salience for adults with autism compared to controls, but that social items aren't associated with reduced salience. The findings have implications for social motivation theories of autism.

101 **205.101** 'Intuitive Systemizing' in Autism: Self-Reported Systemizing Drive Is Related to Ability to Solve Logical Problems but Not to Conscious Understanding of Logical Reasoning

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Background:
Autism Spectrum Disorder (ASD) has been characterised as a drive towards systemizing—understanding and predicting non-social rule-based systems—and away from empathizing—a drive towards social-emotional processing. The Dual Process Theory of Autism proposes that systemizing bias could be explained as a general drive towards deliberative processing, which is characterised as slow, effortful, and conscious, while empathizing is explained by a general bias towards intuitive processing, which is fast, autonomous, effortless and non-conscious. Previous research, however, has found neurological and physiological responses to non-social stimuli in autism that resemble responses to the social in the neurotypical population, indicating there may be an affective component to non-social processing in autism. Enhanced systemizing in autism and enhanced empathizing in the general population may therefore be explained by a bias towards 'intuitive' processing for the non-social and social domains, respectively, with an inherent intuitive bias towards one domain or the other conferring an advantage in understanding and predicting that domain.

Objectives: To investigate self-reported systemizing drive, logical reasoning ability, and reasoning processes in an autistic group and neurotypical (NT) controls.

Methods: 30 participants with autism (24 male, 6 female, ages 18-54, mean 22, SD 3) and 34 neurotypical participants (21 male, 13 female, ages 18-66, mean 22, SD 8.5) completed the Systemizing Quotient-short (SQ) to measure self-reported drive to systemize and the Test of Logical Thinking (TOLT), which includes two scores, one for the correct solution to a logical problem (TOLT Solution score) and one for understanding the correct reasoning process to arrive at the correct solution (TOLT Reasoning score).

Results: Across both groups, SQ was positively correlated with TOLT solution score (r=.386, p=.002) but not with TOLT reasoning score (r=.115, p=.364). The autism group (M=9.97, SD=3.62) performed significantly better than the NT group (M=7.76, SD=2.99) on the TOLT Solution score (t(62)=2.664, p=.01) but there were no significant group differences in TOLT reasoning score (t(62)=.440, p=.661). The mean difference between TOLT Solution and TOLT Reasoning scores for the autism group were almost twice that of the NT group (ASD mean=4.13, SD=4; NT mean=2.21, SD=2; t(62)=2.496, p=.015). The mean difference between TOLT scores was significantly positively correlated with SQ across the whole autism/NT sample (r=.327, p=.008).

Conclusions:

Self-reported systemizing drive is related to ability to solve logical problems. Those with autism performed significantly better than NT controls on the TOLT in terms of getting the answer correct. However, there was no difference in their ability to justify their answers with the correct

reasoning and the autism group were significantly more likely to get the correct answer along with the incorrect reasoning. This is consistent with the proposal that a drive to systemize in autism may confer logical reasoning ability, but not necessarily the ability to consciously understand the logical reasoning that leads to the correct answer. The non-conscious and apparently less effortful logical reasoning in autism is characteristic of intuitive processing within the non-autistic population, raising the possibility that autism can be characterised by 'intuitive systemising' within the Dual Process Theory of Autism.

Poster Session
206 - Communication and Language
5:30 PM - 7:00 PM - Room: 710

102 **206.102** Measuring Early Communication in Classroom Contexts

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Background:
There are few standardized tools or strategies designed specifically to measure communication in students with autism who have minimal verbal skills in natural contexts (Kasari et al., 2013; Tager-Flusberg & Kasari, 2013), Standardized or norm referenced assessments often yield scores that are at the floor of norm-referenced assessments. New measures, like the Communication Complexity Scale (CCS; Brady et al., 2012; 2018), may help fill the void of appropriate assessments for this population. The CCS is a 12-point scale that measures pre-linguistic and early-linguistic communication in individuals with autism or intellectual and developmental disabilities who have minimal verbal skills. The CCS can be used to describe students' communication during a standardized play-based assessment and during naturalistic-classroom contexts. This poster presents CCS data from observations in naturally occurring interactions in classroom environments.

Objectives:

1. Present student's CCS scores obtained during classroom observations and standardized play-based assessments.
2. Present CCS reliability results from classroom observations.

Methods:

Participants

- Six students with a diagnosis of autism spectrum disorder and expressive vocabularies of 30 or fewer words, signs, or symbols, between the ages of 5-16 years participated.

Procedure

- A 20-30-minute scripted play-based assessment was administered to each participant. The standardized play-based assessment consists of 12 activities. Research assistants viewed videos of the assessment and assigned a score to the highest communication act produced in each activity. Intentional communication acts were also assigned a function of behavior regulation (BR) or joint attention (JA)
- Each participant was observed during four-to-six, 10-minute naturally occurring classroom contexts, using Noldus Pocket Observer and a time-sampling procedure. During the 12-minute observations, research assistants observed participants for 30-seconds and then had 15-seconds to code the highest communication act that occurred during the 30-second observation period. Function was also recorded for the highest communication act. In addition to BR and JA, we coded Response to Questions or Prompts. We also recorded if particpants' were communicating with teachers or peers.
- Inter-rater reliability during naturalistic classroom observations was computed by comparing scores and functions within each interval, and the average of the highest scores across intervals.
- The following summary scores were derived:

1) Optimal CCS score = average of 3 highest observed communication acts (regardless of function)

2) Typical CCS score = the average of scores from the middle of the distribution

2) Highest BR = the highest communication observed with a BR function

3) Highest JA = the highest communication observed with a JA function

Results:

- Reliability: The range of percent agreement between observers was 56.25 – 100% and the average was 77.08. The Optimal CCS scores from the two observers were all within a point of each other.
- Participants' communication scores varied by context. Most participants' scores were highest in 1:1 interactions and the scripted communication samples.
- For 5/6 participants, almost all communication was directed to adults as opposed to peers.
- Communication to adults was more complex than communication to peers

Conclusions:

- Reliable coding was more difficult during academic instruction.
- Information from the CCS can help identify communication goals and monitor progress.

103 **206.103** Naturalistic Question-Asking in Children with ASD: A Childes Corpus Study

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Background:

Prior research has found that children with ASD often produce fewer questions than their typically developing (TD) peers. Additionally, children with ASD may rely on questions that are restricted in their form and function. A failure to produce questions, especially information seeking queries, may limit potential learning opportunities and may have an impact on multiple developmental domains.

Objectives:

The purpose of this study was to describe the naturalistic questions produced by children with ASD, as compared to their language-matched, TD peers.

Methods:

The Nadig corpus in CHILDES was used, which consists of transcripts of children (ages 1;11 – 6;06) participating in ten minutes of unstructured play with their primary caregiver. To date, transcripts from 12 children (ASD n= 6, TD n=6) have been analyzed for the current project. Groups were matched on mean length of utterance (MLU) and number of word tokens and types; the ASD group was older (ASD: M=63.33 months; TD: M=36.67 months; *p*=.004). A coding scheme captured question form (yes/no vs. wh-) and function (information seeking, non-information seeking); coders were blind to child diagnosis.

Results:

Because of the small size of this pilot sample, descriptive data are provided. The full sample will include 38 children. See Figures 1 and 2.

Number of Questions:

On average, the TD group asked approximately 6.16 questions (SD = 3.57), while the ASD group asked 3 questions (SD = 4.02).

Proportion of Utterances that are Questions:

Questions made up .04 (SD = .05) of the total utterances of children with ASD, while .06 (SD = .03) were questions for the TD group.

Form of Questions:

Proportion variables were utilized to calculate the respective reliance on yes/no vs. wh-questions; .58 (SD = .42) of questions posed by children with ASD were yes/no questions; and .42 (SD = .41) were wh-questions.

In the TD group, .67 (SD = .23) of queries produced were yes/no questions and .29 (SD = .18) were wh-questions.

Function of Questions:

Proportion variables were employed to determine the usage of questions to seek information (vs. for instance, permission or clarification). Information seeking questions comprised .83 (SD =.21) of questions posed by children with ASD, while for the TD group, .67 (SD= .23) of questions were information seeking.

Conclusions:

Findings demonstrated that children with ASD produce fewer questions than their TD peers. This suggests that children with ASD may evoke fewer learning opportunities from their conversational partners. However, frequency of questions appears to be the sole question-asking deficit for children with ASD. The proportion of utterances that are questions were similar across both groups. Proportionally, children with ASD posed slightly more information seeking and wh-questions than their TD peers. These results are inconsistent with prior research, which suggests that the questions posed by children with ASD are often repetitive and non-functional, limited in their form and function (e.g., Hurtig, Ensrud & Tomblin, 1982; Tager-Flusberg, 1994). The results of this study offer further insight into the naturalistic question-asking behaviors of children with ASD, which may have implications for question-asking interventions.

104 **206.104** Nonverbal Communication and Social Imitation Skills in Children with Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is a developmental disorder characterized by communication problems and repetitive movements (American Psychiatric Association, 2013). People with ASD demonstrate stress (Miller & Seligman, 1975) and fear (Maier & Watkins, 1998) in uncontrollable social situations. In these situations, people with ASD typically withdraw themselves, allowing learned helplessness and peer rejection to intensify communication problems (Seligman, 1975). Training in nonverbal communication skills, such as joint attention, will strengthen communicative imitation. Imitation is a major component of social interaction. Building imitation skills in children with ASD will ultimately contribute to their ability to interact with other people and form relationships. By identifying which skill is most predictive of communication gains during treatment, clinicians would have adequate evidence as to which treatment may be the best fit for children with varying severities of ASD.

Objectives: The primary aim of this study was to determine whether pre-existing nonverbal communication skills provided a strong foundation for social imitation skills. Specifically, researchers examined whether better response to joint attention at baseline was associated with greater improvement on imitation assessments following ten weeks of play-based treatment focused on building social imitation skills.

Methods: Young children with ASD (N=10) participated in videotaped recordings of the Early Social Communication Scales (ESCS), as well as two imitation assessments—the Motor Imitation Scale (MIS) and both the object and gestural forms of the Unstructured Imitation Assessment (UIA). Children also received ten weeks of twice weekly Reciprocal Imitation Training, a naturalistic developmental behavior intervention focused on building social imitation skills. Responses to proximal and distal pointing were coded from videotaped ESCS assessments. Percentage of models correctly imitated were scored from the MIS and the UIA. The ESCS data was utilized to predict change in imitation using regression analysis of the MIS and UIA before and after therapy.

Results: Regression analyses indicated that child responses to proximal bids for joint attention (examiner pointing to a picture in a book) were

related to change both in MIS scores and UIA object imitation scores, after controlling for imitation score at intake. Interestingly, responses to distal bids for joint attention (examiner pointing to a poster on the wall) were not predictive of change in imitation over time. In proximal responses, the object is closer to the child's line of sight and is noticed more often by children with ASD than a gesture referencing an object in the distance.

Conclusions: The results of this study develop better understanding of the relationship between reciprocal joint attention and social imitation. Having a stronger foundation of joint attention skills, particularly responses to joint attention, was associated with more improvement in imitation during a short-term, play-based intervention. Future work should examine this relationship in a larger sample of children to better understand which children may benefit most from imitation-based therapies such as Reciprocal Imitation Training.

105 **206.105** Online Processing of Svo Word Order in Monolingual- and Bilingual-Exposed Chinese Preschool Children with Autism Spectrum Disorder

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Background: Previous studies in monolingual-exposed children with autism spectrum disorder (ASD) have witnessed their intact knowledge to comprehend Subject-Verb-Object (SVO) sentences in English or Chinese (Swensen et al., 2007; Zhou et al., 2017; cf. Su & Naigles, 2018). Moreover, Reetzke et al. (2015) and Dai et al. (2017) reported equivalent general language abilities in bilingual-exposed children with ASD via standardized scales. However, in oral format, dialects were differentiated from Mandarin for their syntactic differences (Reetzke et al., 2015). Therefore, a refined investigation needs to be conducted on the understanding of SVO word order in Chinese bilingual-exposed children with ASD.
Objectives: Using the Intermodal Preferential Looking, this study attempts to examine early knowledge of SVO word order in bilingual children with ASD exposed to Mandarin and dialect, compared with monolingual peers merely exposed to Mandarin.

Methods: 28 preschool children with ASD in Hunan province of China were recruited to be categorized into 2 groups, i.e., monolingually exposed children with ASD (ME, N=14) and bilingually exposed children with ASD (BE, N=14), well-matched on **age** (AGE=44.21±5.90 vs. 46.64±8.04 months), **autistic behavior scores** (ABC=63.79±20.22 vs. 66.14±18.65), **vocabulary production size** (PCDI=297.50±311.95 vs. 260.29±217.89 words) and **syntactic complexity scores** (MLU=2.11±2.04 vs. 2.68±2.13), all ps>.05, Coh's ds<0.35. Children listened to simple reversible SVO sentences paired with two visual scenes, only one of which matched the test stimuli, e.g., distinguishing between 'the bird pushing the horse' and 'the horse pushing the bird'.

Results: A repeated measure analysis of variance (2 groups×5 verbs×2 trials) only yielded **main effect of trial** $F(1, 10)=5.42$, $p=.04$, $\eta^2=.35$. One-tailed T-tests revealed that children with ASD in both groups exhibited their **sensitivity to SVO word order**, by looking longer at the matching screen during test trials than control trials (ME: Test: 52.98%±14.87% vs. Control: 45.83%±10.35%, $t(13)=1.93$, $p=.04$; BE: Test: 52.44%±9.84% vs. Control: 43.60%±11.86%, $t(13)=2.54$, $p=.01$). However, two groups differed in their optimal performance shown either in the 2nd half (ME: 2ndTest: 56.82%±16.85% vs. Control: 45.83%±10.35%, $t(13)=2.66$, $p=.01$) or 1st half (BE: 1stTest: 54.12%±10.13% vs. Control: 43.60±11.86%, $t(13)=3.05$, $p<.01$) of test trials. **Time course** confirmed that the ME group showed a preference of looking at the matching scene only after the object NP was presented (fig. 1), while the BE group could give an immediate response with the presence of the subject NP (fig. 2). **Correlation** data revealed that monolingual-exposed children with higher severity of autism were slower to locate matching screens ($r=.55$, $p=.02$). Bilingual-exposed children with larger vocabulary production size looked more to the match during the 2nd half of test trials ($r=.530$, $p=.03$).

Conclusions: Therefore, grammatical strength in children with ASD won't be challenged with bilingual exposure. Both monolingual- and bilingual-exposed children with ASD succeed in mapping the subject and object noun phrases in SVO sentences with the thematic agent and patient roles around 4 years old, corroborating "the universal constraint on the form-meaning mapping" (Franke et al., 2013). Moreover, the efficiency of online processing in children with ASD is affected by multiple factors including language environment, severity of autism and vocabulary size.

106 **206.106** Parent-Child Interactions in School-Age Children with Autism Spectrum Disorder, Fragile X Syndrome, and Down Syndrome

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Background: Difficulties in pragmatic language are a hallmark of autism spectrum disorder (ASD), and are also prominent in other neurodevelopmental disorders showing phenotypic and genetic overlap with ASD, such as fragile X syndrome (FXS) (e.g., Roberts et al., 2007). High rates of noncontingent and perseverative language have been reported in both idiopathic and syndromic ASD (FXS-ASD), though differences were observed as well (Martin et al., 2018). Understanding the impact of these difficulties across communicative contexts and conversational partners has important implications for illuminating potentially shared etiologic pathways and informing targeted interventions. This study examined pragmatic profiles of these groups during parent-child interactions to characterize both child and parent contributions to communication, including parental contingency and responsiveness, known to impact language outcomes (Haebig, McDuffie, Weismer, 2013; Siller & Sigman, 2008).
Objectives: Pragmatic skills including contingency, perseveration, initiations, and responsiveness were examined during parent-child interactions in school-aged children with ASD, FXS, Down syndrome (DS), and typical development (TD) and their parents.

Methods: Participants included boys with ASD (n=34), FXS-ASD (n=41), FXS-Only (FXS-O) (n=11), DS (n=22) and TD (n=22). Parent-child language samples from a five-minute dyadic free-play interaction were transcribed verbatim and analyzed using a detailed hand-coding system (Roberts et al., 2007). Language samples were examined for discrete pragmatic skills described above and parent strategies (e.g., use of scaffolds, praise, narration), which were considered in relation to parental features of the Broad Autism Phenotype (BAP). Nonverbal mental age, receptive and expressive vocabulary, and mean length of utterance were controlled in analyses.

Results: Boys with ASD and FXS-ASD were less contingent than all other groups (ps<.01). Boys with ASD were less responsive during conversation compared to all other groups, including FXS-ASD (ps<.02). Boys with FXS-ASD were more perseverative than all other groups (ps<.01). No significant differences emerged in initiations (ps>.11). Similarly, parents of children with ASD and FXS-ASD were less contingent compared to parents of children with DS (ps<.06) and TD (ps<.08), whereas only parents of children with FXS-ASD differed from the FXS-O parent group (p=.01). Parents of individuals with FXS-ASD were more perseverative than parents of children with DS and TD (ps<.02), though they did not differ significantly from the ASD or FXS-O groups (ps>.28). No significant differences in responsiveness or initiations emerged (ps>.12). Finally, parents of children with ASD

used marginally fewer parent strategies (e.g., scaffolds, narration) compared to parents of children with DS (p=.05), which was related to BAP features in the ASD parent group (p<.05).

Conclusions: Consistent with prior literature examining discrete pragmatic skills during examiner-child interactions (Martin et al., 2018), results highlight both areas of overlap and divergence across idiopathic and syndromic ASD. Interestingly, similar profiles emerged in parents, which may highlight the ways in which parental language style can be bidirectionally influenced by child pragmatics, as well as BAP status, during dyadic interactions. Overall, results of this study have the potential to inform pragmatic language interventions that are aimed at improving dyadic contingency in school-age children with ASD.

107 **206.107** Parental Linguistic Alignment in Conversations with Children with ASD and TD Children

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Background: Linguistic alignment is the tendency to re-use an interlocutor's lexical choices ("mommy, give me the *giraffe*", "is that a *giraffe*?"), syntax ("*the giraffe has fallen*", "yes and *the elephant has gone* to help her") and semantics (topic continuation). It arguably facilitates the establishment of common ground and rapport, and fosters more successful social interactions (Dale et al 2013). While the ability to align in children with ASD has been investigated, the way in which parents align to and scaffold their children's linguistic production is unexplored, although it may have important consequences for the social and linguistic development of the children. For instance, parents might mark joint attention, and engagement, as well as give feedback and further elaboration to their child's utterances.

Objectives: We investigate whether i) parents consistently align their lexical, syntactic and semantic choices to their children's utterances; and ii) this tendency is modulated by the child's clinical and cognitive features.

Methods: We analyzed spontaneous speech in 67 parent-child dyads from a longitudinal corpus (6 visits over 2 years), consisting of 30 minutes of play activities. We included 32 children diagnosed with ASD (mean age at recruitment = 32.76 months and 35 linguistically matched TD children (mean age at recruitment = 20.27 months). Alignment was calculated as cosine similarity between successive conversational turns (parent following child). Lexical alignment was based on lemmatized words, syntactic alignment on 2-grams of part-of-speech tags, and semantic alignment on Word2Vec representations of the corpus (Duran et al 2019). We first contrasted parental alignment in actual conversations with that in surrogate pairs formed by a parent and a child from two different conversations and found consistent alignment above baseline. We used Bayesian multilevel zero-and-one-inflated-beta regression models to account in the same model for rate of alignment, level of alignment when aligning, and exact repetitions (the latter controlled for, but not reported here). The models assessed alignment as a function of diagnosis, visit, Vineland Socialization, Mullen Expressive Language (EL) and Visual Reception (VR) at first visit. We controlled for effects of child MLU.

Results: The Table displays the full findings. Propensity to align (rate) and level of alignment (mu) were lower in parents of children with ASD. As the children grow older, parents increase their propensity to align over time (fewer non-aligned turns), but not their average level of alignment (stable for lexical and semantic alignment, decreasing for syntactic alignment). Parental alignment was higher for children with higher socialization (lexical), EL (all) and VR (semantics). For children with ASD, higher EL reduced the difference (interaction) in parental lexical and semantic alignment from TD children, but it increased the difference in syntactic alignment; higher VR reduced the difference in lower semantic alignment.

Conclusions: Parental alignment is modulated by the child's clinical and cognitive features. Alignment is generally higher for TD and generally children with higher cognitive abilities. Crucially, we observe different patterns for rate and level of alignment, which were not previously separated in studies of alignment. Research is needed to further explore their separate implications.

108 **206.108** Perceptual and Acoustic Measures of Prosody in Individuals with Autism Spectrum Disorder and First-Degree Relatives

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Background: Impairments in prosody (e.g., intonation, stress) can be among the most notable characteristics of individuals with autism spectrum disorder (ASD), and can significantly impact communicative interactions (Mesibov, 1992; VanBourgonien & Woods, 1992). Subtle differences in prosody have also been reported in parents of individuals with ASD, suggesting that familial characterization of prosody may help to highlight genetic influence on components of language impacted in ASD. While prior studies of prosody in ASD have used the *Profiling Elements of Prosody in Speech-Communication* (*PEPS-C*) to gather perceptual ratings of prosody and some have incorporated acoustic measures alongside these ratings, comprehensive perceptual and acoustic investigation of how specific prosodic abilities (e.g., contrastive stress, lexical stress) differ in individuals with ASD and their parents are needed to clarify key domains contributing to perception of atypical prosody in ASD.

Objectives: To assess perceptual and acoustic measurements of prosody in individuals with ASD and their parents.

Methods: Individuals with ASD (n=26), their parents (n= 43), and respective control groups (n=16 ASD controls; n=30 parent controls) completed the *PEPS-C*, which was rated by blinded coders. Responses to the expressive subtests of the *PEPS-C* from a subset of participants (ASD n=5; proband controls n=6; ASD parents n=14; parent controls n=10) were further characterized with acoustic analysis using Praat (Boersma, 2001) to obtain measures of mean fundamental frequency (f_0), standard deviation (SD) of f_0 and f_0 range, both measures of f_0 variability (acoustic analysis of data from the full sample is ongoing). Additionally, correlational analyses were conducted to examine relationships between these measures.

Results: Individuals with ASD and their parents exhibited poorer prosodic imitation, lexical stress expression, and contrastive stress expression (*ps*<.05). Individuals with ASD also demonstrated significantly greater atypicalities in phrase stress expression (e.g., "I saw a *blue bird*" vs. "I saw a *bluebird*") compared to controls, and this difference was marginal between the parent groups, with the ASD parent group demonstrating greater atypicalities (*p*=.05). Of the seven receptive subtests, individuals with ASD performed more poorly than controls only in their understanding of contrastive stress (*p*<.01). Acoustic analyses did not reveal significant differences in the ASD (*ps*>.67) or parent groups (*ps*>.61). Decreased f_0 range was associated with ratings of poorer contrastive stress ability in ASD parents (*r*= .60, *p*=.04).

Conclusions: Individuals with ASD and their parents demonstrated greater prosodic atypicalities across several domains of the *PEPS-C* based on perceptual ratings. However, consistent with prior work, these differences were not readily apparent based on acoustic measures of prosody (Diehl et al., 2013), although associations in the ASD parent group suggest that perceptual differences may be related to decreased f_0 variability.

The large overlap between subtests in which individuals with ASD and their parents differed from their respective control groups highlights the domains of imitation, lexical stress, and contrastive stress as potentially key areas contributing to overall perception of prosodic atypicalities during conversational interactions. Ongoing analyses including a larger sample size will further investigate acoustic differences and relationships with perceptual ratings of prosody in all groups.

109 **206.109** Phonological Factors Underlying Performance on a Multi-Lingual Non-Word Repetition (ML-NWR) Task

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Background:

Performance on non-word repetition (NWR) tasks is commonly used as a clinical marker of language impairment (LI) (Chiat, 2015). To achieve a range of complexity, available tools sometimes compromise wordlikeness and/or do not control phonological factors across stimuli (Edwards et al., 2004; dos Santos & Ferré, 2018). For example, in the English-medium CNRep (Gathercole et al., 1994), half the words are 4-5 syllables long while the average for English is 2.72 (Cutler et al., 2004); further, presence/absence of complex onsets and codas and their position are not controlled, although these factors can affect acquisition for typically-developing children (Fikkert, 1994).

Objectives:

A growing number of North American children are bilingual in English-Spanish, English-French, or French-Spanish. To appropriately diagnose LI in these populations, we designed the Multi-lingual Non-word Repetition (ML-NWR) Task. The stimuli in each language control for wordlikeness and various types of phonological complexity, yet are highly similar across languages to facilitate cross-language comparison.

Methods:

We created 27 non-words 2-4 syllables in length (Table 1). For each word length, syllable structure complexity was controlled: all syllables were open, initial syllables were closed, or final syllables were closed. Segmental shape was controlled within and across syllables. Stress location followed regular rules for each language.

ML-NWR data was analyzed from 88 children, aged 5-10. Their dominant language (L1) was English or French; some were bilingual (L2s = French, English, or Spanish). 36 children were diagnosed as ASD, 18 of whom additionally had LI. 52 were typically developing. Children in all diagnostic groups (ASD-LI, ASD, TYP) were similar in age, nonverbal IQ, and SES; further, ASD-LI and ASD groups did not differ in symptom severity on the Social Communication Questionnaire.

Results:

We focus on performance differences in children's L1 related to syllable shape (L2 analyses are on-going). Performance on open versus closed syllables was similar across language and diagnostic groups. However, differences were observed depending on position of closed syllable—final versus non-final (Figure 1). For both languages, there were main effects of diagnostic group and position. For French, but not English, there was a significant group-by-position interaction. Planned comparisons show that the ASD-LI group performed significantly worse than ASD on *final* closed syllables in English; and on *non-final* closed syllables in French.

English and French differ in stress location: the most prominent syllable is final in French (Delattre, 1939) and non-final in English (Chomsky & Halle, 1968). Consequently, in our French stimuli, final closed syllables were stressed while non-final closed syllables were not; in English, the opposite pattern held. In short, in the ML-NWR, stress facilitated the production of complex syllables, likely because stressed syllables have greater duration.

Conclusions:

Our findings arise from cross-language differences in stress location and thereby highlight the need to consider several linguistic factors in the design and scoring of assessment tools. Although word length and syllable complexity are typically varied across stimuli in existing NWR tasks, location of stress relative to syllable complexity is not controlled and scoring only considers percent phonemes correct, regardless of stimulus shape.

110 **206.110** Pragmatic Language Abilities in Siblings of Individuals with ASD

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Background: Pragmatic language impairment is a defining feature of autism spectrum disorder (ASD). More subtle pragmatic differences also constitute a core feature of the broad autism phenotype in clinically unaffected relatives (BAP; Landa, 1991, 1992; Losh et al., 2008; Piven et al., 1997). Whereas pragmatic abilities have been studied extensively in parents through both direct assessment and questionnaire, studies of pragmatic skills in siblings have been more limited, relying on parent report and/or focused on early developmental periods when more complex pragmatic skills have not yet emerged. This study assessed pragmatic language abilities in school-age and young adult siblings of individuals with ASD, using direct assessment of conversational interactions.

Objectives: To characterize pragmatic language features of the BAP in siblings of individuals with ASD, and explore how pragmatic abilities aggregate within families.

Methods: Participants included 117 individuals with ASD, 43 siblings, and 46 typically developing controls. Pragmatic language abilities were assessed using the Pragmatic Rating Scale-School Age (PRS-SA; Landa, 2011) during conversational interactions from the Autism Diagnostic Observation Schedule (ADOS; Lord, 2001) or ADOS-2 (Lord, 2012). The PRS-SA is comprised of items that tap five sub-domains of pragmatic skill: presupposition/theory of mind, discourse management, speech and language behaviors, suprasegmental characteristics (e.g., intonation, rate of speech, volume, and rhythm; which are important for mediating expression of communicative intent), and non-verbal communicative behaviors. ANCOVAs were conducted to examine group differences. Sibling correlations were also explored. Analyses controlled for age and IQ.

Results: A stepwise pattern emerged across all domains of the PRS-SA, where individuals with ASD presented with the greatest pragmatic

language impairment, followed by siblings, and controls showing lowest rates of pragmatic violations. Whereas individuals with ASD exhibited greater impairment than both sibling and control groups across all domains (*p*s<.001), siblings differed from controls only in the suprasegmental domain (*p*=.031). Additionally, pragmatic language ability was positively correlated between the ASD and sibling groups (*r*=.27, *p*=.03), with correlations driven by associations in the suprasegmental domain (*r*=.31, *p*=.01).

Conclusions: Findings revealed differences in suprasegmental aspects of speech among siblings of individuals with ASD. Within-family associations further suggest that suprasegmentals may comprise a key feature of the pragmatic-related component of the BAP in siblings. This contrasts with studies of the BAP in parents, where more widespread pragmatic difficulties have been observed. However, studies of parents included more naturalistic conversational tasks, which highlights the importance of extending the current study to contexts beyond the ADOS. Finally, results emphasize the need for further exploration into suprasegmental differences observed in siblings. Future studies should investigate suprasegmental use in siblings objectively through acoustic analysis which may reveal key aspects of pragmatic language impacted by genetic liability to ASD.

111 **206.111** Pragmatic Language Competence of School-Aged Children with Autism in Peer Conversations

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Background: These years more and more verbally fluent children with autism spectrum disorders (ASD) are able to adapt into the mainstream education and develop peer relationships in their school age. Researches show that these children may still present some residual deficits, and the pragmatic language competence is one of them. However, little is known about these subtle difference from a quantitative and detailed aspect. Most of the standard tests of pragmatic language (parent/teacher report scales or checklists and structured evaluation) find that these pragmatic deficits may be the ability of turn-taking and autistic-specific speech acts. Since the pragmatic impairments sometimes only present in real-life social interactions, we set up a natural environment and explore children's pragmatic language competence during peer conversations between typically-developed (TD) children and these children with ASD, which provides a new perspective in detecting and evaluating pragmatic language ability.

Objectives: This study aims to compare the communication acts, conversational skills and autistic-specific speech acts of these mandarin-speaking children with ASD and TD children during peer talk.

Methods: 13 ASD (mean age 9.15±1.34, IQ: 92.38±13.15) and 13 age-matched and IQ-matched TD children (mean age:9.08±1.65, IQ: 98.62±11.63) participated in this study. We used a strategic card game to induce the peer talk between the children with ASD and his/her TD friend/cousin （age difference less than 2 years old). Then we coded and analyzed the 10 minutes' conversation by CHILDES (Child Language Data Exchange System). The coding system we used in communication acts is Inventory of Communicative Acts-Abridged (INCA-A). The coding aspects of conversation skills includes turn-taking, initiation, continuation (reply and expand), discontinuity and repair. Furthermore, we defined the special autistic-style speech into five types according to the ASD linguistic symptoms. The Chi-Squared Test and t test are used to test the significance of the difference and the Pearson correlation coefficient was used to analyze the clinical significance of the pragmatic language competence.

Results: The results suggested that compared to their own TD peer, children with ASD showed significantly less sum of conversation continuation (ASD:37.46±12.96, TD:66.69±23.45, p=0.002), especially less expand in his/her turn (ASD:16.38±8.69, TD:40.54±23.44, p=0.02), less ratio of conversation continuation to initiation (ASD:0.89±0.41, TD:1.63±0.64, p=0.004), more autistic-style speech (sum: p=0.005, type: p=0.002) and more discontinuity(p=0.02). The difference in communication acts, sum of turns, and conversational repair were not significant. Strong correlation was found between total score of ADOS and some pragmatic indications, such as sum of effective utterance (r=-0.61, p=0.02), type of autistic-style speech (r=0.70, p=0.007) and sum of conversation initiation (r=0.63, p=0.02).

Conclusions: The results of the present study gave new evidence about the pragmatic language competence of children with high functioning ASD. They tend to express more actively in changing topics and initiating turns, but their performance of continuation of a certain topic, clarifying messages and adding more related information in their own speech turns was not as good as their TD peers, which cannot be reflected from their ADOS score and appear to be more difficult to improve even if they have adapted to mainstream education.

112 **206.112** Pragmatic Language Outcomes Following Social Communication Intervention for Children with High Functioning Autism Spectrum Disorder or Social Pragmatic Communication Disorder: Evaluation of a Novel Preference-Based Measure

ABSTRACT WITHDRAWN

Background: Children with High-Functioning Autism Spectrum Disorder (HFASD) have significant, heterogeneous pragmatic (social use of language) deficits and may have structural language impairments (Landa 2000, Volden et al 2009). Children with Social (Pragmatic) Communication Disorder (SPCD) have similar communication difficulties but do not meet diagnostic criteria for ASD (DSMV). Pragmatic/language deficits have long-term effects on employment success and mental health (Howlin et al 2004, Mayes & Calhoun 2011). Speech-language therapy (SLT) may prevent adverse consequences in both groups but there are few trials of pragmatics intervention (Gerber et al 2012). A manualized intervention, the Social Communication Intervention Programme (SCIP) (Adams & Gaile 2015) provides relevant content but estimates of changes in pragmatics are required for trial purposes. Given pragmatics heterogeneity at baseline, a way forward is to adopt an individualized approach to language/pragmatics therapy planning and a preference-based outcome measure.

Objectives: To study the variability of a modified goal–attainment scaling method (SCIP- GAS) as primary endpoint to SCIP intervention for children with HFASD or SPCD; to study the relationship between parent outcome commentaries and SCIP-GAS scores.

Methods: 15 UK SLTs identified twenty children with pragmatics/language needs. Inclusion: aged 6-11; social communication difficulties on pragmatics checklist (Adams et al 2012); normal range non-verbal IQ. Baseline: Children's Communication Checklist-2 (CCC-2) (Bishop 2003); Social Language Development Test (SLDT) (Bowers et al 2017) (secondary outcome); Module 3 ADOS-2 (Lord et al 2012). A researcher independent of the intervention completed testing. SLTs received SCIP training and six hours of supervision from a Research SLT (RSLT). Children received 20 direct SCIP therapy sessions. Primary endpoint SCIP-GAS: At Time 1 (T1) parents provided three prioritized communication goals. Expected steps in each goal were defined by RSLT at T1. After intervention (T2) parents and SLTs (independently) rated each goal compared to T1 baseline ability on a

scale of -1 (got worse) to + 5 (greatly exceeded). Parents provided a commentary on outcomes. Two RSLTs compared parent comments with SCIP-GAS scores to derive guidance about clinical significance for a future trial.

Results: All children met criteria for communication impairment on CCC-2; 11 met ADOS criteria for ASD; 9 were defined as SPCD. All children except one progressed on SCIP-GAS parent outcomes (mean 6.8, SD 3.1). All children progressed on practitioner SCIP-GAS ratings (mean 8.6, SD 2.2). Clinical significance was associated with SCIP-GAS scores of 6-9; high clinical significance with scores above 9. SLDT: Making Inferences scores were significantly higher at T2; there were no T1-T2 differences on Multiple Interpretations or Supporting Peers.

Conclusions: A preference-based pragmatics measure showed feasibility as an outcome following social communication intervention for children who have HFASD and SPCD. Estimates of sample size and clinical significance for a full trial have been made.

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113 **206.113** Preschool Language and Cognitive Predictors of Middle Childhood Reading Abilities in ASD and Typically Developing Children

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Background: A growing body of research has demonstrated that reading abilities in individuals with autism spectrum disorder (ASD) and no intellectual disability (ID) are heterogeneous and that basic reading skills such as rate, accuracy and fluency may display greater developmental dissociation from higher order reading comprehension skills in ASD than in those with typical development (TD). Variability in reading skills has been shown to relate to concurrent oral language skills. However, little is known about the developmental trajectory of this association.
Objectives: The purpose of the current study was to examine preschool language and cognitive predictors of reading achievement more than eight years later, in middle childhood, in a sample of children with ASD compared to those with TD.

Methods: Participants were part of the Autism Phenome Project (APP) longitudinal cohort, and included children with ASD (*N*=32) and TD (*N*=43) without ID (middle childhood FIQ range 70-140), who were first assessed at ages 24-54 months (mean age=36.99 months, *SD*=5.73 months) and then followed-up in middle childhood at ages 115-163 months (mean age=138.26 months, *SD*=9.75 months). Time 1 assessments: IQ, Mullen Scales of Learning (MSEL); receptive vocabulary, Peabody Picture Vocabulary Test (PPVT); and expressive vocabulary, Expressive One Word Picture Vocabulary Test (EOPVT). Middle childhood assessments: IQ, Differential Ability Scales, Second Edition (DAS-II); reading rate, accuracy, fluency, and comprehension, Gray Oral Reading Test, Fifth Edition (GORT-5).

Results: While the ASD group had average middle childhood FIQ (*M*=96.06, *SD*=15.10), they scored significantly lower than TD, therefore ANCOVA's controlling for FIQ were conducted on all reading variables. GORT-5 reading rate, accuracy and fluency were not significantly different between ASD and TD groups. However, ASD scored significantly lower than TD on reading comprehension (f=9.19, p=.003). Separate hierarchical linear regressions were conducted for ASD and TD groups examining T1 predictors (MSEL VIQ & NVIQ, PPVT, EOWPVT) of middle childhood GORT-5 reading rate, accuracy, fluency, and comprehension. None of the T1 variables predicted significant variance in any TD reading measure. However, in the ASD group, when controlling for other T1 variables, the PPVT was a significant predictor of reading rate (β=.882, p=.048), reading accuracy (β=1.093, p=.011), reading fluency (β=1.043, p=.018), and reading comprehension (β=1.018, p=.008). This was the only significant preschool predictor of reading achievement in the sample.

Conclusions: The current study provides evidence that**,** consistent with previous research, basic reading skills are a relative strength for children with ASD, but reading comprehension is a relative weakness and the patterns of association between basic and higher order skills are weaker in ASD than TD. Furthermore, while the preschool cognitive and language variables in this study did not explain significant variance in the TD reading scores, preschool receptive vocabulary was a significant predictor of all reading variables in the ASD sample. This indicates a tighter association between early receptive oral language skills and later reading (receptive written language) skills in ASD than TD samples and has implications for the role both language and reading interventions may play in the development and education of children with ASD.

114 **206.114** Probing Symptoms of Autism in a Thin Slice

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Background: Interest in big phenotypic data, motivates development of behavioral probes for use in community settings outside the research lab. While the Autism Diagnostic Observation Schedule (ADOS; Lord et al, 2000) is a touchstone for measuring autism's core symptoms, its required intensive training and lengthy administration duration make it hard to deploy broadly in community settings.
Objectives: Inspired by appraisal from brief, "thin slices" of interaction (Grossman, 2015), and by rapid scoring of subtle pragmatic behaviors using semi-structured probes (Simmons, Paul and Volkmar, 2014), we constructed a 5-minute series of semi-structured probes and gestalt ratings, to score social communication behaviors known to differ in autism. Here we describe their performance.

Methods: Verbally fluent, high-functioning participants comprised a group of autistic children (n=14) and an age-matched group of typically developing controls (TDC; n=20). Ages ranged from 6 to 13 years (*M*=8.7 (*SD*=1.7)), for each group, respectively. Diagnostic status was confirmed by expert clinicians using comprehensive evaluation including ADOS. Verbal and full-scale IQ differed slightly between groups (FSIQ: ASD, 103.4 (12.3); TDC, 108.8 (16.3); d=0.37).

Probes were delivered by trained research assistants. They targeted (1) gaze-following joint attention; (2) informativity of speech and gestures, when narrating a story shown in a previously viewed cartoon video; (3) help-seeking communication, after being tasked with writing using a

secretly broken pen; and (4) integration of gesture with speech, when describing a previously-manipulated toddler's shape-sorting toy.

Probes comprised series of increasingly supportive prompts, providing opportunities to demonstrate varying levels of abilities, and facilitating rapid and reliable scoring of participant responses, from video, afterward. Scores matched probe hierarchies, and also included three gestalt ratings for awkwardness, quality of rapport, and quality of responses. Scores took integer values from 0, to 2, 3, or 4. Higher scores indicated lower performance (e.g., more prompting required or greater awkwardness).

Results: The ASD group scored a higher sum of probe scores (possible range = [0, 36], ASD: *M*=11.7 (*SD* = 10.0), TDC: 6.7 (3.7), *d*=0.66, *p*<.001), indicating worse performance. Speech-gesture integration differed between groups (*r*=.50, see Fig 1). In the ASD group, speech-gesture integration varied negatively with verbal IQ (*r*=-.61). There were marginal (*p*<.1) group differences in overall rapport (*r*=.35), amount of information in narration (*r*=.30), and prompt level required before requesting help (*r*=.42).

Response to subtler joint attention bids was associated with lower ADOS Social Affect (SA; *r*=.46, *p*<.05) and total scores (*r*=.39). Overall quality of responses increased marginally with age (*r*=-.31). Amount of information provided in narration was related to full-scale (FS; *r*=-.44), nonverbal (*r*=-.45), and marginally to verbal IQ (*r*=-.35).

Within the ASD group, response to subtler joint attention prompts likewise correlated with ADOS SA (*r*=.59) and marginally with ADOS total scores (*r*=.50). Awkwardness was marginally related to FSIQ (*r*=.59).

Conclusions: Group differences and relationships to autism symptom severity suggest the promise of using combined gestalt impressions and structured probes to measure a variety of core behaviors from a brief interaction.

115 **206.115** Prosody in Adolescents with Autism: The Impact of Language, Speech Motor Control, and Auditory Processing

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Background: Some individuals with Autism Spectrum Disorder (ASD) exhibit differences in expressive and receptive prosody. There is lack of agreement regarding the characteristics and underlying processes associated with atypical prosody in this population. Current theories to explain atypical prosody in ASD range from poor language ability to speech motor control and/or auditory processing differences.
Objectives: We investigated the following research questions: 1) Do individuals with ASD perform less accurately than controls on expressive/receptive prosody tasks?; 2) Do individuals with ASD show significant differences on speech motor control tasks as compared to controls?; 3) Do individuals with ASD perform significantly different on auditory processing tasks compared to controls?

Methods: A between-group study was conducted to investigate prosody, language, speech motor control, and auditory processing among teenagers with ASD (n=11; ages 13;11 to 19;11 years) compared to TD controls (n=11) matched for age, gender, and receptive language (English). Participants completed: 1) standardized expressive and receptive vocabulary testing; 2) Profiling Elements of Prosody in Speech-Communication 2015 (PEPS-C 2015) to assess expressive/receptive prosody in pragmatic, affective, and grammatical domains; 3) Alternate Motion Rates (AMRs) to measure speed and precision of articulation, 4) Sequential Motor Rates to assess sequencing and coordination of the speech mechanism for articulation; and 5) the SCAN-3:A to screen auditory processing abilities. Trained listeners blind to participant group membership rated expressive prosody and motor speech tasks. Inter-rater reliability was good/moderate (Cohen's kappa >.55; Altman, 1991).

Results: There were no significant differences between groups on standardized expressive (*p*=.189) or receptive (*p*=.054) vocabulary. The group with ASD performed significantly less accurate (*p*<.05) than the TD group on 12 out of 14 PEPS-C 2015 tasks. Regarding speech motor control, the participants with ASD performed with significantly a lower (*p*<.05) group mean (slower speech rate) for repetition of [p^] and [k^] syllables. No significant differences between groups were observed on motor programming/planning (SMRs). Trained listeners rated participants with ASD as sounding qualitatively different or "atypical" than controls on motor speech tasks. No significant differences were observed in auditory processing abilities (p=.635). Qualitative analyses revealed that among the group with ASD, 82% "failed" the PEPS-C 2015 expressive/receptive composite scores. Among these individuals, 27% had *moderately to extremely low* language; 73% qualitative differences in motor programming/planning and motor execution (e.g., 25% sequencing errors; 50% imprecise or slurred speech, respectively); and 22% failed the SCAN-3:A. Two (18%) with ASD who "passed" the PEPS-C, had *moderately to extremely high* language abilities; 9% failed the SCAN-3:A; and 9% exhibited minor sound substitutions and variable speech rate. All TD participants passed the PEPS-C 2015, had *average* to *extremely high* language, no qualitative differences on motor speech tasks; and 18% failed the SCAN-3:A.

Conclusions: This research supports that some individuals with ASD have atypical prosody. The underlying mechanisms of atypical prosody in this population cannot be attributed to only one mechanism since motor speech, language and auditory processing abilities are intertwined. There is evidence to support poorer motor speech abilities compared to language performance and vice versa in some individuals with ASD.

116 **206.116** Quantitative and Qualitative Features of Co-Speech Gesture in Verbally Fluent Individuals with ASD

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Background:
Co-speech hand gestures augment verbal communication by mapping a visual accompaniment. Research on gesture in verbally fluent individuals with ASD is equivocal when it comes to how *often* gesture is used to supplement speech, suggesting that global variables (e.g., rate) may not adequately capture gesture differences in ASD. Thus, here we take a more granular look by investigating the communicative contribution of each individual gesture spontaneously produced during an interaction. The contribution of an individual gesture can be analyzed in at least two ways: quantitatively and qualitatively. A quantitative measure looks at how much *content* a gesture contributes to the interaction, whereas qualitative features measure how *well* a gesture carries out its intended purpose. We predicted that quantitative features would not adequately account for group differences in gesture use, given the countless nuances involved in live social interaction. Instead, we hypothesized that *qualitative*, or "subjective," features of gesture are more pronounced markers of ASD than *quantitative* features.

Objectives:

To test the hypothesis that qualitative features of gesture are more pronounced markers of ASD than quantitative features.

Methods:

Verbally fluent individuals with ASD (*n*=36), aged 10 to 35, and typically developing controls (TDC; *n*=14), were given two communication tasks to elicit co-speech gestures. Participants were group-matched on age, gender, and full-scale IQ. In the "Box" task, participants were asked to play with a shape-sorter toy for 15-30 seconds, and then asked to describe how it worked. In the "Cartoon" task, participants were shown a short clip of a cartoon, and then asked to describe it. Spontaneous gestures produced during both tasks were coded from videos for quantitative and qualitative features. Quantitative features included how often a gesture added *new information* to speech, and how often *two-handed* gestures were used—in other words, how often a gesture was cognitively or visually expansive. Qualitative features included *certainty* (rater's certainty that a given hand movement was a gesture), and *confidence* (rater's confidence in the intended meaning of the gesture). Coders were undergraduate student research assistants, who were naïve to participant diagnostic status. All variables were z-score transformed for comparison.

Results:

A mixed ANOVA yielded a significant Group*Measure (i.e., quantitative v. qualitative) interaction with a large effect size (p=.001, η^2=.21), see Figure. Post-hoc t-tests revealed that both qualitative features reached significance independently (certainty: p=.01, d=-0.78; confidence: p=.004, d=-0.86), with the ASD group showing lower qualitative ratings in both cases. In contrast, neither quantitative feature differed by group (*new information*: p=.11, d=.50; *two-handed gestures*: p=.32, d=.29), suggesting that gesturers in both groups made similar attempts to use their gestures to add content to the discourse.

Conclusions:

Qualitative features of gesture, such as certainty and confidence, may be more robust markers of ASD than *quantitative* features. That is, while the general content conveyed by individuals with ASD through gesture may be similar, their gestures may be less clear and thus less communicatively effective. Qualitative ratings are likely better predictors of group membership because they capture more of the nuances involved in nonverbal communication.

117 **206.117** Reported Use of Augmentative/Alternative Communication By Pediatric Psychiatric Inpatients with Autism Spectrum Disorders

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Background: In previous work, we found that, contrary to expectations, verbal ability was not strongly related to the severity of problem behaviors in pediatric psychiatric inpatients with autism spectrum disorders (ASD) (Williams, Siegel, & Mazefsky, 2017). The potential effect of augmentative/alternative communication (AAC) use by the individuals with ASD who were minimally verbal (MV) remained an unanswered question. Other research has suggested that introducing a form of AAC such as Picture Exchange Communication System (PECS; Frost & Bondy 2002) or a speech-generating device may be associated with a decrease in the occurrence of problem behaviors for MV children with ASD (Ganz et al. 2009; Mirenda 2003).

Objectives: This is an initial descriptive report of AAC use in our population of pediatric psychiatric inpatients with ASD, adding to the limited information available on the proportion of youth with ASD who use AAC, the forms used, and the user characteristics.

Methods: A questionnaire, adapted from one by Tager-Flusberg and colleagues, was used to gather information from family members about AAC use, the verbal abilities, and communicative functions of 641 pediatric psychiatric inpatients with ASD. Receptive vocabulary was measured with the *Peabody Picture Vocabulary Test*-4 (Dunn & Dunn, 2007) for a subset of 479 inpatients.

Results: 242 (37.8%) of the pediatric inpatients reportedly used some form of AAC. They did not differ from the 399 inpatients who were non-AAC users in mean age [12.90 (users); 12.83 (non-users), p = .807], age range (4 to 20 years), or gender distribution [AAC users = 202 Males (83.5%); 40 Females (16.5%); non-users = 315 Males (78.9%); 84 Females (21.1%), p = 0.180]. The types of AAC that were reported to be used by most of the inpatients were low-tech, picture-based formats, with only 45.5% reported to use some form of a voice output communication aid or speech-generating device. Thirty-three percent of the AAC users were reported to use complex sentences; 49.5% were reported to share thoughts at least sometimes, but most (93.4%) used their means of communication for basic functions of expressing wants/needs and making requests. The receptive vocabulary scores of the non-AAC users were significantly higher than the AAC users (83.07; 47.09, p > .0001). A subset of 28 children in the non-AAC group were reported to only use simple sentences some of the time (85.7%) or never (14.3%) and had PPVT standard scores that ranged from 20 to 100 with a mean of 52.86, suggesting that, whereas some of these children may be so severely affected they would have difficulty using AAC, others may be potential candidates.

Conclusions: The percentage who use AAC in this inpatient population is consistent with previously reported estimates of AAC use in other ASD samples (Wodka et al., 2013). Consistent with other reports, this inpatient population primarily used AAC for the basic communicative functions of expressing wants/needs and requesting (Ganz et al., 2012). Future research will use information from the AAC questionnaire to examine the relationship between the ability to communicate and severity of problem behaviors in this population.

118 **206.118** Speaking the Same Language? a Comparison of the Language and Communication Profiles of Girls and Boys with High Functioning Autism

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Background: Young females with Autism Spectrum Disorder (FwASD) present with more subtle impairments in social interaction (Lai et al 2011) and restricted interests (Mandy et al 2012) than male peers (MwASD). This may impact negatively on correct diagnosis of ASD in females (Kopp and Gillberg, 2011) which in turn reduces access to suitable services. Less is known about gender differences in communication for young people with ASD, especially high-level language/discourse. There is some evidence that gender differences are found in both functional communication (Park

et al 2012) and social impact of communication deficits (Sedgewick et al, 2016). Detailed investigation into subtle gender differences in language/discourse skills could support understanding of the female phenotype of autism and indicate areas of particular interest for this group; causal factors of poor well-being, appropriate diagnosis and bespoke therapy provision.

Objectives: To provide a thorough analysis of language and discourse skills for FwASD. To investigate all language domains: receptive/expressive skills, at word/sentence and above sentence level, and across pragmatic/semantic and language of emotion ability. To create a profile of skills for FwASD and compare skills sets with MwASD and typically developing females (FwTD) and males (MwTD).

Methods: Measures of structural language and functional communication were compared between 13 female and 13 male children (aged 8.11-11.06) with High-Functioning Autism Spectrum Disorder (HFASD); performance IQ normal range. 26 typically developing children (TD) were matched for age and gender. Subtle differences in PIQ were controlled during analysis. Participants were recruited through autism charities, NHS trusts and participant data bases. Assessments included: Standardised and experimental measures of vocabulary, sentence level and discourse level processing; Experimental pragmatic/semantic measures of non-linguistic communication, non-literal interpretation of spoken language and complexity of narratives; Novel experimental tasks of receptive and expressive emotion vocabulary. All assessments were conducted by clinical specialists, in school or at home. Analysis was undertaken using a 2 (Gender) x 2 (Group) analysis of variance (ANOVA), controlled for PIQ.

Results: Overall trends indicate that females with HFASD will outperform males with HFASD on a range of pragmatic and semantic tasks. However, they perform worse on these measures than TD females. TDs had consistently better scores than HFASD in above sentence level tasks (although not in measures of vocabulary or sentence level grammar where all groups showed matched results). Female HFASD perform similarly to TD females on some language of emotion measures (receptive and semantic category naming) and better than male TD or HFASD. These may represent relatively spared skills compared to gender norms.

Conclusions: Outcomes indicate a specific profile of language and communication strengths/weaknesses for female HFASD. They support the theory of a distinct female phenotype of ASD already identified in social skills and repetitive behaviours. They may indicate why FwASD fail to meet criteria for current diagnostic schedules, but also why they struggle to match communicative expectations of their female TD peer group. Results from this study have clinical implications for diagnostic services and speech and language intervention. As well as explaining difficulties maintaining friendships and managing well-being.

119 **206.119** Speech Impairment Affects Expressive Language in Minimally Verbal Children with Autism Spectrum Disorder

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Background:

25-30% of children with autism spectrum disorder (ASD) remain minimally verbal (MV) past age five (Kasari et al. 2013; Norrelgen et al. 2015). It remains unclear why spoken language acquisition is limited in these children, but we do know that a lack of spoken language is associated with high rates of challenging behaviors (Dominick et al., 2007) and is thus an important therapeutic target.

Speech impairment as a contributor to expressive language has been under-investigated relative to factors such as joint attention, language impairment, nonverbal IQ, and ASD severity, though disorders such as childhood apraxia of speech (CAS; a disorder in the planning and sequencing of speech movement; Iuzzini-Seigel et al., 2015) are hypothesized to be over-represented in ASD compared to the general population (Tierney et al., 2015).

Objectives: To estimate the proportion of individuals with MV ASD with speech impairment and to explore the contribution of measures of speech, receptive vocabulary, and nonverbal IQ to variability in expressive language.

Methods:

Videos of 57 individuals with MV ASD (13 F; ages 4;4-18;10) participating in the Kaufman Speech Praxis Test (KSPT; Kaufman, 1995) were coded for features of CAS and other speech anomalies. A consensus reliability method was used for coding.

One-way ANOVAs were performed to determine whether groups differed on age, ADOS severity, NVIQ, receptive vocabulary (PPVT), KSPT Section 1 (KSPT1; nonspeech oral-motor), and KSPT Section 2 (KSPT2; speech). Variables differing significantly between groups were entered into a hierarchical multiple regression to understand their contributions to the variance in Number of Different Words (NDW) from a structured language sample.

Results: Four groups emerged: No Abnormalities Detected, Non-CAS Speech Disorder, Suspected CAS, and Insufficient Speech to Rate. Groups differed significantly on PPVT, NVIQ, KSPT1, and KSPT2 (Table 1). The overall regression model including these four variables was significant ($F(4,40) = 8.672$, $p < 0.0005$), accounting for 41.1% of the variance in NDW (adj. R^2). However, KSPT1 and NVIQ contributed insignificant amounts of R^2. A reduced model including just KSPT2 and PPVT was also significant ($F(2,42) = 17.777$, $p < 0.0005$) and accounted for 43.3% of the variance in NDW (adj. R^2). PPVT score contributed a ΔR^2 of 0.126 ($p = 0.003$); KSPT2 contributed a ΔR^2 of 0.333 ($p < 0.0005$). PPVT and KSPT2 were not collinear (VIF = 2.8).

Conclusions: Minimally verbal individuals with ASD differ in the nature and severity of their speech involvement, suggesting the existence of separate speech endophenotypes in this population. Speech motor ability (KSPT2 score) accounted for significant variance in expressive language, with PPVT score accounting for additional significant variance. Speech impairment may limit expressive language development in some individuals with MV ASD and is an important area to explore for the creation of novel therapies for these children.

120 **206.120** Speech and Song Imitation in Autism Spectrum Disorder: A Cross-Linguistic Study

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Background:

Autism Spectrum Disorder (ASD) is characterized by difficulty with social communication, including understanding pitch in spoken language

(O'Connor, 2012), despite average or above average musical pitch processing skills (Bonnel et al., 2003; Heaton, 2003, 2005). Impaired linguistic but enhanced musical pitch processing has also been found in tone language speakers with ASD, such as Mandarin (Jiang et al., 2015). It remains unclear whether pitch production would also differ between music and language in ASD.

Objectives:

This study investigates pitch and duration matching in speech and song imitation of individuals with ASD and typically developing (TD) controls, who are native speakers of a language with or without lexical tone: Cantonese and English. This shows the effect of linguistic pitch expertise on pitch production in ASD and highlights differences in pitch processing between domains of speech and song among ASD individuals.

Methods:

Preliminary data were collected from 20 English speakers (11 ASD and 9 TD) and 10 Cantonese speakers (7 ASD and 3 TD). Participants listened to and imitated 48 (English) or 40 (Cantonese) sung and spoken sentences. Imitation recordings were analysed in Praat to extract median pitch and duration of each syllable rhyme and compared to model production. Absolute pitch and duration deviations were averaged across all syllables to obtain imitation accuracy for each sentence (Liu et al., 2013).

Results:

Linear mixed effects models were fitted for pitch and duration deviation separately for English and Cantonese speakers, with diagnostic group (ASD vs. TD) and domain (speech vs. song) as fixed effects and participants and stimuli as random effects.

For English, there was a significant main effect of domain on pitch and duration deviation, as both ASD and TD groups imitated song pitch better than speech pitch but speech duration better than song duration. A significant group x domain interaction was found for pitch deviation, as the TD group imitated speech pitch (but not song pitch) more accurately than the ASD group.

For Cantonese, there was a significant main effect of domain and a significant group x domain interaction on pitch and duration deviation. Song pitch was imitated more accurately than spoken pitch, and this advantage was enhanced among TD as opposed to ASD participants. Speech duration was imitated more accurately than song duration, and this advantage was enhanced among ASD as opposed to TD participants.

Conclusions:

Overall, results show that both ASD and TD groups imitated song pitch more accurately than speech pitch, in both English and Cantonese, and all groups imitated speech duration more accurately than song duration. Consistent with previous studies on American English and Mandarin speakers (Liu et al., 2013; Mantell & Pfordresher, 2013), these findings are expected since pitch precision in music is required and duration accuracy in speech is crucial.

Interestingly, compared to TD controls, English speakers with ASD were less accurate in speech pitch imitation, but Cantonese speakers with ASD were less accurate in song pitch imitation. This suggests that the symptomology of ASD may be different for individuals with different language background.

121 **206.121** Stability and Change in Language Development from 4 to 11 Years in Verbal Children with Autism Spectrum Disorder: A Community-Based Study

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Background: Language difficulties are a common feature of autism spectrum disorder (ASD) and are associated with adverse outcomes including literacy difficulties, challenging behaviour and aggression (Mawhood 2000; Baghdadli 2003; Hartley 2008). Yet we understand little about how language develops for children with ASD compared with other children, particularly beyond the preschool years.
Objectives: We compared language ability at ages 4, 5, 7 and 11 in four groups of children: ASD with language disorder (ASD+LD; n=17), ASD without language disorder (ASD-LD; n=30), developmental language disorder (DLD; n=107) and typical language (TD; n=872). We also investigated predictors of language outcome in ASD.

Methods: Participants were selected from a large, prospective community-based cohort study of child language. A comprehensive, standardised language assessment (The Clinical Evaluation of Language Fundamentals- Fourth Edition; CELF-4) was used to assess receptive and expressive language across four time points. Mean scores on the CELF-4 and slopes (rate of language growth) were estimated from 4 to 11 years using generalised estimating equations. We used linear regression to analyse predictors of language outcome at 11 years.

Results: There was individual variability in scores and rate of growth for children in all four groups. For expressive language, children in the ASD-LD group had estimated mean scores that were 1.09 units lower than the TD group indicating similar ability at 4 years. By contrast the ASD+LD and DLD groups both had substantially lower estimated mean scores than the TD group (33.45 and 31.84 units lower, respectively). The estimated mean difference in slopes was similar for the ASD-LD and TD groups (p=0.905) indicating comparable rate of growth in language from 4 to 11 years. There was, however, a significant difference between the DLD and ASD+LD groups compared to the TD group (p=0.001 and p=0.003, respectively) indicating mean standard scores increased more quickly for the DLD and ASD-LD groups relative to the TD group from 4 to 11 years. This increased rate of growth was particularly evident for the ASD+LD group (Figure 1). The overall findings for receptive language were comparable to those for expressive language although rate of growth for the ASD+LD group was less rapid (Figure 2). Language at 4 years was the only consistent predictor of language at 11 years in the ASD group (p=0.001 for both receptive and expressive language).

Conclusions: For language ability and rate of growth, children with ASD-LD had similar profiles to children with TD, and children with ASD+LD had similar profiles to those with DLD. While rate of growth followed a predictable pattern (based on norms) for the TD and ASD-LD groups, those with DLD and ASD+LD demonstrated some developmental 'catch up' between 4 and 11 years. Language at 4 years predicted language at 11 years for ASD. These data can assist parents to better understand their child's language prognosis and inform intervention and service planning. The findings also contribute to our understanding of critical time periods for growth and development in children with ASD and how this may be similar or different to other groups of children.

122 **206.122** Syntactical Profiles of Autism Spectrum Disorder: Evidence from Part of Speech Errors on Expressive and Receptive Standardized Speech Assessments

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Background: Many individuals with Autism Spectrum Disorder demonstrate language difficulties, even if fluent language has been achieved, such as difficulties with grammar, prosody, and semantics. Previous research is mixed as to whether part of speech errors (e.g., nouns, verbs, adjectives), or syntax knowledge, is a deficit within ASD more broadly or is only present when ASD co-occurs with language impairment. Syntax accuracy is of particular interest from a sex-differences perspective, in that females with ASD have been said to engage in "social camouflage," using speech and communication patterns to better blend in.

Objectives: The following research investigates part of speech errors on standardized assessments of expressive and receptive vocabulary to (a) investigate syntactical differences as a function of ASD, and (b) to investigate syntactical sex differences within ASD.

Methods: Participants (N = 166, 57 females) comprised children (ages 2-10; n = 82), adolescents (ages 11-17, n = 20), and adults (ages 18-85, n = 64) who participated in an ASD assessment; of these, 98 received an ASD diagnosis. Each participant completed an IQ assessment and standardized measures of receptive language (Peabody Picture Vocabulary Test-4th edition; PPVT-4) and expressive language (Expressive Vocabulary Test-2nd Edition, EVT-2). Variables of interest included standard scores on both measures and proportion of errors (number of incorrect items/number of items administered). Thus, there were six total speech error variables: errors for nouns, verbs, and adjectives for both expressive and receptive errors.

Results: Multivariate analyses indicated significant sex and ASD diagnosis interactions that qualified both main effects for overall PPVT and EVT standard scores. On the EVT, no sex difference emerged for those without ASD, whereas females outscored males for those with ASD, $F(1, 156) = 5.32$, $p = .02$. On the PPVT, TD males outperformed TD females, whereas ASD females outperformed ASD males, $F(1,156) = 7.39$, $p = .007$. The six part of speech error proportion variables were treated as a unit and analyzed together as a syntactical profile. Latent profile analyses yielded a total of 3 profiles: high errors, low errors, and moderate errors. Logistic regression indicated that profile membership significantly predicted ASD diagnosis, $B = .413$, $p = .031$. Within the profiles, individuals with ASD were significantly more likely to reside in the profile with moderate errors, as opposed to excessive or few errors.

Conclusions: Results indicate significant sex and diagnostic differences on standardized measures of expressive and receptive language, with support for the social camouflaging hypothesis, such that females with ASD outperformed males on both indices and thus may use language and communication skills to better blend in. Furthermore, individuals on the spectrum do not seem to be making significantly more or fewer errors than their TD counterparts, but are more likely to make consistent, moderate errors on parts of speech both receptively and expressively. These results can aid in ASD assessment, in the assessment of the female ASD phenotype, and in the understanding and assessment of comorbidity of Specific Language Impairment within ASD.

123 **206.123** The Impact of Autistic Traits on the Affective Prosody and Gesture Perception in Conversation

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Background: Integration of speech and gesture is an essential ability that helps humans to participate in daily communication and social interactions. However, deficits in communication and social reciprocity are primary aspects of Autism-Spectrum Disorders (ASD) and several studies show that individuals with ASD have more difficulty in integrating audiovisual speech stimuli (Stevenson et al., 2014) and discriminating temporal asynchronies in linguistic situations (Bebko et al., 2006). The deficits in speech and gesture integration in ASD may reflect processes of multisensory integration that impact on social and emotional communication.

Objectives: This study is aimed to investigate the differences of emotional speech and gesture processing between individuals with low levels of autistic traits and high levels of autistic traits.

Methods: A total of 64 right-handed native English speakers between 18 and 40 years (25.20±6.11) participated in this study. The participants were divided into two groups: one group was a low autistic traits group (M:10, F:30) and one group was a high autistic traits group (M:8, F:16). We used a cutoff of below 18 to enter the Low AQ (LAQ) group and above 29 on the Autism-spectrum Quotient (Baron-Cohen at al., 2001) score to enter the High AQ (HAQ) group. Participants were presented with dyadic interactions and asked to respond about speakers' emotions from prosody (Task1&Task2: Audio-only), gesture (Task3: Visual-only), and with either emotionally congruent or incongruent displays (Task4: Audio-visual). For the audio-only and the video-only tasks, the stimuli included three emotional categories (Angry, Happy, Neutral). For the audio-visual task, stimuli included happy and angry emotions that were either congruent or incongruent across modality (Piwek et al., 2015).

Results: In the results of the prosody experiment, the HAQ group showed significantly lower accuracy than the LAQ group in Task2 ($F(1,186)=4.559$, $p=.034$). There was a significant emotion effect in both tasks (F-test, all $p<.001$). The HAQ group showed lower accuracy in recognising the happy emotion in both Task1 and 2. An interaction between group and emotion was found in Task2 ($F(2,186)=5.867$, $p=.003$).

In the gesture experiment, the HAQ group exhibited significantly lower accuracy than the LAQ group ($F(1,186)=11.272$, $p=.001$), and a significant main effect of emotion ($F(2,186)=260.001$, $p<.001$). Also, there was an interaction between group and emotion ($F(2,186)=12.135$, $p<.001$). In both groups, the angry gesture had the lowest percentage of correct recognition (LAQ: 42.9%, HAQ:40.1%).

In the congruence experiment, there was no group difference. A significant congruence effect was found ($F(1,124)=150.116$, $p<.001$) and a marginal group by congruence interaction ($F(2,124)=3.855$, $p=.052$). In reaction times, the HAQ group reacted slower than the LAQ group in all tasks, in particular a significant group difference was found in the congruence experiment ($t=-2.139$, $p=.036$).

Conclusions: This study investigated how autistic traits impact on affective prosody and gesture perception. The results of this study show that significant performance differences exist between low and high autistic trait individuals with the HAQ group presenting lower accuracy in recognising affective prosody and gestures. It suggests that consideration of these differences can contribute to understand the impact of autistic traits on social communication.

124 **206.124** The Language Delay in Preschool Children with Autism Spectrum Disorder with and without IQ Discrepancy

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Background: IQ discrepancy (IQD) refers to the discrepancy between verbal and nonverbal intellectual abilities, indicating an atypical pattern of verbal-performance IQ differences (i.e., the distance between measured verbal [VIQ] and performance intelligence [PIQ] quotients). IQD appears to be related to several aspects of child development, but no studies have examined the association between IQD and language delay in children with autism spectrum disorders (ASD).

Objectives: The aims of the study were to establish whether 1) a group difference existed in the language delay among preschool-age children with ASD with different levels of IQD; 2) an association existed between IQD and language delay.

Methods: A total of 127 preschool children with ASD were divided into three groups according to the size of the IQD: EVEN IQ (n=90; IQD within 1 SD), discrepantly higher VIQ (n=14; VIQ > PIQ above 1SD [≥ 15 points]), and discrepantly higher PIQ (n=17; PIQ > VIQ above 1SD [≥ 15 points]). Children with ASD were assessed with the Language Disorder Scale of Preschoolers (LDS) and Wechsler Preschool and Primary Scale of Intelligence™ – Fourth Edition (WPPSI™-IV) respectively to measure their language disability and determine their IQD. The LDS contains three subtests: overall language ability, listening comprehension, and oral expression. Each subtest could differentiate three groups: normal, borderline, and delayed. Chi-square tests were used to examine the relationships between IQD and language delay.

Results: The results indicated significant differences among the three subgroups ($p < 0.05$) in the LDS. The results of the LDS show that 75 children had language delay in overall language ability (62.0%); 54 children in listening comprehension (44.6%); and 66 children in oral expression (54.6%). The FIQ, VIQ, PIQ, and IQD in the WPPSI-IV were 77.47 (SD = 35.65), 77.80 (SD = 14.89), 78.58 (SD = 16.27), and 10.49 (SD = 8.93) respectively, all of which were below the FIQ of 100 in the psychometric curve. Chi-square tests showed that IQD was related to children's overall language ability, listening comprehension, and oral expression ($X^2 = 17.30$, df = 4, $p = .002$; $X^2 = 19.59$, df = 4, $p = .001$; $X^2 = 15.30$, df = 4, $p = .004$). Children with even IQD showed better language ability than did children with discrepantly higher VIQ or PIQ. Moreover, children with discrepantly higher VIQ were associated with better language ability than were children with discrepantly higher PIQ, and vice versa.

Conclusions: The results of this study showed that IQD was significantly associated with language delay in children with ASD. The results of this study could encourage clinicians, educators, and therapists to consider IQD when measuring children's language function and to analyze the patterns of language disability in preschool children with ASD. Possible language problems of children with ASD may be detected early based on routine evaluation of cognitive profiles. Furthermore, the language delay could be explained in terms of IQD. Professionals should pay attention to children's language problems when they have IQD.

125 **206.125** The Relation between NON-Adaptive Behaviors, the Need for Transactional Support for Children with ASD and the Maternal Overburden

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Background: Children with ASD have different needs of transactional support such as interpersonal as well as learning support in their day-to-day family lives and their school activities. These children may be relatively independent from the initiative and responsiveness of their adult partners; from the constant availability of the partners for each initiative, and how the partners can make adjustments in speech and in behavior to be of support for the day-to-day learning situations of the child.Along parallel lines, the degree of development shown by children with ASD can involve different things in the familial context, beginning with mental and physical strain as the result of the attributions of daily life, such as high levels of stress and low quality of life for the family members.

Objectives: To verify the possible relations between the need for interpersonal support and learning and maternal overburden.

Methods: The transversal study involved 56 individuals, which were split into two groups, one group of 28 children of both genders , with ages varying between 28 to 113 months; and a second group of 28 female individuals, ranging from 30 to 50 years of age. with diverse educational backgrounds, ranging from elementary graders to college graduates. These individuals are the respective mothers of the children with ASD, who themselves work at the Brazilian Public Health-Care Service. To register the interpersonal and learning support we used the SCERTS model for assessment (Prizant, Wetherby, Rubin, and Rydell, 2006). For non-adaptive behavior we used the Autism Behavior Checklist /ABC (Krug et.al.1993); pre-validated for Brazilian Portuguese as the Inventory of Autistic Behaviors/ IAB, (Inventário de Comportamentos Autisticos/ICA); and for the assessment of maternal overburden we used the Burden Scale (in the Brazilian translation of the Burden Interview, Scazufca,2002).

Results: According to the coefficient of Spearmen, the ABC indicated a correlation with the variables of response in the Burden and in the SCERTS for Interpersonal Support.

Conclusions: We observed that the greater the index of non-adaptive behavior, greater was the children´s with ASD need for interpersonal support and their maternal overburden.

126 **206.126** The Relationship between Verbal Fluency, Language and Executive Musical Working Memory in Children with Autism Spectrum Disorder

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Background: Verbal fluency requires the ability to generate semantic responses to a target category. Studies have found both intact and impaired verbal fluency skills in children with autism spectrum disorder (ASD). Yet, deficits in executive functioning, social communication and often receptive and expressive language are well documented. Language skills may play a role in verbal fluency and executive functioning. However, the role of language proficiency in the relationship between verbal fluency and executive functioning in children with ASD is not well known. Language skills and executive functioning in children with typical development (TD) show improvement following musical training. Given musical strengths of children with ASD, we study the relationship between verbal fluency and executive function as used when playing music, i.e., executive musical working memory.

Objectives: To examine the relationship between verbal fluency and executive musical working memory of children with ASD with low and high levels of language skill.

Methods: Children with ASD (*N*=30) ages 8 to 12 years old participated in the study. They completed the Verbal Comprehension Index (VCI) of the Weschler Intelligence Scale for Children (WISC-V), and were divided into low (VCI <75, *n*=16) or high VCI groups (VCI > 75, *n*=14). Within each group, we examined the relationship between verbal fluency, as measured on the Delis-Kaplan Executive Function System (DKEFS) Category Fluency condition, and executive functioning, as measured by performance on an executive musical working memory task, measured as the total of their combined performance when judging whether 2 consecutive sequences of musical pitches were the same or different (calculated as Hits minus False Alarms ratio).

Results: DKEFS Category Fluency raw scores in the ASD group with lower VCI were significantly related to performance on the executive musical working memory task $F(2,13)=6.032$, $p=.014$, when accounting for age, with higher scores on one task associated with higher scores on the other task. In contrast, DFEKS Category Fluency in the ASD group with higher VCI was not significantly related to performance on the executive musical working memory task $F(2,11)=.881$, $p=.442$. We repeated analyses dividing groups with a cut-off VCI at 70 instead of 75 and found the same pattern of results.

Conclusions: These results suggest that language levels (VCI) influence the relationship between verbal fluency and executive functioning (executive musical working memory) in children with ASD, such that this relationship is stronger for children with ASD with language impairments (lower VCI levels) than those without language impairments. Findings shed light on the debate over verbal fluency abilities in children with ASD, suggesting that VCI and executive functioning skills should be considered when assessing verbal fluency, given the observed variation according to language levels. Finally, these results have implications for treatment for language and social communication in children with ASD and language impairments. Children with ASD and lower levels of VCI, as opposed to higher levels of VCI, may benefit more from musical training, known to improve verbal skills and auditory working memory in children with TD, to enhance their verbal fluency and social communication abilities.

127 **206.127** The Role of Communication Factors in Bolstering Early Speech Production Growth for Young Children with Autism: A Moderation Model

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Background: Many children with autism spectrum disorders (ASD) are nonverbal in toddlerhood and preschool years (Anderson et al., 2007), often presenting with delays in gesture production (Iverson & Wozniak, 2007) and joint attention (Wetherby et al., 2007). Previous longitudinal findings have suggested nonverbal IQ is a strong predictor of later language, whereas Fusaroli et al. (2018) demonstrated that expressive language is the stronger predictor when examined with nonverbal IQ. Previous research has also demonstrated that joint attention is a predictor of later language, but primarily with standardized assessments as outcomes (Pickard & Ingersoll, 2015; Yoder et al., 2015). This study provides a unique contribution by including both social communication and early language samples in a moderation model predicting vocabulary growth.
Objectives: This study aimed to identify the unique roles of social communication elements including emotion and eye gaze, communication, and gesture in moderating growth in spoken language production between toddlerhood and pre-school.

Methods: A subset of secondary data collected longitudinally through the Autism Phenome Project (APP,*N*=55, 42 males, mean age at initial visit=33.9 months, SD=5.5) was utilized. The APP intends to define clinically meaningful ASD subtypes based on behavioral and biological data, specifically evaluating children immediately following ASD diagnosis at age 24-40 months and follow-up evaluations three years later. A simple linear regression analysis was performed for TWT at the age of diagnosis to predict growth in total word types (TWT) three years later. Subsequently, we performed multiple linear regression models incorporating the interaction effects of TWT and Social Composite scale elements from the *Communication and Symbolic Behavior Scales, Developmental Profile* (CSBS-DP; Wetherby & Prizant, 2002) Behavior Sample Social Composite scores (see Table 1).

Results: TWT at toddlerhood positively predicted TWT at preschool age in a simple linear model. This association remained significant with the addition of Communication scale performance and its interaction with TWT in toddlerhood to the model, suggesting when controlling for performance on the Communication scale and its interaction, an increase in TWT at toddlerhood by one SD above the mean increased TWT in preschool age by 0.714 SDs. The significant interaction suggested a moderator effect impacting toddler vocabulary growth (see Table 2). This was consistent with a significant negative moderation of the linear association between TWT in toddlerhood and preschool age by the performance on the communication scores in toddlerhood. Similarly, Social Composite score in toddlerhood negatively moderated the linear association between TWT in toddlerhood and preschool age. Performance on the Gesture scale and the Emotion and Eye Gaze scale did not significantly moderate this association.

Conclusions: These findings distinguish communication factors including rate, behavior regulation, social interaction, and joint attention as interactional parameters that uniquely explain the strength of relationship between TWT in toddlerhood at preschool age. The positive association between TWT at time of diagnosis and three years later was stronger in children with lower Communication scale scores in toddlerhood. Studies targeting social communication skills should focus on these underlying elements *directly* since indirect, growth effects in other social communication areas may co-occur.

128 **206.128** The Role of Early Social Motivation in Explaining Variability in Useful Speech in Young Children with ASD

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Background: Abundant research has confirmed that children with ASD show deficits in both expressive and receptive vocabulary early in their development. However, the mechanisms that contribute to early language learning difficulties remain poorly understood. Social motivation may lead to relatively more processing of input which leads to more receptive language, which in turn, provides the semantic basis for expressive language.
Objectives: We tested the extent to which receptive language level measured at the mid-point of a 12-month intervention mediated the pathway

from baseline, pre-intervention, social motivation to expressive language level at the end-point of the study.

Methods: Seventy children with ASD between 15 and 30 months from a larger longitudinal randomized study of intensive treatment for toddlers with ASD were included in the current study. Seventeen participants from the larger study were excluded due to missing data. The larger study evaluates the effects of intervention intensity and style on the developmental quotients of young children with ASD. Social motivation at study entry was measured by the Social Approach subtest raw score from the Pervasive Developmental Disorder Behavioral Inventory (Cohen & Sudhalter, 1999). Receptive language level was measured 6 months after study entry (mid-point) and expressive language was measured 1 year after study entry using age equivalency scores from the Mullen Scales of Early Learning (Mullen, 1995).

Results: The confidence interval for the indirect effect of initial social motivation on endpoint expressive age equivalency score through midpoint receptive language excluded zero, and therefore, is significant (unstandardized *ab* = 0.1058, 95% CI = [.0090, .1990]; see Table 1 and Figure 1). Style or intensity of treatment did not moderate the mediated effect of mid-point receptive language on the association between baseline social motivation and end-point expressive language (all *p*s > .05).

Conclusions: The findings support the hypothesis that mid-point receptive language partially explains the association between early social motivation and later useful speech. This is consistent with an input-processing deficit explanation of language deficits in children with ASD. Future work will assess whether this mediated association occurs because social motivation leads to communication that elicits more input or whether social motivation leads to more processing of existing input. Both could explain an association between social motivation and receptive language (i.e., the a path of the indirect association).

129 **206.129** The Role of Linguistic Input in Person-Reference of Preschoolers with ASD

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Background: Numerous studies have examined the effects of linguistic input on children with autism's expressive language (e.g.,Fusaroli et al.,2018). In the domain of person-reference, or how a speaker refers to themselves and their conversational partner: using pronouns (e.g., I, you) or nouns/names (e.g., kiddo, mom, John), one study showed that the parental input of toddlers at high risk for autism was characterized by a higher use of the child's name, especially in the context of attracting the child's attention, compared to the input of low-risk toddlers (He et al.,2018). Furthermore, studies have provided evidence for children with autism's avoidance of pronouns and preference for using their own name (e.g.,Shield et al.,2015). Nevertheless, no study has directly examined the effect of parental input on person-reference in autism.
Objectives: We aimed to examine the relation between preschoolers with autism and their parents' person-reference. We focused on amount of person-referential language and on preference for one form of reference, pronouns, over the other, nouns/names, both concurrently and across time.

Methods: We collected language samples from children with ASD (N=38; 7female) and their parents during free play at three time points: T1:*M*=27.13months, T2:*M*=39.63, and T3:*M*=51.68. The samples were transcribed following standard SALT transcription procedures, and measures of person-reference were extracted for both children and their parents: proportion of person-reference words out of total words to reflect amount of person-reference, and proportion of pronouns and of nouns/names out of total words, and proportion of pronouns used over total number of person-referential words (pronoun and nouns/names) to capture the trade-off between the two forms of referential language. At each time point, children's ASD diagnosis was confirmed with the ADOS, and their cognitive and language ability was assessed with the Mullen(**Table-1**).

Results: There were no significant correlations between children's person-referential language out of total number of words and that of their parents either concurrently or across time points. Children used more pronouns than nouns/names out of total words at Time 2 and 3, and the proportion of pronouns out of total person-referential words did not change over time (**Table-2**). Parents used significantly more pronouns at each time point as well, and their preference strengthened across time ($\chi^2(2)=7.913, p=.019$). There were no significant correlations between children's proportion of pronouns and that of their parents either concurrently or across time after controlling for children's language ability and correcting for multiple comparisons.

Conclusions: In contrast to past research showing general influence of linguistic input on expressive language in autism, we found no associations between parents' and children's person-reference either in amount or in preference for one form of reference over the other. Children used significantly more pronouns and this preference did not change across time. These results combined with the children's relatively strong expressive language as evidenced by their Mullen scores suggest that the factors contributing to the use of person-reference in ASD may be primarily non-linguistic after a certain baseline language ability is achieved. These findings can inform clinical advice to parents about ways of addressing their children with ASD.

130 **206.130** The Social-Communicative Abilities in Young Children with Autism Spectrum Disorder: Profile and Prediction of Language

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Background:
Previous studies have shown that early social-communicative abilities (i.e., joint attention, imitation) plays an important role for development of language ability in young children with autism spectrum disorder (ASD). Regarding early language ability is related to long-term outcomes and adaptive function in children with ASD. Thus, this study examines the profile of social-communicative abilities and predictors of language development in young children with ASD.

Objectives:

This study is planned to compare the abilities of joint attention and imitation in young children with ASD to young children with developmental delays (DD). In addition, we also examine the role of joint attention and imitation in language development among young children with ASD and with DD.

Methods:

There are 122 young children at 25 and 36 months of age, including 61 young children with ASD and 61 young children with DD. The Screening Tool for Autism in Two-Year-Olds, Taiwan version (T-STAT) was modified and used for measuring joint attention and imitation, including initiating joint

attention (IJA), responding joint attention (RJA), object imitation, and manual imitation. In addition, the Mullen Scales of Early Learning (MSEL) and Communication Subscale from Adaptive Behavior Assessment System -II (ABAS-II) were used to measure language abilities and communication adaptation respectively.

Results:

The results of this study showed that joint attention was core deficits in young children with ASD, especially for IJA. However, the imitation of young children with ASD was delayed instead of deficit. In addition, the profile of joint attention and imitation of young children with ASD and young children with DD could be separated. The poorest ability was IJA in young children with ASD while the poorest ability was the manual imitation in young children with DD. Both joint attention and imitation were significantly related to language ability in young children with ASD. However, only full-IJA and imitation were significantly related to language abilities in young children with DD. For young children with ASD, manual imitation was the strongest predictor of receptive language, expressive language, and communication adaptation. And, partial-IJA was the strongest predictor of expressive language. In addition, RJA was the strongest predictor of receptive language and communication adaptation. For young children with DD, only manual imitation was the strongest predictor of expressive language.

Conclusions:

This study revealed that IJA is robust challenge for young children with ASD again. This study showed that the profile of early social-communicative skills of young children with ASD and young children with DD could be different. In addition, the findings also supported that early social-communicative skills were related language in young children with ASD and with DD. However, early social-communicative skills contributed significantly development of language abilities in young children with ASD instead of young children with DD. The early social-communicative episodes provided interactive experiences and opportunities for young children with ASD and with DD to learning. Thus, it could enhance their language development through the mapping process. The results of the study provided implications for the early diagnosis and early intervention in young children with ASD.

131 **206.131** The Use of Formal Language As a Sign of ASD in Undiagnosed Children Attending Typical Schools

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Background: 'Diglossia' refers to the two varieties of the same language, which are used, under different conditions, by the same speakers within a community. In the 'diglossic' languages, we distinguish a common, colloquial or Low variety – L spoken in everyday situations and a more formal or High variety – H, reserved for specific contexts. The regular use of H as a medium of ordinary conversation is felt to be pedantic or artificial to the community. The Arabic language is a diglossic language with an L variety that varies significantly among the Arab countries, and an H-variety (Fushaa) common among all Arab speaking and commonly used in school books (but not in the teaching process by the teacher), in the Mosque, in most of the TV Arab cartoons and kids' series (e.g. sesame street was presented in Fusha), and in "serious" programs in TV.
Objectives: This study explores the clinical observation that children with ASD tend to use the "fushaa" more often than their neurotypical counterparts. We hypothesised that this feature could represent a reliable red flag for the identification of verbally fluent children with ASD that go undiagnosed.

Methods: In an observational cohort study design we screened through their teachers all the children with first language Arabic, fluent speaking children attending Arabic Kinder Garden in two of the 5 governorates of the state of Kuwait. The identified subjects were assessed for the use of the "fushaa" during audio-recorded structured tasks lasting 30 minutes. The corroborated cases were then further assessed for the extend of exposure to the "fushaa", their verbal IQ (PPVT-R), the presence of ASD (Social Communication Questionnaire and the ADOS-2), as well as for temperamental specific features (Children's Behavioral Checklist).

Results: Up to November 2018, we were able to screen 36 KGs from a total of 61, i.e. 3045 children out of 5000 (60.9%). Teachers identified 26 children as using "fushaa" in everyday life, 22 of whom where corroborated fushaa users (0,72%), and we got parent permission to assess 15 of them (68.2%). From these 11 children (73.3%) were classified as ASD cases.

Conclusions: The use of "fushaa" by young children in their everyday activities is uncommon. The high probability of these children to be classified as ASD establishes the use of this phenomenon as a significant red flag for ASD in children that they are very able and thus they have been missed. The results should be replicated in other diglossic environments to assess if the phenomenon is not limited to Arab speakers only, shedding light to the way able children with ASD acquire language.

132 **206.132** Understanding Pediatric Quality of Life in Autism Spectrum Disorder: Variability in Dimensions in Children with Varying Language Levels

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Background: Expressive language abilities vary widely in children with autism spectrum disorder (ASD); studies estimate that as many as 30% do not acquire spoken language. Compared to verbal children, minimally verbal (MV) children encounter different challenges that may affect quality of life. There is an urgent need for studies to explore whether existing pediatric quality of life scales are appropriate for use in children with ASD across language levels in order to promote investigations of quality of life that inform development of interventions appropriate for children of different ability levels.
Objectives: To compare the factor structure of the Pediatric Quality of Life Inventory (PedsQL) in MV children with ASD to children with phrase speech and children with fluent speech.

Methods: A sample of 2,380 children was drawn from the Autism-Speaks Autism Treatment Network (ATN) registry using the following criteria: at least 5 years-old at assessment, with ADOS and PedsQL data available. A confirmatory factor analysis did not support the five PedsQL subscales (RMSEA>0.07 or CFI<0.9) for any language group (defined using ADOS module: MV=Module 1, Phrases=Module 2, Verbally Fluent=Module 3 or 4). Thus, an exploratory factor analysis (EFA) was performed in each language group using Quartimin rotation on a polychoric correlation matrix.

Velicer's minimum average partial test was used to determine the number of factors in each solution. Absolute values of standardized regression coefficients ≥0.4 were considered in the factor loadings. In the case of split loadings, the factor with the highest absolute value loading was chosen.

Results: EFA yielded three factors for the MV and Phrases groups and four factors for the verbally fluent children. Internal consistency fell below the acceptable cut-off (alpha=0.7) for one factor in each of the MV and Phrases groups. Across all three language groups, a factor comprised of 5 of the 8 original physical items emerged. Results from MV and Phrases groups also yielded a factor comprised of items positively loading from the Emotion and negatively loading from the Social problems scales, suggesting a factor reflecting negative experiences. In contrast, negatively loading Emotion items and positively loading School items comprised a factor for verbally fluent children that may reflect positive experiences. Verbally fluent children also showed negative loadings of Physical and positive loadings of Social items, possibly reflecting an adaptive function factor.

Conclusions: The original PedsQL factor structure was not supported in the present sample of children with ASD. Furthermore, exploratory factor analyses provided evidence for different empirically-derived scales for children of varying language levels. Taken together, results suggest that the existing PedsQL scales may not be appropriate to assess quality of life in children with ASD and highlight a need for research considering dimensions of quality of life for children with ASD with varying ability levels. Further analyses will be conducted to explore how other factors (e.g., severity of restricted and repetitive behaviors), in addition to language, relate to quality of life on these empirically derived scales.

133 **206.133** Use of a Newly Developed Japanese Version of the Test of Pragmatic Language to Identify Children with Autism Spectrum Disorder from a Different Angle Than the Children's Communication Checklist-2

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Background: Pragmatic impairment is a core characteristic of autism spectrum disorder (ASD). However, except for the Children's Communication Checklist-2 (CCC-2), few tests have been developed to evaluate pragmatic disability. As the CCC-2 is a parent report instrument, it cannot obtain data on language performance directly from children. To compensate for this limitation of the CCC-2, the Test of Pragmatic Language (TOPL) is administered to children. However, unfortunately, the TOPL cannot identify pragmatic language impairment better than the CCC-2. Therefore, in the present study, we developed a Japanese version of the TOPL (JTOPL) by devising 20 items regarding the comprehension of metaphors, irony, indirect requests, and control of politeness with another seven items regarding the status of the listener and selection of addressing form, among others.

Objectives: The purpose of the present study was to investigate whether the JTOPL reflects development when administered to elementary school children and discriminates between children with and without pragmatic impairment.

Methods: The JTOPL was administered to 102 typically developing (TD) elementary school children (48 boys, 54 girls; mean age: 117.58 months; standard deviation [SD]: 21.18). None showed Social Communication Questionnaire (SCQ) score over the cutoff point of 15. The mean number of correct responses to 27 items on the JTOPL was calculated for each of the six grades. The JTOPL was also administered to 11 elementary school children with ASD (10 boys, 1 girl; mean age: 116.45 months; SD: 19.74). The children with ASD were then compared with 54 randomly chosen TD children (48 boys, 6 girls; one per grade in terms of number of correct responses on the JTOPL). In addition, the correlation between the number of correct responses on the JTOPL and the general communicative competence (GCC) component of the CCC-2 was examined for TD children and children with ASD.

Results: The mean number of correct responses for each grade ranged from 21.6 to 24.8. These values did not differ in any pair of subsequent grades. The mean number of correct responses of the younger half of TD children was significantly lower than that of the older half ($p<.001$). The 11 children with ASD had significantly fewer correct responses than the 54 TD children ($p<.01$). No significant correlation was found between the number of correct responses on the JTOPL and the GCC component for TD children or children with ASD.

Conclusions: The results indicate that the JTOPL reflects development through elementary school age; however, a ceiling effect was seen in terms of the numbers of correct responses. To confirm the validity and reliability of the JTOPL, data from preschool children are needed. The JTOPL could discriminate between children with ASD and TD children while providing a different point of view from that of the CCC-2. While the CCC-2 focuses on inappropriate initiation, stereotyped language, use of context, and nonverbal communication, the JTOPL focuses mainly on figurative language comprehension reaching politeness control and the like. This difference might have led to the lack of correlation between the two instruments.

134 **206.134** Who Are the Bilinguals in the Autism Literature? a Systematic Review

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Background:

Many children with autism spectrum disorder (ASD) are growing up in bilingual environments (Fahim & Nedwick, 2014), yet only limited research has explored how ASD and bilingualism intersect (e.g., Drysdale et al., 2015; Hambly & Fombonne, 2012). Evaluating and synthesizing the literature on the intersection of ASD and bilingualism is complicated by bilingualism's multifaceted operationalization (e.g., language proficiency, history, and contexts; Surrain & Luk, 2017) and ASD's heterogeneity (e.g., variability in language profiles; Tager-Flusberg, 2016).

Objectives:

We systematically review the labels, descriptions, and language framing bilingualism and ASD within the autism literature. By documenting the variability in describing language backgrounds and ASD characteristics, we hope to highlight the nuances embedded in understanding the interplay between the two variables. This objective is required to advance knowledge about ASD for children from diverse language backgrounds, as bilingualism is not necessarily a choice for some individuals with ASD.

Methods:

We searched six databases (ERIC, PsycINFO, Academic Search Premier, Education Abstracts, Linguistics and Language Behavior Abstracts, and Web

of Science) using keywords (*autis**or *ASD*or *asperger**or *pervasive develop**)AND (*biling** or *multiling**or *"language learner*"*or *"second language")*. This electronic search identified 319 articles (see Figure 1 for our identification process); 170 articles from a previous, pilot search were added, yielding 489 articles in total. After removing duplicates, 289 articles were identified and screened based on titles, abstracts, and keywords. Included studies met three inclusion criteria. First, studies were conducted with stakeholders in the field of autism (e.g., children with ASD, parents, service providers). Second, we included studies with participants who spoke more than one language. Reviews were included only if they discussed literature concerning both stakeholders in the field of autism and participants who were multilinguals. Third, papers were published in English and were peer-reviewed. Ninety-six papers fit these criteria and were included in the final database. For this abstract, we assessed twelve full-text articles and coded labels and descriptions used to characterize participants.

Results:

In this preliminary analysis, twelve studies (seven qualitative, four quantitative, and one review) included 199 participants. About half of the empirical studies were conducted in North America (55%). When describing the language backgrounds of bilingual participants, nine out of eleven studies described language proficiency; however, only two used subjective ratings and/or objective assessments to measure proficiency. Three studies used learning labels such as "English as a second language". Two papers used a language pair label (e.g., "English-Chinese bilingual"). No papers described the participants' language dominance (e.g., "nearly balanced bilingual"). When describing the participants with ASD, seven out of eleven studies (64%) did not use any assessments to diagnose or confirm ASD. Three empirical studies (27%) reported nonverbal/verbal functioning of the participants. No studies described the severity of ASD symptoms.

Conclusions:

The substantial variation in the descriptions of language and autism-specific characteristics across studies on bilingualism and ASD calls for more consistent and transparent reporting of participant characteristics. Clarity in reporting is critical to building our understanding of how bilingualism and ASD intersect in behavioral outcomes.

135 **206.135** Wugz, Wugs, or Wugzez? Morpheme Generalization in TD Children and Children with ASD

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Background: Using the plural and past tense morphemes correctly with novel words (e.g., wugs, blicked) indicates that children have internalized these grammatical patterns of English (Berko, 1958). Typically developing (TD) children demonstrate this knowledge in preschool; however, children with Autism Spectrum Disorder (ASD) appear to show severe delays. In particular, researchers have reported that 4-year-olds with ASD produce plurals with novel nouns less than 25% of the time, and regular past tense with novel verbs less than 10% of the time (Park et al., 2012). The developmental origins of this delay are unclear; for example, whether it is rooted in lexical versus grammatical difficulties.
Objectives: The current study uses a longitudinal design to address two questions: (a) Do older children with ASD show better performance on the 'Wug' test? (b) How is their performance on this test predicted by their vocabulary and grammatical talk when they were preschoolers?

Methods: Fifty-eight children between the ages of five and seven years, 29 typically developing (TD) children (M= 5.57 years, SD=.33) and 19 children with ASD (M=6.47 years, SD=.51) participated in the Wug test. Two years previously, they had also been recorded during 30-minute naturalistic mother-child interactions, and their speech was transcribed and coded for noun, verb, plural, and past tense usage. At that time, they were matched on language ability. Currently the TD group outperforms the ASD group on the Test for Auditory Comprehension of Language (TACL) ($t(48)=29.274, p<.001$).
For the Wug test, the children were shown a picture and told, "This is a wug. Now there are two of them. There are two___." Or for verbs "This man knows how to mot. He is motting. He did it yesterday. Yesterday he ___". The current study used seven nonwords to elicit regular plural endings (e.g., wug, gutch, and nizz) and six to elicit regular past tense forms (e.g., mot, rick, and gling).

Results: During the Wug test, the TD group produced significantly more regular plural ($t(47)=2.55, p=.014$) and past tense forms ($t(47)=2.95, p=.005$) than the ASD group. Group means, shown in Figure 1, are markedly higher, though, than those reported by Park et al. (2012). Performance for both groups with plurals was positively correlated with their use of plurals (but not noun types or tokens) in spontaneous speech two years earlier (TD group: $r=.528, p=.036$; ASD group: $r=.503, p=.168$). In contrast, performance for both groups with past tense was positively correlated with their use of verbs (but not past tense morphemes) in spontaneous speech two years earlier (TD: $r=.486, p=.007$; ASD: $r=.584, p=.011$).

Conclusions: While the ASD group still lagged behind the TD group, their ability to generalize the plural and past tense morphemes to novel nouns and verbs was much higher than reported for preschoolers (Park et al., 2012), indicating that their grammatical development is continuing. Interestingly, while their knowledge of plurals seems linked to their earlier grammatical usage, their knowledge of past tense seems more closely linked to their earlier lexical usage, suggesting that noun and verb morphology may rely on different aspects of knowledge during acquisition.

136 **206.136** 'Autistic'-Sounding: A Latent Class Linear Mixed Modeling Approach to Parsing Heterogeneity in Children's Natural Conversations Using Acoustic Properties of Speech

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Background:
Behavioral heterogeneity is a persistent challenge for researchers and clinicians aiming to develop evidence-based social communication interventions for children with autism spectrum disorder (ASD), and to pinpoint the condition's biological bases. Even after attempting to manufacture homogeneity by restricting variables such as age and IQ within study samples, children with ASD still behave very differently across contexts (e.g., consider a standardized vocabulary test versus playground conversation). This study uses a latent growth curve approach to parse acoustic heterogeneity in the spontaneous speech of children with ASD.

Objectives:

Test whether patterns of 'ASD'-like utterances characterize subgroups of children with ASD over the course of a short, naturalistic conversation

with a friendly stranger.

Methods:

Language samples from 35 verbally fluent children with ASD were drawn from an unstructured 5-minute 'get-to-know-you' conversation with a novel confederate who was not an autism expert. All children had IQ estimates in the average range (>75), and were aged 7-16.9 years. Children produced a total of 2,408 useable utterances (mean=68.8 utterances each). Each utterance was classified as 'ASD' or 'TD' using a machine learning classifier with 5-fold cross-validation, developed on the acoustic properties of speech produced by a larger matched sample that included both diagnostic groups (sample described in Cho et al., this conference). The number of 'ASD'-like utterances produced over the course of the conversation (~1-minute windows) was tested for the presence of latent classes ('lcmm' in R). Class member characteristics were compared using simple linear models.

Results:

A 2-class model provided the best fit for the data (as compared to 3 or 4 classes) and revealed evidence of homogeneous subgroups with (1) Increasing (N=23) or (2) Steady (N=12) numbers of ASD-like speech utterances over the course of the conversation (Figure). Group intercepts differed significantly from one another, with the Increasing group producing more ASD-like utterances at the start of the conversation (coefficient: -2.08, Wald test=-2.40, p=.02). Members of the Increasing subgroup produced growing numbers of utterances classified as 'ASD' over time (Coefficient=.49, Wald test=5.97, p<.0001), while the relationship between time and ASD-like utterances trended negative in the Steady subgroup (Coefficient=-.18, Wald test=-1.65, p<.10. Class members did not differ on age, sex ratio, nonverbal IQ estimates, ADOS-2 calibrated severity scores, average turn length, or the number of utterances produced at the group level, but did differ on verbal IQ scores (Steady > Increasing; estimate=11.58, t=2.97, p=.003) and word count (Steady < Increasing; estimate=-150.58, t=-2.88, p=.007).

Conclusions:

Machine-learning classification of speech utterances renders it possible to parse heterogeneous samples into more homogeneous subgroups that dynamically change over the course of a conversation. In this exploratory study, we found two subgroups of children that sound more or less 'ASD-like' over time, with the more talkative group sounding increasingly atypical over 5 minutes. Future research using an expanded sample will include language-based analyses within each class (current results are based on acoustic properties only). This 'profiling' approach holds promise for identifying subgroups that benefit from specific interventions and stands to advance the goal of personalized medicine.

137 **206.137** Individuals with Higher Levels of Autistic Traits Show More Lexically-Guided Perceptual Learning

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Background:

Speech is inherently variable as people pronounce words differently depending on, e.g., accent, dialect, gender or age. To cope with this variation, in our social interactions, we continuously tune into individual speakers. More specifically, we employ lexical and phonotactic knowledge to decode ambiguous speech sounds; and we adjust our phonetic categories (in broad terms: our expectations for how phonemes ought to sound) to include such ambiguous sounds. This phenomenon, referred to as lexically-guided perceptual learning is important for our ability to communicate effectively.

Lexically-guided perceptual learning is also relevant to a family of recent theories of autistic perception formulated within the Bayesian and the predictive-coding computational frameworks. These accounts propose that autistic individuals present fundamental limitations in calibrating their perceptual systems to current environments by using knowledge accrued from recent sensory experiences. Previous studies have examined such limitations focusing on non-linguistic domains. In this study, we examine whether such limitations are also present in speech perception. If so, we should predict that autistic individuals and individuals with higher levels of autistic traits present less pronounced lexically-guided perceptual learning effects compared to individuals with lower levels of autistic traits.

Objectives:

We sought to test this prediction by examining the relationship between lexically-guided perceptual learning and autism traits in adults.

Methods:

In an ongoing study, we tested 47 adults (22 females) aged between 18 and 64 (M = 26.07; SD = 10.80). Each participant was administered a lexically-guided perceptual learning paradigm from an existing study (Drozdova et al., 2015) and subsequently completed the Autism Quotient questionnaire.

The lexically-guided perceptual learning paradigm had an 'exposure-test' design. Participants were first exposed to a short story containing an ambiguous sound from the [l/r] continuum. Each participant heard one of two versions of the story (learning conditions), in which the ambiguous sound replaced either all [r] sounds or all [l] sounds. Next, participants completed a phonetic-categorization task on a continuum of ambiguous [l/r] sounds.

We analysed the responses in the phonetic-categorization task with mixed-effect statistical modelling, and used the number of responses that were consistent with the learning condition as the dependent variable, similar to the original study. Here, the fitted statistical model also included effects of autistic symptomatology.

Results:

Analyses showed that, on average, our participants presented reliable lexically-driven perceptual learning effects, which, similar to the original study, manifested in the first levels of the [l/r] continuum. Contrary to our prediction, individuals with higher levels of autistic traits presented more pronounced lexically-driven perceptual learning effects than individuals with lower levels of autistic traits.

Conclusions:

The patterns of individual variability in lexically-driven perceptual learning effects in our study are in the opposite direction to our prediction based on recent Bayesian and predictive-coding accounts of autistic perception. Our results challenge these accounts to accommodate individual differences in speech processing.

Our results are consistent with accounts suggesting enhanced perceptual abilities in autistic individuals or individuals with higher levels of

autism traits. Our current work involves explicitly examining differences between autistic and neurotypical individuals in lexically-driven perceptual learning.

Poster Session
207 - Diagnostic, Behavioral, Sensory and Intellectual Screening and Assessment
5:30 PM - 7:00 PM - Room: 710

138 **207.138** Speech Abnormalities Associated with ASD in Children with Vision Impairment

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Background:
Vision impairment affects child development, including social communication development (Vann et al., 2015; Hobson, 2005). Research reveals an overlap between the profiles of social behaviors in children with vision impairment and those characteristic of children with ASD (Do et al, 2017(. In addition, speech abnormalities such as echolalia, repetitive and stereotype use of language and part of the "autistic- like" features that are common in children with vision impairment.

Objectives:

The main purpose of this research was to characterize developmental profiles of pre-school children with vision impairment. Another objective was to observe the prevalence of unique speech patterns and speech abnormalities in this group.

Methods:

Thirty-two pre-school children participated this research. They were three to six years old, and all had a diagnosis of significant visual impairment. All of the children were recognized by the ministry of Education as vision impaired and received educational aid by an expert in vision education. The level of vision impairment varied from moderate to blind.
All the children in this research had a compressive psychological evaluation. The evaluation included both developmental evaluation tools that are common at the general population and special designed tools for children with vision impairment. To assess general development level the Mullen Scales of Early Learning (MSEL) and the Reynell-Zinkin scales (RZS) were used. Adaptive behavior skills were measured by Vineland Adaptive Behavior Scales, third edition (Vineland-3) and communication and social skills were assed with the Childhood Autism Rating Scale (CARS2) and the Visual Impairment and Social Communication Schedule (VISS) (Absoud, Parr, Salt & Dale, 2011).

Results:

Children with vision impairment show a variety of Speech abnormalities such as echolalia, repetitive and stereotype use of language. Those abnormalities occurred in all levels of development in children with vision impairment.

Conclusions:

The fact that speech abnormalities are common in visually impaired children regardless of the developmental level or the severity of the visual impairment suggests that the use of repetitive language may be an adaptive behavior rather than an abnormal one. This findings require a further research**.**

139 **207.139** Measures of ASD Severity in Children with Autism and Other Developmental Delays Are Related to Sociodemographic Factors

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Background:
Previously we reported that family income, maternal education, and maternal race decreased the specificity of standardized parent-report autism spectrum disorder (ASD) screening instruments. Additional study is needed to examine how both maternal and clinician reports of ASD symptom severity are related to sociodemographic factors, as well as the correspondence between maternal and clinician reports of ASD symptom severity.

Objectives:

To examine associations between sociodemographic characteristics and scores on instruments that rated child ASD severity completed by mothers and study clinicians, as well as to assess the correspondence between ASD severity scores obtained from mothers and clinicians.

Methods:

We used data from the Study to Explore Early Development (SEED), a multi-site case-control study exploring the phenotypes and determinants of ASD. Participants for this analysis were aged 2-5 years in 2007-2016 and were recruited through educational and healthcare organizations providing services to children with ASD and other developmental delays (DD). Analyses were limited to children whose birth mothers were the reporters. Demographic data were collected in a standardized maternal phone interview. Perspectives on child ASD severity were collected from the mother via the Social Responsiveness Scale (SRS) and from the study clinician using the Ohio State University Autism Rating Scale (OARS). The OARS was completed after a direct observation of the child, as well as a review of all other information available on the child.

We used analysis of variance to examine the relationship between each measure of symptom severity and the sociodemographic factors. Both models, one for the SRS, another for the OARS, included the following independent variables: family income, maternal age, maternal education, maternal race, maternal ethnicity, language spoken in the home, and child sex. To assess the correspondence of maternal and clinician ASD

severity estimates, Pearson correlations were obtained for the OARS with the SRS. Tests for collinearity indicated this was not a concern for these models.

Results:

Lower education (F=6.04, p<.00), lower income (F=6.26, p<.00) and non-white race (F=7.84, p<.00) were associated with higher severity scores on the SRS. Lower education (F=7.62, p<.00), non-white race (F=11.04, p<.00), male sex (F=50.74, p<.00) and younger child age (F=7.53, p<.00) were associated with higher scores on the OARS. The OARS and SRS were strongly correlated (r=.71).

Conclusions:

These results indicate that non-white mothers and those with low education and income report elevated levels of ASD severity in their children with ASD or DD. The strong agreement between maternal and clinician reports of severity of child symptoms suggests the reports of symptom severity reflect true differences in child behaviors. Nevertheless cultural and educational impacts on maternal reporting on self-administered questionnaires cannot be entirely ruled out. Future research is needed to determine the impact of different maternal severity thresholds on access to services.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

140 **207.140** Measuring Improvements in Social Functioning Following Intervention in Young Children with Autism Using the Stanford Social Dimensions Scale

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Background: Impairments in social functioning are a hallmark of autism spectrum disorder (ASD). Many interventions target a range of different components necessary for social functioning. However, currently available measures provide limited sampling of discrete social dimensions, and their capacity to detect change during and after interventions is currently not well established. The Stanford Social Dimensions Scale (SSDS) is a tool currently under development aiming to provide assessment of constructs broadly related to social constructs of the Research Domain Criteria approach such as as understanding of mental states and others' emotional expressions, affiliations and social motivation, social communication, and unusual social approach. The measure has been specifically designed for use in clinical trials to detect changes in social functioning over time. Therefore the SSDS might be particularly well suited as an outcome measure following early autism interventions that target different aspects of social functioning such as Pivotal Response Treatment (PRT) and other naturalistic developmental interventions.
Objectives: The current investigation aimed to determine whether the SSDS is sensitive to change following interventions targeting social skills for young children with ASD. Results reported here are a preliminary part of ongoing treatment studies.

Methods: To date, twelve participants (8 male, 4 female) aged 27 - 84 months (mean: 54.92) participated in the study. Six participants were randomly assigned to receive early intervention focused specifically on enhancing social motivation and reciprocity; 6 were assigned to a wait-list control group and continued stable community-based treatments. Parents filled out the SSDS at baseline and at the end of the study. Repeated measures ANOVA were utilized to assess changes in SSDS scores from baseline to follow-up.

Results: At baseline, the SSDS exhibited excellent internal reliability (Cronbach's alpha = .93). The groups did not differ significantly in IQ at baseline ($t(6.988)=.032$, $p = .975$). and total SSDS scores were also consistent between participants in the treatment and control groups ($t(9.804)=-.240$, $p = .815$). For the participants who received treatment, SSDS scores in the domain of understanding of mental states and others' emotional expressions increased significantly from pre- to post-treatment ($F(1) = 7.893$, $p = .038$, $\eta^2 = .612$), suggesting improvement in measured ability to perceive and interpret social signals. No changes in this domain were observed in the control group ($F(1) = .241$, $p = .644$, $\eta^2 = .046$). There were no significant differences from baseline to follow-up in either group on the total SSDS score and in the other subdomains.

Conclusions: Following intervention targeting different social skills in young children with ASD, improvement was observed in their understanding of mental states and others' emotional expressions based on the Stanford Social Dimensions Scale. Findings reported here provide very preliminary evidence for the utility of the SSDS as a sensitive measure for measuring different aspects of social functioning following social intervention in young children with autism. Results from this investigation including additional data from ongoing work will be discussed.

141 **207.141** Mental Health and Cognitive Outcomes in High-Risk Infant Siblings Followed Longitudinally to Ealry Adolescence: Patterns and Predictors

A. Solish[1], *J. A. Brian*[1], *I. M. Smith*[2], *J. H. Leef*[3], *L. Senman*[4], *N. Garon*[5], *T. Vaillancourt*[6], *W. Roberts*[7], *P. Szatmari*[8], *C. Roncadin*[9], *L. Zwaigenbaum*[10] *and S. E. Bryson*[11], *(1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (3)Department of Applied Psychology and Human Development, University of Toronto & Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (4)Autism, Bloorview Research Institute, Toronto, ON, Canada, (5)Mount Allison University, Sackville, NB, Canada, (6)University of Ottawa, Ottawa, ON, Canada, (7)isand, Toronto, ON, Canada, (8)The Hospital for Sick Children, Toronto, ON, Canada, (9)Autism Spectrum Disorder Service, McMaster Children's Hospital - Hamilton Health Sciences, Hamilton, ON, Canada, (10)University of Alberta, Edmonton, AB, Canada, (11)Dalhousie University, Halifax, NS, Canada*

Background: Having followed a large high-risk (HR) cohort (siblings of children with ASD) from infancy, we examined early predictors of outcomes as they enter mid-to-late childhood/early adolescence. We focus on mental health and cognitive outcomes in relation to early temperament and attention.
Objectives: To examine mid/late childhood/adolescent mental health and cognitive outcomes, and predictors thereof, in a HR sibling sample.

Methods: We re-assessed 117 HR siblings (72 boys; 45 girls; *M* age = 9.6 years; range = 7.7-13.6), followed from age 6 or 12 months, to examine later mental health and cognitive outcomes. Based on blinded clinical best-estimate assessment, 41 met criteria for a diagnosis of ASD (76 = non-ASD). Variables analyzed included: (1) early temperament (Toddler Behavior Questionnaire; TBQ, at age 2) and cognition (Mullen Scales of Early Learning; ages 1 and 2), and (2) mid-to-late childhood/adolescent mental health (Child Behavior Checklist, Ages 6-18; CBCL) and cognition (WISC-V).

Results: ***(1) Mental Health Outcomes***: High-risk siblings with and without ASD experienced high rates of parent-reported symptoms on the CBCL, with > 10% of both Non-ASD and ASD sub-groups experiencing symptoms in the clinical range (*T*-scores > 90th %ile) in Internalizing (17.1%; 35.1%) and Externalizing (14.3%; 35.1%) areas, with groups differing only in rate of Externalizing symptoms (p = .007). Elevated rates of clinically concerning (i.e., borderline or clinical range) problems were reported for siblings with both non-ASD and ASD outcomes for Anxious/Depressed (12.9%, 27%), Withdrawn/Depressed (11.4%, 33.4%), Somatic Complaints (12.8%, 16.2%), and Aggressive Behaviour (14.3%, 33.2%). Elevated DSM-oriented scales included Affective (12.9%, 37.8%), Anxiety (14.2%, 37.8%), Somatic (11.6%, 13.5%), Oppositional (12.9%, 27%), and Obsessive-Compulsive (12.8%; 29.7%) scales. TBQ Attention Shifting at age 2 predicted later Internalizing (R^2 = .08; p =.006) and Externalizing Problems (R^2 = .07; p =.009). ***(2) Cognitive Outcomes*** revealed mean WISC-V index scores within average limits for both groups, who differed only on the Processing Speed Index (PSI; Non-ASD *M* = 99.9; ASD *M* = 87.0; p =.001). The strongest predictor of PSI performance was age 2 Mullen Visual Reception (VR; R^2 = .12 for Non-ASD; p = .02 and R^2 = .36 for ASD; p = .006), with a trend toward 12-month Mullen VR as a predictor (both group p's = .07). For both groups, 2-year Mullen Receptive (RL) and Expressive Language (EL) significantly predicted later Verbal Comprehension Index (VCI); p's < .02. Notably, RL (R^2 = .49) was more informative than EL (R^2 = .28) for the ASD group, whereas the opposite pattern was seen in the Non-ASD group (R^2 = .13 and R^2 = .27 for RL and EL, respectively).

Conclusions: Findings reveal mental health challenges commonly encountered by siblings of children with ASD, regardless of their own ASD outcomes. High rates of mental health challenges, despite average cognitive functioning, highlight the importance of monitoring the mental health of these HR children into middle childhood and beyond. Results highlight the potentially informative roles of temperament and both nonverbal and language abilities in early life in predicting later outcomes.

142 **207.142** Meta-Analysis of Sex Differences in Core Symptomatology in Autism Spectrum Disorder

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Background: Autism Spectrum Disorder (ASD) has drawn the field's attention in recent decades, because of its high, quickly increasing, and disproportionate prevalence between the two sexes (e.g., 1 in every 38 males but 152 females; Autism and Developmental Disabilities Monitoring Network). To understand the sexual disparity, researchers have started investigating the various differences in physiological and psychological characteristics between males and females with ASD.

Objectives: The researchers meta-analyzed published studies, focusing on the sexual disparity in the severity of core symptomatology in ASD. Several potential moderators of the disparity, namely, symptom type, patient age, IQ, the assessment tool, diagnostic criteria, and publication year of a study, were also investigated. These moderators can hardly be studied in full in a single empirical study. The present meta-analysis therefore helps not only synthesize but also advance the literature.

Methods: A systematic literature search was performed on PsycINFO, Scopus, PubMed, and Web of Science for empirical studies written in English and comparing males and females with ASD in their symptom severity. The current study then included in total 84,718 (males) and 19,240 (females) repeated measures of symptoms of ASD for males and females respectively; the data were nested in 295 effect sizes nested in 43 independent studies consisting of 9192 males and 2412 females. The moderators of interest were coded if possible for analysis.

Results: Multilevel meta-analysis with effect sizes nested in studies indicated that males demonstrate higher severity in restricted and repetitive behavior but not in other two core symptoms of ASD or the composite severity than do females. This phenomenon was elaborated by the finding that the Autism Diagnostic Observation Schedule (ADOS) assessment specifically detects more restricted and repetitive behavior for males than for females. The same disparity does not emerge for other symptoms or other assessments. Finally, the analyses indicated to a potential age moderation effect that heightens females' composite ASD severity if they are older than 18. This result, nevertheless, did not appear for any of the three core symptoms individually. No moderation was found for IQ, diagnostic criteria, linear or quadratic publication year.

Conclusions: The results show that males with ASD demonstrate more restricted and repetitive behavior than do females with ASD, and the disparity might be attributed to using ADOS as the assessment tool. Further, different from what the literature suggests, patient age, IQ, the diagnostic criteria, and social-historical context of a study indicated by its publication year do not seem to influence differences in symptom severity between males and females with ASD.

143 **207.143** Mis-Diagnosis, Overdiagnosis, and the Unintended Consequences of Prevention: Interpreting the Uspstf Autism Screening Report

E. Hickey[1], *S. Broder-Fingert*[1,2], *J. Goupil*[1] *and R. C. Sheldrick*[3], *(1)Boston Medical Center, Boston, MA, (2)Boston University School of Medicine, Boston, MA, (3)Boston University School of Public Health, Boston, MA*

Background: In 2016, The U.S. Preventive Services Task Force (USPSTF) concluded "insufficient" evidence to support universal primary care screening for autism spectrum disorder (ASD). The statement led to controversy among research and clinical communities. Although a number of papers have since been published arguing for the potential benefit of ASD screening, none specifically address potential harms of ASD screening. This evidence gap may relate to confusion regarding how the USPSTF measures and evaluates potential harm.

Objectives: In the current study, we reviewed how the USPSTF operationalizes "harm," and explored how that definition impacts ASD screening

Methods: We reviewed the 18 reports released by the USPSTF between 2016 and 2018 that were issued an "I" (insufficient evidence) statement to explore: 1) how harms were operationalized, and 2) how often harms were concretely measured in the literature. We then applied this framework to the example of ASD screening

Results: We identified two categories of harm that relate to ASD screening: (1) classification error and (2) overdiagnosis. Screening classification error, defined by the National Academy of Medicine as the failure to establish an explanation of a patient's health problems in a timely and accurate manner, or the failure to communicate such an explanation, is commonly assessed by testing sensitivity and specificity of screening tools. Because an ASD diagnosis is based on screening for a range of developmental difficulties, screening can lead to false positive and false negative errors. These errors can lead to harm in a number of ways, for example by exposing families to stigma and unnecessary services, or by delaying other needed services through inappropriate reassurance.

Distinctly, overdiagnosis refers to diagnoses that are technically correct but that will not provide benefit to the patients who receive them. The

USPSTF explicitly expressed concern about overdiagnosis related to screening for skin cancer in asymptomatic adults and breast cancer in women over 75 based on evidence that screening might detect patients who met diagnostic criteria but were unlikely to benefit from treatment. Factors hypothesized to contribute to overdiagnosis in ASD include dissemination of screening to asymptomatic populations, growing awareness and an accompanying reduction in stigmatization, improvement of diagnostic procedures and changes in the diagnostic criteria, and the potential for biased clinical judgment (Merten et al., 2017). Some children who correctly meet diagnostic criteria for ASD diagnosis could have a phenotype that is less responsive to autism supports and services, thereby exposing them to the harms associated with these treatments (e.g., being pulled from class) without the benefits.

Conclusions: USPSTF screening conclusions can be better understood by clearly delineating possible causes of harm. While screening is likely to help children who are subsequently diagnosed with ASD and benefit from treatment, data on patients who receive no benefit from an accurate ASD diagnosis are severely lacking. More research on the potential harms of ASD screening is needed at the individual- and population-level. Clarity on these subjects can help inform interpretation of and response to future USPSTF reports.

144 **207.144** Missed Diagnosis of Autism Spectrum Disorder (ASD) in a Psychiatric Population

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Background: Autism spectrum disorder (ASD) is a severe handicapping condition often diagnosed by 5 years of age. To a considerable extent, its timely diagnosis determines its long-term outcomes (Rogers et al., 2018). However, in the presence of comorbid psychiatric disorders, its diagnosis can be delayed. Relatively little is known about the risk factors that delay the diagnosis of ASD.

Objectives: To examine the characteristics of children admitted to a psychiatric unit in whom the diagnosis of ASD was missed.

Methods: Children with suspected ASD were recruited from a consecutive series of 991 patients admitted to a short-term 14-bed academic child and adolescent psychiatry inpatient unit over a two-year period. Diagnosis of ASD and comorbid psychiatric disorders was made by a multidisciplinary team.

Results: 14 children (aged 9-17 years) with suspected ASD were identified out of which eight received a final diagnosis of ASD. 13 (93%) had received at least one psychiatric diagnosis. None of the patients had intellectual disability. The most common psychiatric diagnoses initially diagnosed in this sample were ADHD (n=7); Depression (n=6); Anxiety Disorder (n=5); Aggression/Impulse Control Disorder (n=4); and one each of Bipolar Disorder, Psychosis, and Obsessive-Compulsive Disorder. Multiple psychiatric comorbidity was a common characteristic of the children with a missed diagnosis of ASD.

Conclusions: Children with multiple psychiatric symptoms beginning early in life should be screened for ASD.

145 **207.145** Mobile Computer-Mediated Assessment of Autism Risk By Non-Specialists in Home Settings: Insights from the START Project

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Background: In many parts of the world with poor access to clinical expertise, a large number of children on the autism spectrum remain undetected, and hence are deprived of early interventions. Even those who are diagnosed experience significant delays between parents' noticing atypicalities in behaviour and specialist clinical diagnosis. To bridge this detection gap, we have developed START ("Screening Tool for Autism Risk using Technology"), a tablet-based app usable by minimally-trained non-specialist workers in home settings. START presents a range of tasks as simple games for an evaluation of social, motor, sensory, and cognitive function in 2-7-year-old children.

Objectives: To conduct a proof-of-principle study with START, administered by non-specialist workers in and around Delhi, India, using a case control study design comprising three groups of children: those with autism spectrum disorders (ASD), intellectual disabilities (ID), or typically developing (TD) children.

Methods: Non-specialist workers tested 127 children with ASD (n=46), ID (n=38) and TD (n=43), aged 2-7 years in their homes. We present data on three sets of measures: (1) *social motivation* measured using a) *preferential looking task*: tablet-based eye-tracking to measure distribution of overt attention between a social and a non-social stimulus, and b) *choice task*: to measure preference for social rewards; (2) *sensory interests* were measured by showing children a video of a spinning wheel which they could stop at will; and (3) *motor following task:* where participants were asked to follow with their finger the trajectory of a butterfly moving in a predetermined random manner.

Results: (1) In the preferential gaze task, children with ASD spend significantly (Figure 1, top left) less time looking at the social stimuli than the TD group ($F(2, 104) = 4.21$, $p = 0.017$) but in the choice task (Figure 1, top right) the groups do not differ in their choice of the social stimulus ($F(2, 98) = 0.58$, *ns*). (2) Children with ASD spend significantly longer looking at a spinning wheel than TD ($F(2, 81) = 19.57$, $p < .001$). (3) Children with ASD execute the motor following task with significantly greater spatio-temporal mean squared errors than do TD or ID groups ($F(2, 78) = 19.36$, $p < .001$).

Conclusions: This study provides proof of principle for START, revealing the expected pattern of ASD-TD group differences in relevant tasks. It also demonstrates the feasibility of such mobile scalable testing of neurodevelopment by non-specialists in home settings.

146 **207.146** Mothers with a History of Anxiety/Depression Report Higher Prevalence of Behaviors and Sensory Sensitivities: A Group-Matched Study Comparing Maternal Reporting of ASD Symptoms

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Background: Parent report is central to clinical assessment of ASD, yet the influence of parent characteristics, such as depression and anxiety, on report of symptomatology is poorly understood. Maternal depression has been associated with increased symptoms on parent report measures but not clinician-administered measures (Bennett et. al., 2012). Parental psychiatric symptoms negatively correlate with parental expectations for children with ASD (Thomas et al.; 2017). Given heightened prevalence of depression and anxiety among parents of children with ASD and the reliance on parent report in clinical evaluation, it is essential to understand the influence of maternal anxiety and depression on parental report of presenting concerns and clinical and behavioral features of ASD.
Objectives: To investigate the relationship between maternal anxiety and depression and parent reporting in terms of frequency of reporting specific behaviors and symptoms.

Methods: The study entailed chart abstraction of 40 individuals with ASD, aged 3-18, seen at an autism clinic. Twenty mothers self-reported a history of anxiety and/or depression (mean child age=7±2.3years), and twenty did not report anxiety or depression (mean child age=7±2.5years). Child clinical characteristics included age, ADOS severity score, IQ, and Vineland Adaptive Behavior Scales-II (VABS). A parent intake questionnaire, completed by the mother or both parents, provided information on family history, sensory function (avoids/seeks loud noises, bright lights, being touched, or certain food textures), maladaptive behaviors (screaming, hitting, biting, tantrums, self-injury, elopement), autism-related behaviors, and presenting concerns.

Results: The two groups did not differ significantly on age, ADOS calibrated severity score, IQ, or VABS subdomains or adaptive behavior composite. Mothers with a history of anxiety and/or depression reported more problem behaviors (M=2.90, SD=1.52) than mothers without anxiety and/or depression (M=1.75, SD=1.77; t=2.10, p=.048). In addition, mothers with a history of anxiety and/or depression (M=5.95, SD=2.91) endorsed more sensory sensitivities than mothers with no anxiety and/or depression (M=3.8, SD=2.21; t=2.39, p=.023). To further examine sensory sensitivities, we analyzed a parent report of autism-related behaviors, which used a 5-point Likert scale. Mothers with a history of anxiety and/or depression indicated their children were more frequently upset by loud noises (M=2.70, SD=1.22) than mothers without anxiety or depression (M=1.20, SD=.775; t=4.439, p<.001). Additionally, mothers in the anxiety and/or depression group reported their children were more frequently overly preoccupied with details (M=2.00, SD=1.41) than mothers in the control group (M=1.07, SD=1.1; t=2.12, p=.042).

Conclusions: There have been few studies to examine the relationship between maternal anxiety and depression and parent report of ASD symptoms. In the current study, despite comparable ratings on clinician-administered and structured parent interviews, parental report on a questionnaire indicated increased report of autism symptoms among parents with anxiety or depression. This topic requires further investigation in studies designed to tease out potential influencing factors, such as reporting bias or enhanced attention to detail, that may account for these differences. Ongoing qualitative analysis of open-ended responses in the current sample will provide additional information about use of emotional language in parent report.

147 **207.147** Network Structure of the ASD Phenotype Reveals Both Expected and Novel Relationships in a Large Community Sample

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Background: Autism Spectrum Disorder (ASD) is characterized by significant heterogeneity within core symptom domains (social communication and repetitive and restricted behaviors). Heterogeneity is often further compounded by comorbid conditions such as anxiety and attention deficits, as well as by impairments in other domains such as executive functioning and language expression and function. Insights into the complex interplay between behavioral domains is crucial to understand mechanisms underlying ASD heterogeneity.
Objectives: To reveal network structure of ASD phenomenology, depicting relationships between social communication, restricted/repetitive behaviors, and other domains of functioning commonly impaired in ASD. To quantify network characteristics that describe connections among these domains in ASD.

Methods: Our sample consisted of 449 participants (91% male, ages: 5-18 years, mean[SD] age: 10.2[3.0] years, mean[SD] Full Scale IQ: 94.7[22.6]) with community diagnoses of ASD. Standardized measures commonly used to assess behavioral functioning of children with ASD were used, including parent-report questionnaires assessing ASD symptoms, executive functioning, adaptive skills, language and communication, attention and hyperactivity/impulsivity, anxiety, and sleep habits, as well as clinician-administered gold-standard diagnostic tools and cognitive assessments. An undirected network representation of measures was constructed, with nodes representing the scales of the measures and edges encoding partial correlations between the scales. The data was processed with a nonparanormal transformation to calculate nonparametric correlations due to non-normal distributions of scales. Network estimation was performed using the graphical LASSO algorithm which yields partial correlations between any two given scales that are controlled for the influence of all the other scales. The extended Bayesian information criterion was used for optimal parameter selection. Three graph indices were computed to quantify topology of the network: betweenness centrality, closeness centrality, and node strength.

Results: The network structure (see Figure 1) indicated only a few strong connections (partial correlation r > 0.1) between the two core ASD domains (social communication and restricted/repetitive behaviors). Connections between these domains were primarily established through measures that assess both domains (e.g. SRS-2, ADI-R). Repetitive behaviors were directly connected to executive functioning through a connection between preference for sameness and the executive skill of shifting (r=0.19). The social anxiety scale, with high centrality indices (z-scores: closeness=1.52, betweenness=2.17), acted as a bridge between other anxiety scales and social functioning. Connections between ADHD symptom domains and core ASD domains were predominantly established through executive functioning or higher-level aspects of language use. Intellectual functioning was primarily linked to language and communication variables, but not to social functioning. Social communication had high centrality (z-scores: closeness=1.69, betweenness=1.58) and high strength (z-score=1.59), reflecting its core role in ASD.

Conclusions: Our results provide insights into the complex interplay among ASD symptoms and co-occurring impairments. Identified links between core symptom domains are consistent with current conceptualization of ASD phenomenology. Novel findings on connections between executive functioning, repetitive behaviors, language, anxiety, and social functioning may define testable hypotheses regarding causal mechanisms of ASD symptomatology.

148 **207.148** Objective Measurements of Social Visual Engagement Predict Parental Impressions of Child Behavior in a Clinical Sample

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Background:

Parents have unique insights into their children's development: their daily interactions provide experiences beyond lab or clinic that form impressions distinct from those of trained clinicians in a single appointment. Although clinician best estimate remains the gold standard for diagnosis of autism spectrum disorder (ASD), parents contribute critical insights that impact initial screening, symptom profile reports, and medical histories. Despite these strengths, parental impressions are inherently subjective, based on relatively small "samples" – i.e., parents' own children rather than the many hundreds to which clinical professionals are exposed. Here, we measure the extent to which parent-report measures can be predicted by performance-based measures of social visual engagement collected via eye-tracking. These measures offer an assessment of the real-world validity of lab-based eye-tracking measures as well as the potential for objective metrics of child behavior.

Objectives:

To determine the extent to which parent-report measures of social-emotional functioning in children can be predicted by performance-based, objective measures of children's social visual engagement collected via eye-tracking.

Methods:

Participants were N=146 consecutive referrals (ages 1.1–4.75 years) to a community diagnostic clinic. Referrals were made based on concerns for ASD or other developmental delays. Parents completed the *Ages & Stages Questionnaires: Social-Emotional, Second Edition* (ASQ:SE-2), a questionnaire commonly used to identify early signs of social-emotional difficulties. Children viewed video scenes of age-matched peers engaging in naturalistic social interactions while eye-tracking data were collected. Percentage of fixation time to faces was calculated for each participant. We then used hierarchical logistic regression to predict parent responses on the ASQ:SE-2 from children's eye-tracking measures.

Results:

Eye-tracking-based measures significantly predict ASQ:SE-2 parent responses. Items more relevant to social visual engagement (e.g., *Does your child look at you when you talk to him?; Is your child interested in things around her, such as people, toys, and food?*) are more strongly associated (r=0.406, p<0.001 and r=0.359, p<0.001, respectively), while items less relevant were unrelated (e.g., *Does your child hurt himself on purpose?*; *Does your child try to hurt other children, adults, or animals?*, both r<0.01, p>0.05). Hierarchical logistic regression yielded parameter estimates modeling (a) the odds of a child rarely or never looking at a parent's face when talking (versus looking sometimes or most times) and (b) the odds of a child looking at least sometimes (versus most times) [Figure 1]. In both cases, *t* and *p* values indicate that eye-tracking-based measures significantly predict the odds of a child's real-world behavior (*t*>2.6, *p*<0.01): for every 1% *decrease* in eye-tracking-based measures of face-looking, the model indicates a 15% increase in the odds that a child rarely or never looks at a parent's face; likewise, every 1% decrease in face-looking indicates a 6% increase in the odds that a child looks only sometimes [Figure 2].

Conclusions:

Objective measures of face-looking are significantly associated with parental impressions and predict specific aspects of a child's social-emotional functioning. These results highlight the real-world relevance of lab-based eye-tracking measures and offer potential for capitalizing on measures that converge with the unique insights gleaned from parents.

149 **207.149** Objectively Measured Social Communicative Behaviors during the ADOS-2

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Background: Autism spectrum disorder (ASD) is defined in part by persistent disturbances of social communication and interaction, such as eye contact (social gaze), facial expressions (smiles), and vocal turn-taking. In current best practice, ASD is recognized on the basis of expert clinician judgment, which is informed by gold-standard measures such as the Autism Diagnostic Observation Schedule-2 (ADOS-2; Lord et al., 2012). To date, observational research addressing social communication disturbances in children with ASD is rare in part because the field has lacked efficient methods for measuring behavior (Chin et al., 2018, Rehg et al., 2014, Swanson et al., 2017). Yet, improving social communication and reducing interaction disturbances depend on an objective understanding of how children with ASD behave during clinical assessments. The current study aims to improve objective understanding of social communicative behaviors among children with ASD during the ADOS-2.

Objectives: To investigate associations between objective measures of child's social gaze and social smile measured from adults' first-person video, child-adult vocal interaction measured from audio recording, and the traditional examiner-scored symptom measure ADOS-2 calibrated severity scores (CSS).

Methods: Fifteen children (*M* age=35.93mo, SD=6.61) were administered the ADOS-2 assessments. The ADOS-2 yields a total CSS as well as subscales for Social Affect (SA CSS) and restricted/repetitive behavior (RRB CSS). Children's total duration of smiles, socially-directed smiles, and social gaze during the assessment were recorded with a small Pivothead camera worn in glasses by the examiner and the parent. iMotions software was used to detect child smile expressions and gaze during the assessment as recorded on the parent and examiner Pivothead camera. Audio from wall-mounted camera recordings was processed with a Language ENvironment Analysis (LENA) software, which provided automated vocalization detection yielding child and adult vocal initiation counts and turn counts within conversational vocal blocks. Measures included proportion of gaze and smile at examiner and parent, total duration of gaze and smile at adult, rate of child and adult vocal initiation, and ADOS-2 CSS (total, SA, and RRB).

Results: The mean duration of smiles recorded by both examiner and parent head-mounted cameras was negatively associated with the total CSS (*r*=-.53, *p*<.05) and RRB CSS (*r*=-.52, *p*<.05), but not significantly associated with SA CSS (*r*=-.39, *p*>.05). The association between the proportion of gaze at the examiner and the total CSS was marginally significant (r=-.493, p=.06). Higher RRB CSS was significantly correlated with lower proportion of gaze (*r*=-.62, *p*<.05) and social smile (*r*=-.62, *p*<.01) at the examiner. In boys (n=11), more adult vocal initiation was associated with fewer smiles at examiner (*r*=-.67, *p*<.05), but this association was not significant for the group as a whole.

Conclusions: Objective measurements of children's smiles and gaze during the ADOS-2 converge with examiner-scored ADOS-2 calibrated severity scores. Although these dimensions of social communication are indexed by ADOS-2 SA CSS, objectively measured social behaviors were unexpectedly associated with RRB CSS, which may limit social interaction. The objective measurement of key behavioral features of ASD appears

to have the potential to produce quantitative indices of ASD symptoms.

150 **207.150** Parent-Teacher Discrepancy in Ratings of Executive Functioning in Black and White Children with ASD

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Background: Racial based reporting biases have been found, wherein teachers report higher rates of externalizing symptoms in Black children than parents do (Harvey et al., 2013), and than reported for White peers (Lau et al., 2004). In children with Autism Spectrum Disorder (ASD), increased discrepancy between parent and teacher report on standardized questionnaires can affect clinical characterization and subsequent treatment involvement (Lerner et al., 2017). While some research has explored parent reported differences in executive functioning (EF) across race (Ratto et al., 2016), research has not yet explored the impact of parent-teacher discrepancy on the characterization of these skills.
Objectives: To explore parent-teacher discrepancy in ratings of EF across race.

Methods: Data were collected from 284 children with ASD as part of neuropsychological evaluations at an academic medical center (N=1290). Full-scale IQ (FSIQ) was determined using standardized intelligence measures (Table 1). Parent and teacher forms of the Behavior Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000) were used to assess EF skills yielding T-scores. To assess parent-teacher discrepancy, difference scores were calculated (parent – teacher; Figure 1). Regression analyses (including age and FSIQ) explored whether race predicted parent-teacher discrepancy, parent, and teacher ratings of EF.

Results: Controlling for age and FSIQ, significant discrepancies were found between parent and teacher report for ratings of Black children compared to White children on the following subscales and indices: "Inhibit" (B = -5.247, p = 0.045), "Monitor" (B = -5.947, p = 0.024), "Initiate" (B = -6.140, p = 0.023), "Organization of Materials" (B = -11.649, p = 0.027), and "Meta-Cognitive Index" (B = -5.188, p = 0.047), with parents rating lower symptoms than teachers. Race significantly predicted parent report, with Black parents rating lower levels of symptoms than White parents on the following subscales: "Inhibit" (B = -5.395, p = 0.009), "Initiate" (B = -3.960, p = 0.024), "Plan/Organize" (B = -4.147, p = 0.028), "Organization of Materials" (B = -3.625, p = 0.040), "Monitor" (B = -5.346, p = 0.004), "Behavior Regulation Index" (B = -4.105, p = 0.033), "Meta-Cognitive Index" (B = -4.227, p = 0.014) and "Global Executive Composite" (B = -4.461, p = 0.009). Race did not significantly predict differences in teacher report. Results maintained significance following a Benjamini-Hochberg procedure correction for multiple comparisons.

Conclusions: Race significantly predicted a difference in discrepancy between parent and teacher report of EF problems on several subdomains of the BRIEF. Compared to Caucasian children, teachers and parents disagreed more on EF ratings for Black children, with teachers on average indicating more impairment than parents. Upon further exploration, the discrepancy seems to be driven by parents of Black children rating lower levels of symptoms than parents of Caucasian children. Racial reporting differences were not found on behalf of teachers. Findings may indicate potential differences in symptom presentation between home and school, wherein home cultures may be better suited to meet the needs of Black children with ASD (Ratto et al., 2016) or may indicate underreporting of symptoms by their parents.

151 **207.151** Patterns of Autism Symptom Severity Change during Early Childhood

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Background: While Autism Spectrum Disorder is commonly considered to be stable throughout the lifespan, evidence now indicates that at least some individuals demonstrate substantial changes in symptoms and functioning over time. Assessing change in autism symptom severity is a key concern for researchers, clinicians and parents alike. Previous studies have generally shown that symptom severity remains stable over time, with small groups decreasing or increasing. However, recent papers have also indicated the possibility of substantial change in symptom severity levels.

Objectives: We used the ADOS CSS (ADOS-2: Autism Diagnostic Observation Schedule-2, Calibrated Severity Score) to evaluate the extent of change in autism symptom severity demonstrated by children diagnosed with ASD from the MIND Institute's Autism Phenome Project (APP) and Girls with Autism Imaging of Neurodevelopment (GAIN) study.

Methods: One hundred and twenty five children with ASD (89 boys and 36 girls) were assessed at approximately 3 years of age (Time 1) and again at approximately 5-6 years (Time 3) for autism symptom severity, IQ and adaptive function. A severity change score was computed by subtracting each participant's Time 1 ADOS CSS score from their Time 3 ADOS CSS.

Results: Given the wide range of severity change scores demonstrated (ranging from increase of 4 points to decrease of 6 points, Figure A), the RCI (Reliable Change Index) was used to determine what constituted significant change - this was a 2 point change. Children were divided into groups according to their demonstrated increase, decrease or stability of autism severity. Almost half the children in the sample demonstrated significant autism symptom severity change over time (Figure B). The Decreased Severity Group (28.8%) included children who decreased in severity by 2 or more points. It was characterized by a large range of individual severity scores at age 3, an over-representation of girls, higher IQ means at both times and higher adaptive functioning at Time 3 compared to other groups. The Stable Severity Group (54.4%) included children who changed by 1 point or less in either direction. It had almost identical Time 1 and 3 CSS means, equal proportions of boys and girls, made IQ gains over time but remained stable in adaptive functioning. The Increased Severity Group (16.8%) included children who increased by 2 or more points in severity. This group had the lowest mean severity scores at Time 1 but the highest at Time 3, had an under-representation of girls and showed stability in IQ and adaptive functioning.

Conclusions: Autism symptom severity can change substantially during early childhood. Patterns of change are associated with factors such as sex, IQ and adaptive functioning. The current study included a higher proportion of girls (28.8%) compared to previous studies. Since girls showed a greater tendency to decrease in severity compared to boys, this could partially explain the higher perecentage of children who decreased in severity in the current study. This work can be relevant for families, professionals and researchers as it helps guide expectations for long-term outcome.

152 **207.152** Patterns of Symptom Severity Developmental Trajectories in Children with Autism Spectrum Disorder in Taiwan

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Background: Autism spectrum disorder (ASD) is widely known to be a highly heterogeneous neurodevelopmental disorder. Recently growing bodies of researches focused on the developmental trajectories of autism severity, which has been seen as one ofpromising waysto understand the heterogeneity of ASD and may lead to a better understanding of prognosis (Baker, Smith, Greenberg, Selzer & Taylor, 2011). However, seldom longitudinal studies have been conducted in the East, and none in Taiwan. Therefore, it highlights the necessity of the investigation.
Objectives: The purpose of this study is (1) to explore the subgroups of autism severity in the children with ASD from toddlers to school age in Taiwan, (2) and further characterize these subgroups by cognitive and adaptive functions.

Methods: Seventy ASD participants were assessed at three time points from toddlerhood to school age (mean age: T1 = 35.11 months, T2 = 55.11 months, T3 = 109.17 months) across 6 years. The standardized assessments were used to measure autistic total symptoms severity (ADOS calibrated severity score [CSS]), cognitive functions (MSEL, WPPSI-IV or WISC-IV) and adaptive functions (VABS-II). The hierarchical cluster analysis collocated with two-way mixed designed ANOVA were conducted to identify the subgroups of three time points ADOS-CSS. The comparison of cognitive and adaptive functions between subgroups were showcasedby one-way ANOVA.

Results: In hierarchical cluster analysis, three subgroups were identified including “worsening group” (n = 43), “persistent high group” (n = 18), and “improving group” (n = 9). All groups improved on FSIQ, but the worsening and improving groups show significantly higher progress than does the persistent high group (p = .016*). The improving group has higher but no significant difference in T1 FSIQ (p = .060). In T3, the improving group has the highest cognitive outcome (p= .001**). In terms of adaptive functions, three groups show significant differences in Vineland adaptive behavior composite (improving > worsening > persistent high; p = .000***). The improving group has the best performance in the communication (improving > worsening > persistent high; p = .000***) and daily living skill (improving > worsening = persistent high; p = .005**) domains, but not in the socialization domain (improving = worsening > persistent high; p = .000***).

Conclusions: Similar to western findings, the development of autism severity can bedivided into three groups. Each group is characterized by different cognitive and adaptive functions, which shows total symptoms severity is a valid indicator for Taiwanese children with ASD. Three groups have similar FSIQ in toddlerhood, and all of them show improvement over time. But the greater improvement in the improving and worsening groups might contribute different outcomes in school age, of which the improving group has the highest FSIQ, followed by the worsening group, and the persistent high group, which has the lowest FISQ. The improving group also shows the best performance in adaptive functions in school age; however, the advantage mainly appears in the communication and daily living skill domains, but not in the socialization domain, which might reflect the existence of ASD social deficit.

153 **207.153** Perspectives of Autistic Adults, Relatives and Clinicians on the Characteristics of Current and Optimal Post-Diagnostic Support Services

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Background: there are few post-diagnostic support services available for autistic adults. Service developments are required to address this significant unmet need.
Objectives: (1) to explore the characteristics of current UK post-diagnostic support services from the perspectives of autistic adults diagnosed in the last 5 years, relatives and clinicians and (2) compare these characteristics with views about optimal services and the recommendations made in the UK NICE guidelines (2012) and (3) identify specific areas that require development to create optimal post-diagnostic support services.

Methods: 346 adults with a clinical diagnosis of an autism spectrum disorder completed a national survey about their experiences of the post-diagnostic process, and possible adjustments; 46 relatives completed a parallel survey. 36 UK diagnostic teams were surveyed to capture the characteristics of current post-diagnostic services, and suggestions about modifications. A modified Delphi survey process was used to seek consensus on the characteristics of optimal post-diagnostic services. Data analysis comprised content analysis, descriptive statistics, tests of correlation, difference and agreement.

Results: the median age of autistic adults was 44 years (and 41 years at diagnosis, range 18-89); 54% of respondents were female. Two thirds reported a mental health condition (55% anxiety; 54% depression). Almost all adults and relatives reported that feedback after the diagnostic assessment was received. Only 56% reported opportunities to discuss what support might be beneficial, and 51% had the opportunity to discuss their strengths or the impact of the diagnosis on relationships or work. Clinical consensus was reached on 11 statements describing characteristics of optimal post-diagnostic support services. All clinical teams agreed that offering an extra ‘follow-up meeting at 2-4 months after the feedback meeting to discuss implications of diagnosis, coping strategies and future planning’ should be a characteristic of optimal post-diagnostic support services. 50% of clinical teams did not have the resources to treat co-morbid mental health conditions identified during the diagnostic assessment (this aligned with the experiences of the autistic adults surveyed); and 47% of clinical teams reported they were unable to provide any further support or preventative interventions for those not in crisis. Diagnostic teams agreed that ‘a diagnosis of autism should not limit access to community and/or inpatient mental health services.’ Teams also agreed that optimal post-diagnostic services ‘should include occupational therapists and speech and language therapists’ and opportunity to access ‘step-on/step-off’ support to protect mental health, and maintain well-being. Consensus was that optimal post-diagnostic services should include people in the core team with expertise in autism, from multiple agencies/specialities, and that training other parties on the treatment of co-existing conditions should be commissioned and resourced (in partnership with other agencies) as opposed to being ad hoc.

Conclusions: service users and clinicians all identified gaps in current post-diagnostic support. Clinical teams achieved full consensus on the characteristics for optimal autism post-diagnostic support service developments. These findings can inform the necessary developments. Optimal services need commissioning, and some reorganisation of resources is required. Service structures and policy specifications should be developed to best support the well-being of autistic adults, relatives and clinicians.

154 **207.154** Piloting "Autoscreen": Preliminary Results of a Novel Digital Tool for Clinically Efficient Assessment and Decision Making for Toddlers with ASD Concerns

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Background: Early accurate identification of young children with Autism Spectrum Disorder (ASD) represents a pressing clinical care challenge. Current AAP practice guidelines endorse ASD screening at 18 and 24 months of age, followed by referral and evaluation for those at-risk by qualified providers. At present, a variety of resource barriers exist, resulting in large numbers of children not being screened and prolonged waits for diagnostic assessments. Consequently, the average age of diagnosis in the US remains between 4 and 5 years of age.
Objectives: Based on advanced computational analysis of a large sample of toddlers receiving gold-standard evaluations for ASD and a dynamic design process involving leading diagnostic experts at partner academic institutions, we created a stand-alone screening application designed to present community pediatric providers with a 15-minute ASD risk assessment method (i.e., a structured interaction via app-based instructions and in-app rating system of ASD symptoms).

Methods: This pilot study included 18- to 36-month-old children (n = 24) clinically referred for ASD evaluation as well as professionals and paraprofessionals (n = 24) licensed to conduct clinical ASD evaluations (e.g., pediatrics, clinical psychology, and speech-language pathology). Each provider used Autoscreen to assess a different child. Immediately afterward, a different blinded provider conducted a full diagnostic evaluation for the child. Meanwhile, the Autoscreen provider entered behavioral codes into Autoscreen and a risk index was automatically computed.

Results: Participating professionals favorably regarded our functionally robust prototype. Providers reported (a) excellent usability of the tool (System Usability Scale mean = 87.36), (b) high acceptability of the tool (Acceptability, Likely Effectiveness, Feasibility, and Appropriateness Questionnaire mean = 87.28), (c) and 88% agreement with Autoscreen's dichotomous risk index (i.e., high versus low risk) using the *a priori* predictive model. Based on a receiver-operating characteristic (ROC) analysis, a comparison of predicted ASD risk by Autoscreen with best estimate clinical diagnoses presented encouraging evidence of Autoscreen's potential as an instrument for reliable ASD risk classification. Levels of accuracy, sensitivity, specificity, and other performance metrics demonstrated the potential of Autoscreen to compete with established screeners while simultaneously addressing several pain points of providers. Although quite preliminary, an observed accuracy of 79%, sensitivity of 0.77, and specificity of 0.86, outperform many commonly used screening instruments.

Conclusions: Ultimately, we hypothesize that Autoscreen could powerfully enhance early identification of children with ASD and improve provider confidence around risk assessment and referral decisions. Although these early results are promising, there are a few key areas in which Autoscreen must be improved—both in terms of risk classification and technological enhancement—before it could be considered ready for real-world deployment. Most notably, a larger, higher-powered study capable of evaluating reliability metrics is required to demonstrate Autoscreen's credibility as an impactful clinical tool. Such a study is part of planned future work.

155 **207.155** Positive Predictive Value of the Modified Checklist for Autism in Toddlers, Revised with Follow-up for Black and White Children

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Background: Early diagnosis and intervention improve outcomes for children with Autism Spectrum Disorder (ASD) (Baird et al., 2001; MacDonald, Parry-Cruwys, Dupere, & Ahearn, 2014). However, Minority children are typically diagnosed substantially later than White children, despite similar prevalence and symptom severity (CDC, 2006; Fombonne, 2003). To reduce this gap, universal screening has been proposed as a way to identify *all* children at risk for ASD early. However, limited research exists exploring the effectiveness of ASD-specific screening tools between racial groups, particularly Black versus White children. Studies that have done this combine across racial minority groups, thereby potentially precluding identification of meaningful differences (e.g., Khowaja, Hazzard, & Robins, 2015; Scarpa et al., 2013).
Objectives: We compared the positive predictive value (PPV) of the Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R/F; Robins et al., 2014) for Black and White children who screened positive at 18-month well-child visits. Sensitivity and specificity were not measurable in this sample, given that all screen negative cases were not evaluated.

Methods: Participants were 310 children ages 16-21 months, evaluated as part of a larger study on the early detection of ASD. Children who screened positive on the M-CHAT-R/F at their 18-month pediatric well-child care visit were offered a free developmental and diagnostic evaluation by a licensed clinical psychologist or a developmental-behavioral pediatrician and a doctoral student. M-CHAT-R/F PPV for (a) ASD and (b) any developmental disorder was compared for 128 Black and 182 White children. Racial groups were also compared on monthly household income, which was used as a proxy for socioeconomic status.

Results: Racial groups (Black, White) differed on monthly household income (Black group monthly income M = \$2,498, SD = \$2,453; White group M = \$5,838, SD = \$2,837), t (241) = 9.74, p < .001. However, M-CHAT-R/F PPV for ASD was similar for Black (PPV = 0.445, CI = 0.37 – 0.53) and White (PPV = 0.431, CI = 0.37- 0.50) children (χ^2(1, N = 310) = 0.0736, p = .79). The PPV for any developmental diagnosis (i.e., ASD, Language Disorder, or Global Developmental Delay) was higher for Black children (PPV = 0.890, CI = 0.83 – 0.93) than for White children (PPV = 0.809, CI = 0.75 - 0.86), χ^2(1, N = 310) = 4.4707, p = .03).

Conclusions: We explored the predictive utility of the M-CHAT-R/F in detecting Black and White children at risk for ASD and other developmental delays based on an 18-month positive screening. PPV for ASD was similar between the two racial groups and consistent with previously reported values, yet the M-CHAT-R/F appeared to be slightly better at detecting any developmental disorder in Black toddlers. This is one of few studies to specifically compare M-CHAT-R/F performance for Black and White children and suggests that the screener performs adequately irrespective of child race.

156 **207.156** Prediction of Maladjustment Trajectories during Elementary and Junior High School with Symptoms of ASD Assessed in Preschool

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Background: It is important to understand ASD symptoms in early childhood, especially in naturalistic contexts. If a preschool teacher can easily grasp the ASD characteristics of the child, that will enable to start developmental supports in early stages of the childhood. We developed Transitional Assessment Sheet for Preschoolers (TASP) which is a screening tool that preschool teachers can easily grasp the state of preschool children, TASP can grasp not only ASD symptoms but also ADHD symptoms and DCD symptoms. While studying the long-term course over 10 years in our cohort study, we examined the relationship among ASD symptoms which had grasped by preschool teachers and the adaptation in their adolescent.

Objectives: We examined how the ASD characteristics of children in early childhood grasped by TASP influences the adaptation to school and mental health in their elementary and junior high schools in our cohort study.

Methods: The sample comprised 3,717 participants (1,908 boys and 1,809 girls) of our cohort study investigated annually for 10 years between the 3rd grade of preschool (age 5 or 6) and 3rd grade of junior high school (age 14 or 15). We examined 3 kinds of developmental disorder symptoms (ADHD, ASD, and DCD) assessed at preschools as predictors of developmental trajectories of 4 maladjustment variables (academic failure, peer problems, internalizing problems and externalizing problems) during 9 years in elementary and junior high schools using the conditioned latent growth model. Developmental disorder symptoms were rated by preschool teachers using our original scale, TASP. TASP consists of 35 items from 7 subscales (Hyperactivity/Impulsivity, Inattention, Social Interaction, Communication, Inflexibility, Fine Motor, and Gross Motor) and its reliability and validity were examined from various aspects (internal and test-retest reliability and factorial, concurrent and predictive validity). Socio-emotional maladjustment was rated by teachers of elementary and junior high school using Strengths and Difficulties Questionnaire (SDQ), an internationally used scale for assessment of emotional and behavioral problems. Academic achievement was measured with Kyokenshiki Norm-Referenced Test, a standard achievement test widely used in schools around Japan.

Results: The conditioned latent growth model showed the following results: (a) Level of peer problem was predicted by high hyperactivity/impulsivity, poor social interaction, and poor gross motor skills through the impact of hyperactivity/impulsivity was diminished in high graders; (b) Level of academic achievement was predicted by low hyperactivity/impulsivity, elevated inattention, poor communication skill, and poor fine motor skill though impacts of hyperactivity/impulsivity and communication were diminished in high graders; (c) Level of internalizing problem was predicted by poor social interaction, poor communication skills, elevated inflexibility, and poor gross motor skills through impacts of communication and inflexibility were reduced in high graders; (d) Level of externalizing problem was predicted by high hyperactivity/impulsivity and elevated inattention though impacts of hyperactivity/impulsivity were reduced in high graders.

Conclusions: We found that ASD characteristics, grasped by preschool teachers in early childhood using TASP, predict social isolations and depressed states in their elementary and junior high schools.

157 **207.157** Preschool Staff Spot Social Communication Difficulties, but Not Restricted and Repetitive Behaviors in Young Autistic Children

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Background: Clinicians sometimes visit the preschool as part of the assessment of autism spectrum disorder (ASD) in children. This could be the case when clinical findings and information from parents are insufficient for a diagnostic decision. A less costly and time-consuming source of information could be ratings of the child´s autistic behaviors by preschool staff. It has been found that preschool staff rate general autistic symptoms in children more accurately than parents. However, it is not known what kind of autistic behaviors, whether difficulties of social communication and interaction (SCI) and/or restricted and repetitive behaviors (RRBs), that preschool staff identify.

Objectives: The objective of the study was to investigate how accurate preschool staff are at reporting difficulties in SCI and RRBs in young children. The first aim was to investigate if preschool ratings of SCI and RRBs would discriminate between children with and without ASD at three years of age. We expected that ratings of both SCI and RRBs would contribute uniquely to the differentiation between the groups. The second aim was to investigate if there was a specific association between preschool ratings on SCI behavior and clinical assessment of social behavior, and between preschool ratings on RRBs and clinical assessment of RRBs. We expected a positive correlation between the corresponding measures.

Methods: Preschool staff's ratings on the SCI and RRB subscales from the Social Responsiveness Scale – 2 and the Repetitive Behavior Scale-R were compared between three-year-old siblings, having an older brother or sister with ASD, either diagnosed (n = 12; six girls) or not diagnosed (n = 36; 20 girls) with ASD, and typically developing control siblings with no family history of ASD (n = 16; seven girls). Ratings were investigated from a categorical (group status) and dimensional (preschool ratings relative to clinical assessment of autistic symptoms) perspective. All preschool staff were blind to diagnostic status and the diagnostic assessment took place independent of rating results.

Results: In line with our expectations, we found that preschool staff differentiated between the ASD group and the two other groups for SCI behaviors and that the preschool SCI ratings were significantly associated with clinical assessment of social deficits in the high-risk group. However, against our expectations, ratings of the preschool RRB subscale showed no differentiation between the ASD group relative to the two other groups. Moreover, the preschool RRB ratings did not correlate with clinical assessment of RRBs in the high-risk group.

Conclusions: Ratings of SCI behaviors by preschool staff are in line with clinical assessment and can be a valuable source in differentiating children with ASD from those who have not. However, results indicate that preschool ratings of RRBs should be interpreted with caution. More research is needed within the RRB rating field.

158 **207.158** Preschoolers with ASD Who Have Both Cognitive and Adaptive Functioning Delays: Follow-up to Age Eight

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Background: Intellectual disability is a common co-occurring condition in individuals on the autism spectrum. Individuals with an intellectual disability have delays in both cognitive scores/IQ and adaptive functioning (typically standard scores < 70). In preschoolers, combined delays can be challenging to interpret, as standard scores often increase between preschool and school-age. Our team previously explored stability and change in cognitive and adaptive scores between age 2-4 and age 6 in a large longitudinal cohort. This study extends these findings to age 8.
Objectives: To examine developmental trajectories of children with ASD who have combined cognitive and adaptive delays at age 2-4. Specifically: (1) how do mean cognitive and adaptive scores change from age 2-4 to age 6, and to age 8 and (2), how frequently do delays (scores < 70) persist to ages 6 and 8?

Methods: Participants were 70 children from the Pathways in ASD cohort (76% boys; 33% of larger sample), recruited from one of five Canadian cities. At diagnosis, each child had both cognitive and adaptive standard scores < 70. Children were initially assessed at mean age 41.31 (*SD*= 7.96) months and reassessed at 79.15 (*SD*= 3.92) months and 104.71 (*SD*= 2.83) months. Adaptive functioning was measured using the Vineland Adaptive Behavior Scales, 2nd edition. Cognitive functioning was measured using either the Merrill-Palmer Revised (M-P-R), Wechsler Preschool and Primary Scale of Intelligence- 3rd edition (WPPSI-III) or Wechsler Intelligence Scale for Children- 4th edition (WISC-IV).

Results: (1) Between age 2-4 and age 6, mean IQ increased by 13 points (from 29.30 to 42.77, p <.001) and mean adaptive functioning increased by 4 points (from 62.31 to 65.87, p = .007). Smaller gains took place between ages 6 and 8: 6-point gain in IQ, to 48.55 (p = .003); 2-point gain in adaptive functioning, to 67.94 (p = .001). 2) At age 6, only 57% of children continued to have delays in both cognitive and adaptive functioning (see Table). In contrast, stability of skill level (combined delay vs. no combined delay) between ages 6 and 8 was high (κ = .86). At age 8, 56% had combined delays.

Conclusions: Results are consistent with clinical guidelines that suggest caution in interpreting low cognitive and adaptive scores in very young children with ASD, as scores and skill levels often improve by age 6. Stability of skill level is high between ages 6 and 8. It is also important to ensure that a diagnosis of ASD does not overshadow potential diagnosis of intellectual disability. Mean cognitive and adaptive scores remained < 70 at age 8, and over 50% of children continued to have significant impairment in both areas. During the preschool years, discussing the possibility of later intellectual disability may be appropriate. Re-assessment is important for this subgroup of children with ASD.

159 **207.159** Prevalence of Social Communication Disorder in Children at Risk for Autism Spectrum Disorder

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Background: In the years since the DSM-5 was released, concerns have been raised about the relationship between Social Communication Disorder (SCD) and Autism Spectrum Disorder (ASD).
Objectives: In the present study, we examined rates of DSM-5 SCD symptoms and diagnoses in youth at risk for ASD. We also compared how participants with and without diagnoses of ASD scored on the Children's Communication Checklist (CCC) in order to explore differences in social communication and pragmatic language as this might inform diagnosis of SCD.

Methods: Data for this study come from an epidemiological study examining the prevalence of ASD. Diagnostic evaluations were performed on 292 participants who had previously screened at risk for ASD via the Social Communication Questionnaire-Lifetime Version (SCQ). DSM-5 diagnoses were assigned by clinician best-estimate procedures by one of three doctoral level clinicians. Measures of autism symptoms, cognitive and adaptive skills, and behavioral checklists, including the CCC were included in assessment. The CCC was completed by all English-speaking parents whose children had at least phrase speech (n = 258) in order to measure communication and language issues common to both ASD and SCD.

Results: Out of 292 youth at risk for ASD, only 1 met diagnostic criteria for SCD. While 20 participants met all 4 clinical criteria for SCD, 19 of these (95%) also met criteria for DSM-5 Autism Spectrum Disorder, effectively ruling out a diagnosis of SCD. Analyses of the CCC scores indicated that participants with ASD also experienced impairment in scales measuring pragmatic communication (the hallmark feature of SCD) as well as impairment in the social relations and interests scales.

Conclusions: Results indicated that while a number of children met DSM-5 criteria for SCD, they were almost entirely children also meeting criteria for ASD. Further research is needed to evaluate the overlapping relationship between these disorders to inform diagnostic procedures and treatment recommendations, particularly as many the supports and services available for children with ASD may be difficult for children with SCD to access.

160 **207.160** Professional Views in Working with Children with ASD in Lithuania

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Background: Although research on Autism Spectrum Disorder (ASD) is increasing, most studies across different nations have reported wide variation of knowledge among health and educational professionals regarding diagnosis, treatment, teaching programmes and prognosis of ASD (Eseigbe et al., 2015). Professional's knowledge of ASD, in any health or education setting, is crucial to provision of optimal services and support for the family, which reduces the burden associated with ASD for the society (Imran et al., 2011). However, lack of knowledge and consistency among the services providers create unnecessary tensions between professionals and parents that could be avoided.
Objectives: The present research was conducted to further explore the experiences of professionals and their perceptions, knowledge's and attitudes about ASD and parental stressors while raising a child with ASD in Lithuania

Methods: Due to lack of research in this area in Lithuania, the qualitative methodology was used to explore the existing issues in-depth. Professional's attitudes and perceptions were explored via focus group discussions (FGD), which are a social method of obtaining research data through informal group discussions on a specific topic. In order to maximise the diversity of experiences informing the investigation a range of professional's subpopulations were identified: general practitioner vs specialised, mainstream school teacher's vs specialised school teachers, experienced vs less experienced, highly exposed to ASD vs less exposed to ASD, knowledgeable about ASD vs novice, rural vs urban. The sample consisted of total 42 people (N=7 general practitioners, N=7 ASD medical assessors, N=8 specialised urban school teachers, N=6 mainstream rural teachers, N=7 mainstream urban teachers).

Results: The key themes mentioned across groups were: knowledge and perception of ASD; process of diagnosis, the complexity of relationship

between parents and professionals, integration, training and resources, stigma and society. There were multiple discrepancies found in aspects of care, diagnosis, education and resources, thus divided into different themes or domains concurrently. The comments reported here represent the lives of parents of a child with ASD and portrayed the difficulties and benefits they experienced while having a child with ASD in Lithuania.

Conclusions:

In summary, there was agreement between medical professionals and parents on many issues, such as the need for future improvements with regard to help after diagnosis. Also, participants agreed on the levels of stigma in Lithuanian society and how destructive it is to the families. However, there was some discrepancy in transfer of information between the medical professionals and parents for next steps after diagnosis. Knowledge of ASD symptomology in young children should be the focus of GPs to help refer children early.

Also, experiences of parents indicated the need to equip mainstream school teachers in methods to work with children with ASD. It also highlighted the pressing issue of integration and the preparation that needs to take place for such people to be part of mainstream school. It was reported that parents worried and struggled when dealing with school administration and teachers. Government should aim at increased awareness on ASD to the general public to reduce stigma.

161 **207.161** Prolonged Analysis of ASD Assessment Methodologies Utilizing the ADDM Dataset

ABSTRACT WITHDRAWN

Background: Appropriately identifying ASD can be challenging for practitioners. Differences in training, experience, and cultural/linguistic responsiveness can contribute to delayed or misidentification of ASD (AAP, 2016). Disparities in ASD identification by gender, socioeconomic status and race/ethnicity exist (Mandell et al., 2007). These disparities can significantly impact the educational, social and vocational outcomes for children with ASD. Limited research has been conducted investigating trends in ASD assessment practices over time, and how these practices relate to ASD identification trends by population.

Objectives: This analysis will investigate ASD assessment practices (e.g. types of ASD specific assessments, IQ tests, and adaptive measures) over time (2000 to present). The study will describe what types of assessments providers (medical, educational; as well as by specialty, psychologist, developmental pediatrician, etc.) utilize. The focus of this project will be to investigate changes in ASD assessment practices and whether they vary by provider, source type (education vs. health), and ADDM site.

Methods: Data acquisition has been proposed and approved by the CDC ADDM PI. The data is currently being processed and will be delivered to the lead author by January 15th, 2019. Following the acquisition of the dataset, the authors will determine the appropriate analyses given sample sizes. It is predicted that some analyses will need to be conducted using basic frequencies as the usage of certain assessments or numbers in populations may be limited. However, for more robust analyses the authors intend on utilizing multiple regression methodologies. Additional comparisons will be conducted to explore, e.g., 1) score profiles in relation to diagnostic/eligibility statements and ADDM case status, including the level of confidence ADDM clinician reviewers have in confirming case status; 2) patterns over time (2000-2014) in the use of assessment instruments for children at different ages, and the age at which children are diagnosed with ASD or other coexisting conditions; and 3) variation in testing practices in relation to children's sex, race/ethnicity, and socioeconomic status. Analyses will be limited to children in the "8-year-old" cohorts.

Results: This project will explore changes over time in the assortment of instruments used to diagnose ASD. Special attention will be given to the types and specialties of providers evaluating children with ASD, the frequency and variety of assessment tools utilized over time, the settings in which these instruments are used (education vs. health), and differences in practices among ADDM Network sites. Additional analyses will focus on differences in these assessment practices by child's age at the time of assessment, sex, race/ethnicity, presence/age of ASD diagnosis, coexisting diagnoses, and socioeconomic status.

Conclusions: ADDM data provide an ideal source of information to explore long-term changes in formal assessment practices among providers conducting diagnostic evaluation of children with ASD. These instruments are useful for diagnosing conditions such as ASD and intellectual disability (ID), to determine eligibility for services, and to inform strategies for service delivery. Changes in assessment practices may be related to trends in early identification, racial/ethnic health disparities, and socioeconomic factors.

162 **207.162** Quantifying Convergent Validity between Parent-Reported Developmental Concerns and Eye-Tracking-Based Measures of Social Visual Engagement

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Background: Parent-report plays a crucial role in the diagnostic landscape for autism spectrum disorder (ASD). Caregivers have the most in-depth experience of their children's development — offering information that might not be easily obtained within shorter-duration clinician-based assessments. Here, we investigate the association between performance-based, objective measures of a child's behavior, collected via eye-tracking, and parent-reported concerns on one of the most widely-used developmental screeners, the *Ages & Stages Questionnaire - 3rd Edition* (ASQ). We investigate whether parent's concerns are associated with a child's social visual engagement when viewing scenes of peer social interaction. Social visual engagement is a central means through which children define the course of their own developmental trajectories (Constantino et al., 2017): by engaging with certain aspects of their social environment, children gather unique information that alters their learning. In ASD, variation in social visual engagement is strongly associated with levels of clinician-measured social-communicative competence.
Objectives: To investigate the relationship between parent-reported developmental concerns and performance-based, objective measures of children's social visual engagement via eye-tracking in a large, heterogeneous, clinically-referred sample.

Methods: Parent-reported developmental concerns and eye-tracking data were collected from N=146 consecutive referrals (M_{age}=28.23 months, *SD*=6.89) to a community-based clinic. Children were referred because of general or ASD-specific developmental concerns. All children received a gold-standard diagnostic evaluation, including the *ADOS-2*, developmental history, and developmental functioning measures (ASD n=115, non-ASD developmental delays n=14, no clinically-verified delays n=17). Parent-reported developmental concerns were collected through the ASQ. Eye-tracking data were collected while toddlers watched video scenes of children in daycare settings and were quantified by measuring percentage of

visual fixation to faces and objects. Spearman correlation was used to test for associations between parent-reported concern and visual fixation to regions-of-interest.

Results: The data show significant associations between measures of social visual engagement and parents' concerns about their children's social-emotional and communication development, with increased attention to faces predicting fewer concerns (r=0.451, p<0.001 and r=0.330, p<0.001, respectively; see Figure 1) and increased attention to objects predicting greater concerns (r=-0.452, p<0.001 and r=-0.266, p=0.003, respectively; see Figure 1). Specifically, fixation on faces was significantly associated with parents' concerns about whether their child points, follows directions, plays pretend, plays with dolls, and talks like other children (all p<0.05). These associations appear specific to social-emotional and communication concerns, rather than to general developmental concerns, as fixation on faces was unrelated to parental concern about their child's ability to walk, jump, use stairs, turn doorknobs, or copy a line (all p>0.05).

Conclusions: Results indicate significant moderate convergent validity between eye-tracking-based measures of social visual engagement and parent-reported developmental concerns — consistent with prior research measuring the extent to which measures of social visual engagement are associated with clinician-administered assessments (Jones & Klin, 2013; Jones, Carr, Klin, 2008). Follow-up work will replicate the current results in an independent sample (N=105) and will test the extent to which the relationships between measures can be used to help clarify a challenge in the use of parent-report measures: biases that can manifest as inconsistently reported concerns.

163 **207.163** Racial and Ethnic Differences in Diagnosis and Service Use

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Background: Prior research suggests racial and ethnic disparities in age of diagnosis and therapeutic/educational service use for individuals with autism spectrum disorder (ASD). Specifically, individuals from minority populations are commonly reported as being diagnosed later and receiving fewer services, relative to those from a non-minority group. Additional research is needed to better understand and address differences. Objectives: The purpose of this study is to examine differences in age of diagnosis and therapeutic service use for an ethnically diverse sample of individuals diagnosed with ASD.

Methods: Participants represented a subset of individuals who had previously registered with the SPARK (Simons Foundation Powering Autism Research for Knowledge) study. SPARK is an ongoing, nationwide autism genetic study funded by the Simons Foundation. SPARK participants are asked to provide a genetic sample and answer questions related to developmental/clinical history and symptom presentation. The University of Miami Center for Autism and Related Disabilities (UM-NSU CARD) serves as an affiliated clinical partner site, tasked with recruiting individuals into the SPARK study. For the current study, data from SPARK registrants who selected UM-NSU CARD as their affiliated site and who had completed a questionnaire related to background history were included. The sample consisted of 189 children and dependent adults with ASD (m=8 years (range 1-33 years), and included 58 (31%) Caucasians, 88 (47%) Hispanics, 14 (7%) African Americans & 29 (15%) from Mixed/Other race. Group comparisons of various diagnostic and service use variables were statistically evaluated.

Results: In this sample, there were no mean differences in age of diagnosis or onset of first concern based on racial/ethnic classification. Regarding education and service use, Caucasians had significantly higher use of psycho-pharmaceutical treatments; whereas African Americans were more likely to have repeated a grade in school. No other significant differences were identified in terms of school placement, school services, and other therapeutic interventions.

Conclusions: ASD is known to impact individuals across various racial and ethnic groups, and the clinical prognosis is impacted by access to early and high-quality interventions. Therefore, it is important to continue to examine the differences between racial and ethnic groups, in order to develop individual and community-based strategies to ameliorate such differences. In this sample, minority and non-minority groups received ASD diagnoses at comparable ages. While contrary to prior research, this finding may represent improvements in diagnosis across racial/ethnic groups. Furthermore, the University of Miami is located in an urban and ethnically-diverse area, whereby diagnostic trends may differ from those found in alternative locations. Despite comparable diagnostic ages, identified differences in treatments are clinically and educationally relevant. Future research may want to explore cultural differences in the perceptions and knowledge about psycho-pharmaceutical treatments. Furthermore, educational settings should continue to focus on efforts on addressing disparate educational practices for African American students.

164 **207.164** Screening Profile on M-CHAT(-R/F) for Toddlers Who Screened Positive for ASD and Received "No Diagnosis"

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Background: Previous findings indicate that children who fail an autism screener, the Modified Checklist for Autism in Toddlers with Follow-Up (M-CHAT/F) and its revision (M-CHAT-R/F) are highly likely to have significant developmental concerns. 97.7% (Chlebowski, Robins, Barton, & Fein, 2013) and 94.6% (Robins et al., 2014), respectively of screen-positive cases were diagnosed with ASD or other developmental delay or concern following comprehensive evaluations. Research has investigated which items of the M-CHAT(-R/F) best discriminate toddlers with and without ASD (Kamio et al., 2015; Robins et al., 2010). However, we have yet to specifically characterize a group of "No Diagnosis" children, or those who screen positive for risk for autism, but present with sub-clinical developmental concerns at evaluation.
Objectives: To compare items failed on the M-CHAT(-R/F) of children with "No Diagnosis" (ND) with typically developing children (TD; i.e., children who screened positive on the screener, but were within normal limits on all areas of development) and children diagnosed with ASD, global developmental delay (DD), and developmental language delay (DLD).

Methods: 169 toddlers (mean age at evaluation = 23.7 months, range: 16-41 months) who screened positive on the M-CHAT(-R/F) completed a diagnostic and developmental evaluation. 28 TD children, 39 children with ASD, 33 with DD, and 27 with DLD were matched on sex, age, and race/ethnicity to 42 children with ND. Total items failed on the M-CHAT(-R/F) was regressed onto diagnostic group in separate comparisons between ND and each other group. For each M-CHAT(-R/F) item, Fisher's Exact Tests compared the proportion of children in the ND group who failed the item to that in each other group. Data from M-CHAT items were combined with data from its corresponding M-CHAT-R/F item, with data from three items from the M-CHAT (i.e., peek-a-boo, playing with toys, and wandering without purpose) excluded. Due to the exploratory nature of these analyses, alpha levels were not corrected.

Results: Groups did not differ significantly on level of maternal education. The ND group had significantly fewer average total M-CHAT(-R/F) items failed compared to the ASD group (p=.001), but did not differ from the TD (p=.076), DD (p=.144), or DLD (p=.958) groups. Results from item-level analyses are presented in Table 1, and graphically represented in Figure 1 (attached).

Conclusions: At the first stage of autism screening, toddlers with sub-clinical developmental delays are distinguishable from toddlers with ASD but not other diagnostic groups, highlighting the role of the M-CHAT(-R/F) as an autism-specific screener. Items about social communication (e.g., response to name and language, response to and initiation of pointing) and play (e.g., pretend play, imitation) best distinguish ASD from ND, relative to other items (e.g., unusual motor activity). A subset of the same items also distinguish ND from DD. At screening, children with subclinical presentations are indistinguishable from children who have a DLD. Furthermore, the ND group is highly similar to the TD group at screening, other than being more likely to have poor language comprehension. These findings underline the importance of conducting further diagnostic evaluation for children who fail screening.

165 **207.165** Self-Diagnosis in Adults with Presumptive Autism Spectrum Disorder

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Background: as the prevalence of autism spectrum disorder (ASD) is constantly rising, an increasing number of adults with ASD is expected. Delayed diagnosis is quite common in subjects without cognitive impairment: these adults may be capable of functioning independently, but they frequently have to face challenges in everyday life (i.e. job, interpersonal relationship) which could lead to significant psychiatric comorbidities (i.e. depression), determining a reduction in the quality of life. Diagnosing ASD in adulthood is a challenge for the clinicians and only few specialized centers are available. Therefore, adults with presumptive autistic traits often rely on self-diagnosis, using the internet.
Objectives: the aim of the present study is to study the characteristics of self-diagnosed individuals who subsequently obtained a formal ASD diagnosis.

Methods:: 89 subjects who self-diagnosed themselves with ASD were evaluated by means of clinical interview for DSM 5 and standardized tests (ADOS 2 module 4, ADI-R if caregivers were available, cognitive tests). Sociodemographic and clinical characteristics were obtained for each subject.

Results: among self-diagnosed subjects only the 58.4% (n=52) obtained a formal diagnosis of ASD. These subjects showed low severity of symptoms according to DSM 5 (level 1: 57.7%; level 2: 40.4%), were more frequently males (71.2%), unemployed (52.9%) and single (90.4%). Nearly half of self-diagnosed subjects with a confirmed ASD had received at least one previous psychiatric diagnosis other than ASD (47.1%). Only 28.8% were on psychotropic medications. In stepwise logistic regression analysis, presence of a confirmed diagnosis in self-diagnosed subjects was significantly predicted only by age at evaluation (B=-0,086, SE=0,023, p<0.001).

Conclusions: There is an increase in ASD self-diagnosis in adulthood. This phenomenon may be link to increase knowledge and popularity of ASD in the media and may eventually lead to an increased request of formal diagnosis. However, ASD symptoms in adult not previously diagnosed may be subtler and covert, thus requiring trained clinicians.

166 **207.166** Self-Report and Parent-Report Reveal Similar Patterns of Executive Function Problems in Autistic Adolescents

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Background: Parents of autistic individuals[a] consistently report global executive functioning (EF) problems in their children, with the greatest problems occurring in flexibility and meta-cognition (Granader et al., 2014; Wallace et al., 2016; White et al., 2017). Unlike parent report of EF, self-report allows autistic individuals to offer insight into their own experiences. As suggested by prior research, self-report provides the opportunity to obtain a more accurate understanding of an individual's behavior (Verhulst & van der Ende, 1992; Robins, Fraley & Krueger, 2009). To date, however, research has only investigated self-report of EF in older autistic adults (Davids et al., 2016).
Objectives: To investigate whether autistic youth self report EF problems and if their self-reported profile yields a similar pattern of EF problems to that reported about them by their parents.

Methods: Archival data on the Behavior Rating Inventory of Executive Function (BRIEF) self-report from 134 autistic youth (101 male, ages 11.0–18.75 years, FSIQ≥71) and BRIEF informant report from parents (n=134) were evaluated. One-sample T-tests were utilized to determine if the self-ratings represented statistically significant elevations in EF problems compared to the expected T-score mean of 50. The parent- and self-report versions of the BRIEF have the same three domains in the Behavior Regulation Index (BRI), but only share four of the same domains in the Metacognition Index (MCI); see Figure 2. Therefore we ran two general linear model (GLM) repeated measures ANOVAs to a) examine the self-report BRIEF profile in autistic youth and b) compare subscale score patterns from the BRIEF self- and parent-report in the same autistic youth.

Results: Autistic youth reported significantly elevated EF problems compared to the expected mean for all BRIEF domains (*p*'s<.005) except for the Inhibit domain (*ns*); see Figure 1. A GLM repeated measures ANOVA showed a main effect of BRIEF domain score for autistic youth, $F(5.39, 242.26)=2.98$, $p<.01$). A second GLM repeated measures ANOVA showed a main effect of BRIEF domain score, $F(4.84, 509.22)=5.35$, $p<.001$, and of rater, $F(4.84, 879.57)=9.24$, $p<.001$, as well as an interaction between rater and domain score, $F(1,265)=80.03$, $p<.001$, indicating that parents report higher levels of problems than their children report; see Figure 2. Post-hoc paired-sample T-tests show peak problems in the BRI Shift subdomain for both parent, ($t=71.22$, $p<.005$), and self-report, ($t=57.84$, $p<.05$), across all domains except for self-report of MCI Task Completion (*ns*) and parent-report of MCI Working Memory (*ns*).

Conclusions: These findings suggest that autistic youth self report a profile of EF problems to a greater degree than the normative BRIEF sample. Although they report less severe problems than their parents report about them, autistic youth identify a pattern of difficulties that emphasizes flexibility problems and metacognitive deficits, as do their parents. These results suggest that autistic youth recognize and can identify their own EF challenges. Therefore, assessing the lived experiences of autistic youth is critically important to clinical and research endeavors involving autistic individuals.

[a] Identity-first language rather than person-first language is used frequently in this abstract, consistent with practice among autistic self-advocates.

167 **207.167** Self-Report of Physical Health, Sexual Well-Being, and Alcohol Use in Adults with Autism Spectrum Disorder (ASD)

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Background: There is increasing evidence that individuals with ASD experience higher rates of physical health problems (e.g., gastrointestinal disorders, sleep disturbances, obesity) as compared to the general population. However, previous researcher has also found that some conditions are less commonly diagnosed in adults with ASD (e.g., alcohol abuse/dependence). To the author's knowledge, little is known about adults self-report of their own physical health, sexual functioning, and alcohol use.
Objectives: To explore profiles of self-reported physical health, sexual interest and satisfaction, as well as alcohol use in adults with ASD.

Methods: Data was collected from adults with ASD who were enrolled in state-funded programs in Pennsylvania. Participants completed a battery of self-reported questionnaires from the Patient-Reported Outcomes Measurement Information Systems (PROMIS), which measured physical health, sleep disturbance, impairment, fatigue, sexual interest and satisfaction. Additionally, current alcohol use in the past 30 days and BMI were included. Our sample of 55 adults with ASD is predominantly male (81.3%), White (89.1%) with a mean education level of 12.89 ± 1.91 years, and a mean age of 31.17 ± 7.64 years. 51% reported currently living with their parents. Mean SRS-2 Total T-Score was 61.44 ± 8.31.

Results: 27% of BMIs fell in the overweight range while 60% fell in the obese range (30.86 ± 5.35); this is significantly higher than the BMI for average Americans (25.55; $p = 0.01$). 16% of participants reported physical health problems and sleep impairment in the borderline range. 8% of participants reported borderline fatigue, as well as sleep disturbance. 4% reported clinical symptoms of fatigue. 2% reported clinical symptoms in sleep impairment/disturbance. 43% of participants reported no interest in sexual activity; however, 50% of participants reported that they are not satisfied with their sex life regardless of their reported level of interest in sexual activity. 16% of participants reported having drank at least one drink of an alcoholic beverage in the last 30 days compared to the American average of 56%. Physical health was correlated with being unemployed ($r = -.29$, $p < .05$), SRS-2 Total Score ($r = .33$, $p < .05$), sexual interest ($r = -.42$, $p < .05$), fatigue ($r = .68$, $p < .01$), sleep disturbance ($r = .29$, $p < .05$), and sleep impairment ($r = .42$, $p < .01$). Sleep impairment was associated with living with parents ($r = -.35$, $p < .01$). SRS-2 Total T-Score was correlated with greater sexual interest ($r = 0.36$, $p < .05$). Finally, drinking alcohol was associated with higher sexual satisfaction ($r = 0.58$, $p < .05$).

Conclusions: Self-report of physical health problems, sexual satisfaction and interest, and alcohol use in adults with ASD using PROMIS measures parallel findings from larger studies of children with caregiver self-report or big-data research, including higher rates of obesity in adults with ASD. Future research with larger, more representative samples of adults with ASD is necessary to clarify the degree to which physical health problems, sexual interest and satisfaction, as well as alcohol use in adults with ASD impact each other.

168 **207.168** Sensitivity and Specificity of the Social Communication Questionnaire in a Diverse Clinical Sample

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Background: Screening questionnaires precede a full evaluation to determine the likelihood of an Autism Spectrum Disorder (ASD) diagnosis. They are inexpensive, relatively easy to administer and are used by a variety of professionals across general (e.g., pediatrician office) and clinically referred (e.g., early intervention agency, diagnostic clinics) settings. When used in pediatric populations, developmental screening questionnaires

are most often completed by parents and are intended to gather information about emerging developmental abnormalities that may prompt further assessment by a specialist. Ideally, the results of these questionnaires can inform clinical triage and evaluation processes. However, a review of several ASD-specific screening questionnaires suggested that they often show low sensitivity and are in need of higher levels of scientific scrutiny (Norris & Lecavalier, 2010). The *Social Communication Questionnaire* is a 40-item screening measure completed by parents for identifying symptomatology associated with ASD *(*SCQ*;* Rutter et al., 2003*)*. Despite its popularity, there is limited research that examines how the SCQ functions in diverse clinical populations (Baio, 2018).

Objectives: This study provides a unique opportunity to understand better the sensitivity and specificity of the SCQ within a large, diverse clinical sample in New Mexico with Hispanic and Non-Hispanic populations.

Methods: We compiled a database using information from clinical evaluations completed at the University of New Mexico Center for Development and Disability. The Autism Spectrum Evaluation Clinic completes comprehensive diagnostic evaluations of children who are referred for concerns related to ASD. Our preliminary sample included children between ages 2-18. We conducted sensitivity and specificity analyses across age and ethnic groups using the SCQ published cut score of 15. Fisher exact tests and logistic regression with Firth's penalized likelihood were used to assess heterogeneity in sensitivity and specificity. Non-parametric tests were used to compare continuous variables.

Results: Our preliminary sample included 218 children with 126 (58%) receiving a diagnosis of ASD, 167 (77%) being males and 55% self-identified as Hispanic. ASD was diagnosed for 56% of Hispanic and 60% of Non-Hispanic children. Sensitivity was 0.86 (95% CI = 0.73, 0.95) for the No Language group, 0.50 (0.34, 0.66) for age 2-4 years, and 0.76 (0.61, 0.87) for age 5-18 years. Specificity was 0.40 (0.16, 0.68) for the No Language group, 0.57 (0.34, 0.78) for age 2-4 years, and 0.28 (0.17, 0.41) for age 5-18 years. Overall, sensitivity was not different for Hispanic and Non-Hispanic (P = 0.162) groups, but specificity was lower for age 5-18 Hispanic than Non-Hispanic groups age 5-18 years (P=0.023).

Conclusions: Results of this study indicate that sensitivity and specificity of both Hispanic and Non-Hispanic groups vary greatly across age groups. Further analyses are needed to determine additional factors (e.g., cognitive ability, lower cutoff score) that impact sensitivity and specificity in this clinical sample that can be used to maximize the functionality of the SCQ to inform better clinical referral and triage decisions in diverse populations.

169 **207.169** Sex Differences in CARS Scores for Toddlers with Autism Spectrum Disorders

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Background:

Autism Spectrum Disorder (ASD) is four times more prevalent in boys than girls (CDC 2018). Girls may display a different symptom profile than boys, which may impact diagnosis rates; however, previous studies report conflicting results on sex differences in ASD symptoms. Some studies report no significant differences between sexes (Carter et al., 2007), while others report more stereotyped behavior in boys (Hartley & Sikora, 2009) and greater social communication impairments in girls (Lawson et al., 2018). Studies examining sex differences in total and item level scores on ASD diagnostic measures present similar contradictions (Beggiato et al., 2017; Pilowsky et al., 1998 Rynkeiwicz et al., 2016; Tillman et al., 2018). Given these inconsistent results and that participants in most of these studies are older children and adults, more research is needed to determine sex differences in ASD symptoms among toddlers and how these differences impact the utility of diagnostic tools.

Objectives:

To investigate sex differences in scores on the Childhood Autism Rating Scale (CARS) to examine the utility of the CARS for toddler-aged boys and girls. Specifically, based on prior literature, to test the hypothesis that male and female toddlers receive similar scores on overall severity, emotional reactivity, and stereotyped behaviors, but female toddlers exhibit more impairment in social communication.

Methods:

Participants for this study were part of a multi-site early detection study (Robins et al. 2014). Parents completed the Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R) at their child's 18- or 24-month checkup and were offered a diagnostic evaluation if the child screened at risk after follow-up. This sample includes 323 participants who completed the evaluation between the ages of 17 and 27 months and met ICD-10 criteria for Childhood or Atypical Autism. There were no significant differences between sexes in age ($t(321)=0.308$, $p>.05$) or cognitive ability ($t(321)=-0.671$, $p>.05$). The CARS is a 15-item observation-based rating scale that yields a total score reflecting ASD symptom severity (Schopler et al., 1980). CARS items were divided into three factors (social communication, emotional reactivity, and stereotyped behaviors and sensory sensitivities) based on a factor analysis completed by Moulton et al. (2016). Factor scores were calculated by averaging the scores of all items included in a factor.

Results:

No significant differences were found between boys and girls on total severity scores, factor scores, or individual item scores (Table 2).

Conclusions:

Results support the hypothesis that male and female toddlers score similarly on overall severity, emotional reactivity, and stereotyped behaviors. Results do not support the assertion that female toddlers score higher on items assessing social communication. This suggests that the CARS is a valid diagnostic measure for both male and female toddlers and supports previous findings that show little to no sex differences in ASD core symptoms (Carter et al., 2007). Future studies should continue to compare the symptoms reported for male and female toddlers with ASD to determine any sex differences in symptom profiles and determine the utility of diagnostic measures across sexes.

170 **207.170** Sex Differences in Symptom Profiles in a Preschool Sample of Hispanic Children with ASD

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Background: Females with ASD may show phenotypic differences in behavioral and/or cognitive patterns[1-3], which may vary by age[4-5]. Female toddlers with ASD may demonstrate more severe social communication impairments and less severe restricted and stereotyped behaviors, although these finding differ across studies[6-8]. However, the majority of studies have been conducted primarily with white families, although ASD

diagnosis and symptom presentation also varies according to race/ethnicity, with minority children exhibiting later diagnosis, lower cognitive and language scores and more severe ASD symptoms[9-11]. The extent to which gender differences exist *within* minority groups has not been adequately examined.

Objectives: To evaluate sex/gender differences in symptom presentation within a minority sample of Hispanic preschool-age children referred for diagnostic evaluations.

Methods: The overall sample is comprised of 153 children between the ages of 2 and 5 who were evaluated at an University-based specialty diagnostic clinic as part of a services grant for children suspected of having an autism spectrum disorder. Children at risk for ASD based on screening results were referred directly through local Part C and Child Find services and were either (1) Medicaid eligible or lacking private insurance (2) Head Start or Early Head Start eligible or (3) zoned for a Title 1 schools. Current analyses include only those children who received diagnoses of ASD and who also identified as being of Hispanic descent (n=89, 58% of initial sample), resulting in 43 females (48.3%) and 46 males (51.7%), with a mean age of 45.94 months (SD=9.71) and nonverbal IQ of 72.18 (SD =24.59).

Results: Females were significantly younger at referral (M_F=43.23 vs M_M=48.43 months), *t*= - 2.583 (87), *p*=.011. Age and nonverbal IQ (NVIQ) were significantly correlated, but only for males (*r* =.337, *p*=.022). Patterns of correlations between age, nonverbal IQ and outcome measures differed for females vs. males (see Tables 1-3). Due to this, MANOVAs and MANCOVAs were conducted to test for differences between females and males across the various symptom measures, with age as a fixed factor; age and/or NVIQ as entered covariates, depending on the pattern of correlations observed.

No significant sex differences in NVIQ, receptive or expressive language, or parent report of autism symptoms were found. However, females had lower communication (Battelle Developmental Inventory-2) scores ((M_F=58.83, SD=6.046 vs.M_M=66.38, SD=18.464), *F*(1,66)= 4.477, *p*=.038) and higher ADOS Social Affect severity scores ((M_F=6.70, SD=2.356 vs. M_M=5.00, SD=2.996), *F*(1,86)= 8.189, *p*=.005), after controlling for NVIQ. Females were also rated as more severe with respect to BASC attention problems, ((M_F=67.49; SD=10.018 vs. M_M=61.11; SD=9.778), *F*(1,87)=9.240, p=.003)) and atypicality ((M_F=67.12; SD=16.776 vs. M_M=60.41; SD=13.864), *F*(1,87)=4.247, p=.042). Finally, females were also more likely to have a comorbid diagnosis of Pica, χ^2(1,N=89)= 5.667, p=.017.

Conclusions: Male and female Hispanic children are more similar than different on the majority of measures. However, some differences were found with respect to age of referral, clinician ratings of ASD symptom severity, communication abilities, parent reported behavioral symptoms, and patterns of comorbidity. Implications of these findings for the diagnostic and treatment process will be discussed.

171 **207.171** Sex Differences in the Sensitivity, Specificity, and Diagnostic Cutoff of the Childhood Autism Spectrum Test (CAST) in Israel

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Background: The past decade has seen a shift in the understanding of the different clinical picture of Autism Spectrum Disorder (ASD) in females. Due to various factors, such as test sensitivity and female camouflaging effect (Lai et al., 2011), females on the more functioning end of the autism spectrum have often been missed out (Loomes et al., 2017). It is therefore important to examine the sensitivity of ASD screening instruments separately for boys and girls. The the Childhood Autism Spectrum Test (CAST; Scott et al., 2002) is an ASD screening instrument that has been widely used in the UK (e.g. Allison et al., 2007) as well as cross-culturally (Morales et al, 2017; Sun et al., 2014; Vulchanova, et al., 2016). However, the instrument's cutoff has not been tested separately for boys and girls.

Objectives: The current study aimed to test the sensitivity, specificity and diagnostic cutoff of the CAST in Israel by comparing a clinical sample of boys and girls to a typically developing sample.

Methods: Participants were 295 children, aged 6-12. The clinical group included 101 children: 79 boys (age: 9.08, S.D.=1.97) and 22 girls (M=9.36, S.D.=1.89), recruited through a tertiary ASD clinic, who were clinically diagnosed, based on the ADI-R and the ADOS-2. They were compared to 194 typically developing children: 102 boys (M=8.86, S.D.=1.98) and 92 girls (M=8.88, S.D.=1.94), recruited through internet forums and reported to have no neuropsychiatric diagnoses. Participants' parents filled out the Hebrew translation of the CAST. The clinical cutoff, sensitivity and specificity of the CAST total score were calculated separately for boys and for girls. A calculation of the cutoff for the entire sample was conducted after partialling out some of the typically developing girls sample, to ensure m:f proportion is similar in the clinical and the typical groups.

Results: The separate analysis for boys and girls showed that the optimal cutoff score was 13, with a sensitivity of 0.82 and a specificity of 0.86 (AUR=.91, S.E.=.02), while for girls the cutoff score was 8, with a sensitivity of 0.91 and a specificity of 0.89 (AUR=.97, S.E.=.01). The joint analysis over and above sex, yielded an optimal cutoff score of 12, with a sensitivity of 0.83 and a specificity of 0.84 (AUR=.92, S.E.=.02).

Conclusions: Our examination of the CAST demonstrates the need for separate cutoffs for boys and girls. By employing a joint cutoff, there is a risk of missing out girls whose presentation of symptoms may be more subtle, or camouflaged. Interestingly, despite the lower cutoff for girls, it still allowed for better discrimination between ASD and TD, than the cutoff for boys. It is important to note that our sample of girls with ASD was relatively modest. Further studies should examine different cutoffs for girls and boys on the CAST, as done for other screeners, such as the SRS-2 (Constantino & Gruber, 2012).

172 **207.172** Signs of Autism Found on Chart Review of Screen-Negative Children with Autism

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Background: Autism screening is widely employed to help pediatricians identify children at risk for autism, refer for prompt diagnostic evaluation, and start crucial early intervention. However, the mean age of diagnosis nationally is 52 months, approximately 2 years after autism screening. Screening instruments have estimated high sensitivity, but do miss some cases and can be falsely reassuring. Children who screen negative but go on to receive an autism diagnosis may have early signs of autism in routine medical and developmental history taken at well visits.

Objectives: To search medical records of children with autism who had false negative results on autism screening for behaviors or concerns associated with autism present prior to diagnosis in order to identify areas of development that should be added to the surveillance and screening process for autism.

Methods: Charts were reviewed within a large healthcare system for children who were 16-30 months old and screened for autism in 2013-2016. A

cohort was identified who were screened with the Modified Checklist for Autism in Toddlers (M-CHAT) or the revised version (M-CHAT-R), and who had a later diagnosis of autism in their medical record based on the presence of an ICD code consistent with ASD. Charts of screen-negative children were first manually reviewed by autism experts to confirm autism diagnoses. Among those children with confirmed autism, provider notes were manually searched for documentation of early signs of autism and co-morbidities often associated with autism, and frequencies of these findings were calculated.

Results: 161 children with autism screened by the M-CHAT from 2013-2016 were identified. Of these, 99 (61%) screened positive on the M-CHAT and 62 (39%) children with confirmed autism screened negative. Among screen-negative cases, 66% had impairments noted in social communication, 60% had severe dysregulation of feeding or sleep or both, 48% had repetitive or restrictive play, 60% had abnormal sensory seeking or avoiding behaviors, 18% had a sibling with autism, 71% had a parental concern for autism, and in 61% the physician recorded a concern for autism. Overall, 79% of screen-negative children with autism had record of a parent or physician concern within the areas of social communication or repetitive/restricted play.

Conclusions: Most screen-negative children with autism had early markers of atypical development apparent in chart review prior to their autism diagnosis. A larger than expected proportion of children with autism had a negative screen, given previous studies of the M-CHAT showing high sensitivity. Notably, for most children studied, either the parent or the physician themselves reported a concern for autism. Despite signs of autism, a negative screen may be falsely reassuring against an autism diagnosis. Clinical signs of autism should prompt referral for further evaluation, and should not be overruled by a negative autism screen. Continued improvement of the screening process and screening instruments for autism are needed to improve early identification of children with autism.

173 **207.173** Sociodemographic Predictors of M-CHAT Responses Among Children Who Screened Positive

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Background: Children from minority and low-income backgrounds are likely to be diagnosed with autism spectrum disorder (ASD) at a later age (Mandell, Novak, & Zubritsky, 2005). The Modified Checklist for Autism in Toddlers, Revised, with Follow-up (M-CHAT R/F; Robins, Fein, & Barton, 2009), is a parent completed screening questionnaire. If universally administered, the M-CHAT R/F may help reduce racial and ethnic disparities in age of identification. However, among children who screen positive on the M-CHAT-R/F), little is known about whether sociodemographic factors further predict item-level responses or total M-CHAT-R/F scores.

Objectives: The current study aims to examine whether sociodemographic factors predict both item-level responses and total scores on the M-CHAT-R/F.

Methods: Participants are children aged 15-30 months who screened positive on the M-CHAT R/F at the baseline visit of a NIMH-funded multi-site comparative effectiveness trial (N=310; see Table 1). The population is largely low-income, majority-minority, with public insurance. Research assistants read parents the M-CHAT-R/F and demographic questionnaires at the time of enrollment. A priori hypotheses stated that parent and child sociodemographic factors would predict M-CHAT-R/F item-level responses. Multivariable logistic regression models included all sociodemographic factors (child race; ethnicity; sex; insurance; maternal education level; and – as a proximal marker for low income-- enrollment in Women, Infant, Child [WIC] nutritional program) simultaneously. Because the data were aggregated from a multi-site study, analyses controlled for clinical site of enrollment.

Results: Statistically significant results of multivariable logistic regression models are reported in Table 2. Total M-CHAT R/F score was not significantly associated with any sociodemographic factors. Child ethnicity and insurance type were not significantly associated with item-level responses. However, at the item level, parents were more likely to report wondering if their child was deaf (M-CHAT-R/F item 2) if the child's race was white rather than black or Asian. Across races, mothers who completed college were less likely to wonder if their child was deaf. Parents of females were more likely to report that their child attempts to copy what they do (M-CHAT-R/F item 15). Low income families (as measured by WIC enrollment) were less likely to agree that their child looks around to see what parents turn around for (M-CHAT-R/F item 16).

Conclusions: These findings suggest that sociodemographic variables may affect either early ASD presentation or parent perceptions. Future research should investigate further differences in cognitive and behavioral functioning as they pertain to sociodemographic variables as well as ways these variables may affect interpretation of M-CHAT-R/F items.

174 **207.174** Measurement of Challenging Behaviors and Child Engagement in Youth with Creatine Transporter Deficiency

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Background: Challenging behaviors during standardized testing are prevalent among children with autism and intellectual disability (ID). Such challenging behaviors are a frequent focus of intervention, as they may decrease the child's ability to function independently and participate in the community. Standardized measurements of cognitive functioning generate scores that describe performance on developmental tasks relative to typically developing peers but fail to consider behaviors that may impact performance (e.g. disruptive behaviors, participant engagement). This is unfortunate, since a reduction in challenging behaviors may be one of the first outcomes of intervention, and a more proximal measure of improvement than standardized test scores. To date, no research has examined the specific profile of challenging behaviors in Creatine Transporter Deficiency (CTD), a rare genetic disorder associated with intellectual disability and a high risk of autism spectrum disorder.

Objectives: Using video samples of standardized assessments, the current study aims to quantify the amount of time the child is demonstrating challenging behaviors and the amount of time the child is appropriately engaged.

Methods: The sample consists of 20 male participants with CTD, each of whom have at least two time points of data collection (6 months apart). A review of qualitative interview data with parents of children with CTD and review of previously collected video recordings of standardized assessments informed the design of a behavioral coding scheme. Using a linguistic coding software, EUDICO Linguistic Annotator (ELAN, 2018), raters will utilize 10-minute video samples of the Mullen Scales of Early Learning (MSEL; Mullen, 1995) or the Wechsler Achievement Scale of

Intelligence (WASI; Wechsler & Hsiao-pin, 2011) to code for behavioral patterns exhibited in this population.

Results: Videos from 3 participants were coded from two time points each. 1) adult time spent attempting to engage the child; 2) presence of disruptive behaviors (crying/whining, inappropriately touching or grabbing objects, property destruction, aggression, and eloping); and 3) duration of child engagement (appropriate listening, waiting, or acting). Findings from the first three participants indicate that with an average duration of Demands Placed at approximately 8.9 minutes, the ratio of Disruptive to Engaged time during standardized testing ranged from [0:9.7 to 2.5:4.0] at Time 1 and [0:9.8 to 3.0: 2.9] at Time 2. Coding for the videos from the remaining 17 participants is underway and will be available for presentation.

Conclusions: Quantifying challenging behaviors that occur during cognitive testing may provide an important outcome measure that could be sensitive to intervention and more objective than parent or teacher report. If sensitive to intervention, duration of time spent in challenging behavior and duration of child engagement could be more proximal outcome measures than a change in standardized test scores.

175 **207.175** Student, Parent, and Teacher Perspectives of Self-Determination in High School Students with Autism Spectrum Disorder

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Background: Self-determination refers to an individual being a causal agent in their daily activities including the ability to express their own needs, interests, and wants to make choices and set goals. Self-determination is critical during adolescence and has been linked to positive educational outcomes in individuals with disabilities. Few studies have characterized the measurement of self-determination in adolescents with ASD.

Objectives: The purpose of the current study was to (1) examine the reliability and factor structure of the American Institutes for Research Self-Determination Scale (AIR-SDS; Wolman et al., 1994) student, parent, and teacher forms for high school students with ASD, and (2) examine student and family predictors of self-determination.

Methods: Participants were part of a larger RCT of a comprehensive treatment model for high school students with ASD. The current study utilizes data collected prior to the intervention. Participants included adolescents with ASD (N = 488, Mean Chronological Age = 16.1 years SD = 1.4 years), their parents, and teachers. Students, parents, and teachers completed the AIR-SDS. The AIR-SDS measures two broad self-determination components; a student's capacity, or their knowledge, abilities, and perceptions that enable them to be self-determined, and opportunities to use their knowledge and abilities at home and in the classroom. Parents completed the Family Empowerment Scale and the Zarit Burden Interview. Teachers completed the Social Responsiveness Scale as a measure of autism symptoms and the Vineland Adaptive Behavior Scales as a measure of adaptive behavior.

Results: The student-reported self-determination overall mean had small associations with parent-report (r= .11, p = .04) and teacher-report (r = .11, p = .04). Teacher and parent-reports were moderately correlated (r = .27, p < .001). Item analysis and confirmatory factor analysis were conducted for each version of the AIR-SDS. The internal consistency of the AIR-SDS was high across students (Cronbachs α = .92), parents (Cronbachs α = .91), and teachers (Cronbachs α = .96). The standardized factor loadings supported the hypothesized factor structure in addition to model fit statistics for the student report, RMSEA = .06 (90% CI [.03 , .10]), CFI = .98, TLI = .96, parent report, RMSEA = .07 (90%CI [.04 , .09]), CFI =. 97, TLI = .95, and teacher report, RMSEA = .06 (90% CI [.04. 09]), CFI = .99, TLI = .97. Greater adaptive behavior skills were significantly associated with increased student, parent, and teacher-reported capacity and opportunity. Decreased autism symptoms was a significant predictor of increased teacher-reported capacity. Increased family empowerment was associated with increased parent-reported capacity and opportunity. Decreased family burden was associated with increased parent-reported capacity and parent and teacher-reported opportunity.

Conclusions: The current study provides support for use of the AIR-SDS with high school students with ASD along with their parents, and teachers. Adaptive behavior was a significant predictor of self-determination across reporters highlighting the significance of adaptive behavior skills during high school. In addition to promoting adaptive behavior, supporting family empowerment and reducing family burden may help to increase self-determination in high school students with ASD.

Poster Session
208 - Drug Discovery and Development
5:30 PM - 7:00 PM - Room: 710

176 **208.176** Augmenting mGluR5 Activity Ameliorates Behavior Deficits in a Transgenic Rat Model of Autism Spectrum Disorder

R. Mittal[1], *M. M. Perdomo*[1], *H. Marwede*[1], *E. J. Horesh*[2], *J. Mittal*[1] *and* ***A. A. Eshraghi***[3], *(1)University of Miami School of Medicine, Miami, FL, (2)University Of Miami School of Medicine, Miami, FL, (3)Otolaryngology and Neurological Surgery, University of Miami Miller School of Medicine, Miami, FL*

Background: Despite the high prevalence of autism spectrum disorder (ASD), there are currently no FDA approved medications for treating the core symptoms of this neurological disorder. There is an urgent need to develop new treatment modalities in pursuit of improving the quality of life of ASD individuals and their families. A number of genes implicated in the pathophysiology of ASD converge on the metabotropic glutamate receptor 5 (mGluR5) pathway. As a proof of this concept, pharmacological enhancement of mGlu5 receptors rescues behavioral deficits in *SHANK3* knockout (KO) mice. In addition, treatment of *Mecp2*-deficient mice with mGluR5 positive allosteric modulator (PAM), VU0462807, improves behavior defects. All these studies lay a strong foundation to explore the potential of augmenting mGluR5 activity as a potential treatment modality for ameliorating core symptoms of ASD. However, all the studies have been performed in mice that do not show complex social behavior especially during development. This is important since ASD is a developmental disorder, and modeling the impaired social behavior during development is critical in clinically relevant animal models of ASD. However, the efficacy of mGluR5 PAM in ameliorating ASD associated core symptoms has never been determined in a transgenic rat model.
Objectives: The aim of this study was to evaluate the efficacy of mGluR5 positive allosteric modulator (PAM) 3-Cyano-N-(1,3-diphenyl-1H-pyrazol-5-yl)benzamide (CDPPB) in ameliorating behavior and communication deficits in a well-established ASD transgenic rat model.

Methods: The social interaction profiles of WT and ASD rat model were evaluated on day 8 after treatment with CDPPB (5 mg/ kg) for seven days. Vehicle treated animals or untreated ASD rats as well as WT animals served as the control group.

Results: We observed that treatment of transgenic ASD rats with CDPPB improves social deficits compared to vehicle or untreated animals on day 8 post-administration. These results are in agreement with previous studies demonstrating the efficacy of mGluR5 agonists in ameliorating behavioral deficits in ASD mouse models.

Conclusions: The results of our study argue to explore the efficacy of mGluR5 agonists in developing novel therapeutic strategies for ameliorating core symptoms of ASD. The availability of new treatment modalities will help in improving quality of life of ASD individuals and their families.

177 **208.177** Polypharmacy and Medication Monitoring Among Children and Youth with ASD

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Background: Pharmacotherapy is commonly used to treat individuals with autism spectrum disorder (ASD). Polypharmacy however—the use of two or more medications simultaneously (psychotropic or non-psychotropic)—remains a relatively underexplored area, and yet as many as 87% of children with ASD may be prescribed polypharmacy intervention (Wink et al. 2017). Despite this high prevalence, it is unknown if and how health practitioners are monitoring the use and associated side effects of multiple medications.
Objectives: A systematic literature review was conducted to establish polypharmacy trends among children and youth with ASD, identify specific factors associated with multiple medication use, and to determine if and how medication use, and commonly experienced side effects are monitored over time.

Methods: Five different electronic databases: PsycINFO, Medline, CINAHL, Embase, and Cochrane were used. A total of 16 studies encompassing over 300,000 children and youth with ASD were included after being evaluated for scientific strength using the Joanna Briggs Institute Prevalence Critical Appraisal Checklist (Joanna Briggs Institute, 2014).

Results: Overall, the majority of participants were male, 25 years of age or younger, and rates of polypharmacy varied from 9% to 87%. While rates of polypharmacy use were similar between males and females, medication type differed by sex. Whereas males were prescribed stimulants more often, females were regularly prescribed antidepressants or mood stabilizers. Factors commonly associated with higher rates of polypharmacy included psychiatric co-morbidities, self-injurious behavior, physical aggression, and age.

Conclusions: This systematic review highlights the considerable number of children and youths with ASD taking multiple psychotropic and non-psychotropic medications, and yet only one study addressed medication monitoring and the possible long-term effects of polypharmacy. Findings emphasize the importance of medication monitoring among children and youth with ASD receiving polypharmacy.

178 **208.178** The Utility of Omnibus Statistical Approaches in Go/No-Go Decision Making in a Phase 2 Study in Adolescents with Autism Spectrum Disorder: A Case Example

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Background:
The informativeness of Phase 2 clinical trials in autism spectrum disorder (ASD) has been diminished by a lack of gold standard, syndrome-specific outcome measures that render clear, easy-to-interpret results. This shortcoming has undermined confident go/no-go decision-making when deciding whether a drug candidate is worthy of further clinical development, or not.

Objectives:

One potential remedy involves better statistical approaches that improve confidence in results analyses, especially when the size of the study is relatively small. In this example, two omnibus statistical approaches were applied to a recent set of ASD Phase 2 clinical trial results, to determine the likelihood of the pattern of affirming efficacy findings in the study being a reflection of false discovery (i.e. a false positive finding).

Methods:

The efficacy results were derived from a study involving AMO-02/tideglusib. This orally administered new chemical entity is a GSK-3β enzyme inhibitor with multiple converging lines of preclinical evidence that indicate that it may represent a potential therapeutic agent for individuals with ASDs.

In this study, 83 adolescents between 12 and 16 y.o. were blindly randomized 1:1 to placebo or AMO-02/tideglusib which was up-titrated from 400 mg to 1000 mg once-daily, weight-adjusted, during a 12-week active treatment period.

A step-wise omnibus approach was utilized, commencing with a concordant trend analysis that simultaneously considered mean results from 7 pre-specified outcome measures utilized in the study (including the ABC, VABS, RBS, OARS, and Parent Chief Complaint rating scales as well as a biomarker assessment that assessed pAkt levels in blood). The second step utilized permutation testing which involved 1000 computerized simulations in which study participants were randomly re-assigned to a treatment group, although the entire results data set of each subject was left intact.

Results:

The standard, pre-specified results analyses revealed that most measures trended for greater improvement with AMO-02/tideglusib than placebo including measures of social withdrawal (ABC-Social) and repetitive behaviors (RBS-R), as well as daily living skills (Vineland), memory (NEPSY) and sleep quality (CSHQ), with several measures reaching nominal significance.

The concordant trends analysis confirmed efficacy in 3 of the 7 outcome measures/endpoints involved in the analysis, with the remaining endpoints showing no worsening on AMO-02/tideglusib, and a pattern was evident in which AMO-02/tideglusib consistently outperformed placebo. The probability that this pattern occurred by chance alone was lower than 0.09; the exact value of the false-positive rate could be calculated using permutation testing. Two scenarios were run using the permutation testing approach and these revealed p-values of 0.07 and 0.007 in favor of AMO-02/tideglusib over placebo.

Conclusions:

An initial concordant trend analysis and subsequent permutation testing provided reiterative confidence about the affirming study findings that effectively established positive proof-of-concept for AMO-02/tideglusib as a potential treatment for ASD. Accordingly, it can be concluded that AMO-02/tideglusib merits further progression in clinical development in ASD.

Poster Session
209 - Early phase drug discovery
5:30 PM - 7:00 PM - Room: 710

179 **209.179** An Open Label and Double Blind Randomized Placebo Controlled Pilot Study of L1-79 [D,L Alpha-Methyl-Para-Tyrosine (DL-AMPT)] for the Treatment of the Core Symptoms of Autism Spectrum Disorder (ASD) in Adolescent and Young Adult Males

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Background:

Catecholaminergic neurotransmitters play critical roles in many aspects of social, communication and emotional functions, ranging from regulating mood, anxiety, and pleasure to modulating attention, impulse control and response to sensory stimuli. Many of these functions are noted to overlap with behaviors affected in the Social-Communication Interaction (SCI) domain of ASD. L1-79 is a tyrosine hydroxylase inhibitor known to decrease catecholamine biosynthesis by inhibiting the conversion of tyrosine to dihydroxy-phenylalanine (DOPA), the rate limiting reaction in catecholamine synthesis

Objectives:

To determine if 100 or 200 mg of L1-79 given three times per day (TID) can improve deficits within the core symptom domains in adolescents and young adult males with ASD.

Methods:

Two cohorts of males between ages of 13 and 21, with a diagnosis of ASD confirmed by Autism Diagnostic Observation Scale-2 and Autism Diagnostic Interview-Revised were enrolled in either the 100 mg or 200 mg TID dose group. Five participants in each dose group received open label active drug for 28 days for additional safety testing utilizing EKG, urine and blood sampling. Another 15 and 16 subjects, respectively, were randomized in a 2:1 fashion to receive drug or placebo (PBO) for 28 days. Outcome measures included mean change from baseline to day 28 in the Clinical Global Impression of Severity (CGI-S), standard scores on the Vineland Adaptive Behavior Scale – 2 Socialization Domain (VABS-2-SD), Social responsiveness Scale – 2 (SRS-2), and Repetitive Behavior Scale - Revised (RBS-R). Mixed multiple repeated measures analyses were performed for measures that were taken at interim visits.

Results:

The study drug was well tolerated with no serious AEs or significant laboratory abnormalities. Although no results reached statistical significance for comparison against PBO, multiple assessment measures demonstrated improvements in aspects of social functioning for the 200 mg dose group. Mean changes comparing 200mg to PBO were as follows: CGI-S: -.8 vs. -.4, SRS-2 Social Motivation T-score: -10.6 vs. -3.8, VABS-2-SD: 7.6 vs. 1.5, respectively, SRS-2 Total: -7.7 vs -6.4, SRS-2 SCI: -7.6 vs -5.8, respectively. Additionally, trends of improvement in Repetitive Restrictive behaviors (RRBs) were noted in the SRS-2 RRB T-score (-7.6 vs -5.8) and the RBS-R Total Score (-18.1 vs -12.5) for 200mg vs PBO, respectively. Sameness behavior on the RBS-R was the largest contributor to improvement in the RBS-R (-4.7 vs -2.3, 200mg vs PBO, respectively).

Conclusions:

This small, 28-day pilot study of L1-79 demonstrated trends toward improvement in the core domains of SCI and RRB in ASD in adolescent and young adult males. Results suggest that modulation of catecholaminergic neurotransmitters in ASD may be a viable target for therapeutic intervention. A larger study in male and female adolescents and young adults with ASD is planned.

Poster Session
210 - Immunology
5:30 PM - 7:00 PM - Room: 710

180 **210.180** Antigen-Driven Rat Model of Maternal Autoantibody Related Autism

***J. Van de Water**, MIND Institute, University of California, Davis, Davis, CA*

Background: Maternal autoantibodies reactive to proteins in the developing fetal brain have been previously described in a subset of mothers of children with autism spectrum disorder (ASD), but not in mothers of typically developing children.
Objectives: We recently developed an active immunization rat model of maternal autoantibody related (MAR) ASD that mimics those found in the mothers of children with ASD to directly assess the pathologic significance of prenatal exposure to epitope-specific autoantibodies, and to evaluate the impact of maternal autoantibody exposure on complex, reciprocal play behavior as well as longitudinal MRI and MRS spectroscopy of the brain.

Methods: We generated epitope-specific autoantibodies in female rats through a series of immunizations containing the immunodominant peptide epitopes of the four primary target proteins of MAR-ASD (LDH A and B, CRMP1, and STIP1). Control females were injected with saline/adjuvant only. Autoantibody-positive females were bred, and male and female offspring were tested for autism-relevant behaviors and developmental milestones from early postnatal through adulthood. We also evaluated adult MAR (N=8) and control offspring (N=8) evaluated with a pro-social motivation assay.

Results: Offspring prenatally exposed to MAR-ASD antibodies emitted fewer ultrasonic vocalizations as pups at postnatal day 12 (p=<0.05), spent less overall time engaged in social interaction as juvenile and young adults (p=<0.05), and specifically spent less time in reciprocal play behavior as juveniles (p=<0.05) and engaged in more self-grooming behavior as adults (p=<0.05). MAR offspring demonstrated differences in time-to-release of their dyad partner from a confinement chamber compared to controls.

Conclusions: The developmental trajectory of social impairments and repetitive behaviors observed in the MAR rats parallels features of human autism and lends support to prenatal autoantibody exposure as a risk factor for ASD. Further, the MAR rats appear to be less interested in the release of their dyad partners based on the **increase** in time to release from the confinement chamber over time.

181 **210.181** The Adaptive Immune Response in Children with ASD Correlates with Behavior Severity

P. Ashwood[1], *D. Rose*[2], *H. Yang*[3] *and M. Careaga*[4], *(1)MIND Institute, University of California, Davis, Davis, CA, (2)UC Davis M.I.N.D. Institute, Sacramento, CA, (3)MMI, UC Davis, sacramento, CA, (4)UC Davis/MIND Institute, Sacramento, CA*

Background: Dysregulated adaptive immune responses have been observed in the blood of individuals with autism spectrum disorders (ASD). These have included higher ratios of CD8:CD4 T cells, increased activation markers on the surface of T cells, increased lymphocyte proliferation in response to stimulation, the presence of antibodies reactive to brain proteins and increased production of inflammatory cytokines. Although the degree of dysregulation is associated with more severe behaviours few studies have tried to determine whether specific subphenotypes within ASD are more affected than others.

Objectives: To address the question of heterogeneity in immune responses, we sought to examine the diversity of immune profiles in young children with ASD and the association with behaviour. Moreover, to determine whether co-morbidity may affect immune response we sought to characterize peripheral T cell subsets in children with and without gastrointestinal (GI) symptoms compared to healthy typically developing children.

Methods: Peripheral blood mononuclear cells from children with ASD and from typically developing age-matched control subjects were stimulated with either lipopolysaccharide or phytohemagglutinin. Cytokine production was assessed after stimulation. Initially, the ASD study population was clustered into subgroups based on immune responses and assessed for behavioural outcomes. Secondly, we evaluated responses based on the presence or absence of GI symptoms.

Results: Children with ASD who had a proinflammatory profile based on lipopolysaccharide stimulation were more developmentally impaired as assessed by the Mullen Scales of Early Learning. They also had greater impairments in social affect as measured by the Autism Diagnostic Observation Schedule. These children also displayed more frequent sleep disturbances and episodes of aggression. Similarly, children with ASD and a more activated T cell cytokine profile after phytohemagglutinin stimulation were more developmentally impaired as measured by the Mullen Scales of Early Learning. Interestingly, children with ASD and GI symptoms displayed elevated T_H17 populations, while children with ASD who did not experience GI symptoms showed increased frequency of T_H2 populations. Both ASD groups showed evidence of reduced regulatory T cell populations compared to typically developing children.

Conclusions: Children with ASD may be phenotypically characterized based upon their immune profile. Those showing increased T cell activation/skewing display a more impaired behavioural profile than children with noninflamed or non-T cell activated immune profiles. These data also suggests that children with ASD may have deficits in immune regulation that leads to differential inflammatory T cell subsets. Overall, there may be several possible immune subphenotypes within the ASD population but that they commonly correlate with more severe behavioral impairments.

182 **210.182** Adaptive Cellular Immunity in the ASD Postmortem Brain

M. P. Anderson[1], *M. M. DiStasio*[2], *I. Nagakura*[3] *and M. J. Nadler*[2], *(1)Pathology and Neurology, Harvard Medical School/Beth Israel Deaconess Medical Center, Boston, MA, (2)Harvard Medical School/Beth Israel Deaconess Medical Center, Boston, MA, (3)University of California Davis, Sacramento, CA*

Background: Autism spectrum disorder (ASD) is estimated to affect 1 in 59 children by 8 years of age in the United States and yet, except for rare genetic causes, the etiology in most ASD cases remains unknown. The presence of increased inflammatory proteins and transcripts in the ASD brain indicates the innate immune response is activated in a large proportion of ASD cases.

Objectives: To evaluate for adaptive immune cells and damage typical of immune cell mediated cytotoxicity that could potentially drive an innate immune response in the ASD brain.

Methods: The quantity of immune cell subtype infiltrates, cytotoxic cellular debris, tissue loss and fibrosis were compared in ASD and control brains. Standard neuropathology diagnostics methods including histology and immunohistochemistry were extended with automated image segmentation to quantify identified pathologic features in the postmortem brains.

Results: Multifocal perivascular lymphocytic cuffs are found that contain increased numbers of lymphocytes in ~65% of ASD compared to control brains in males and females, across a range of ages, in most brain regions, and in white and grey matter, and leptomeninges. $CD3^+$ T-lymphocytes predominate over $CD20^+$ B-lymphocytes and $CD8^+$ over $CD4^+$ T-lymphocytes in the ASD brain. Importantly, the number of lymphocytes in these perivascular cuffs correlates to the quantity of astrocyte-derived round membranous blebs, a known cytotoxic reaction to targeted lymphocyte attack and a histologic feature so far unique to ASD. Consistent with an immune cell-mediated injury at perivascular CSF-brain barriers, a subset of white matter vessels have an expanded perivascular space (with jagged contours) and increased perivascular collagen in ASD compared to control brains. Similar T-lymphocyte and astrocyte bleb pathology is observed in subarachnoid and pial surfaces of the cerebral cortex in ASD.

Conclusions: The findings suggest dysregulated cellular immunity may target the damage of astrocytes at foci along the CSF-brain barrier in many cases of ASD.

183 **210.183** Activation of Microglia Mediates ASD like Phenotype in Mice Following in Utero Exposure to Anti-Caspr2 Antibodies

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(6)The Feinstein Institute for Medical Research, Manahasset, NY

Background:
Autism Spectrum Disorder (ASD) is a devastating condition with an incidence that continues to rise worldwide. The rising incidence points to environmental factors. We have been particularly interested in the contribution of maternal antibody to ASD, as we observed that over 10% of mothers of an ASD child harbor anti-brain antibodies. We demonstrated that one such pathogenic maternal antibody is anti-Caspr2 antibody, a monoclonal antibody generated from a mother with anti-brain antibodies and an ASD child. A single in utero exposure to this antibody led to brain and behavior abnormalities in male but not in female mice. Since we determined that approximately 40% of mothers with an ASD-child and with anti-brain reactivity expressed anti-Caspr2 reactivity, anti-Caspr2 reactivity might be dominant brain specificity and have an important translational impact.

Objectives:

To understand how in utero exposure to anti-Caspr2 antibodies causes persistent neurologic abnormalities.

Methods:

We have developed a new model with endogenous antibody production in which dams harbor anti-Caspr2 antibodies throughout gestation, to better mimic the human condition, and to ascertain the pathogenicity of a spectrum of anti-Caspr2 antibodies. Six week old C57Bl/6 female mice were immunized with the extracellular region of human Caspr2. Control female mice are immunized with adjuvant only. IgG titers against Caspr2 are determined by a cell based assay against both human and mouse Caspr2. When antibody titers to mouse Caspr2 are 1:3000 immunized mice are mated with naïve males to generate timed pregnancies. We assessed neuropathology and behavior of mice exposed in utero to polyclonal anti-Caspr2 antibodies.

Results:

Male, but not female, fetuses of dams harboring anti-Caspr2 antibodies showed thinning of the cortical plate, reduced proliferating cells at E15.5, and abnormal neuronal migration similar to our previous results in male fetuses exposed in utero to maternal monoclonal anti-Caspr2 antibody. Adult male but not female mice born to dams harboring anti-Caspr2 antibodies showed an an impaired interest in social novelty in the social preference test, and repetitive/ stereotypic behavior; they buried significantly more marbles than control mice in the marble burying test, and spent more time grooming. We found that the brain of mice exposed in utero to anti-Caspr2 antibodies exhibited decreased dendritic complexity of excitatory neurons. A potential mechanism for decreased dendritic complexity is engulfment of dendritic processes by activated microglia. Indeed, we observed activated microglia identified by localization of CD68 with Iba1, cell shape and number of extended processes. We are currently testing if depletion of microglia in the offspring will prevent the decreased dendritic arborization.

Conclusions:

We show in a new mouse model that exposure in-utero to anti-Caspr2 reactive antibodies induces neurodevelopmental effects in the offspring that can be observed already during the embryonic stage. These antibodies lead to an ongoing activation of microglia in the adult mice. Microglia are druggable targets; therefore modulating microglia might be a potential new therapy.

184 **210.184** Autism and Exposure to Zica Virus: Report of Two Cases

***M. P. Ponde**, BAHIANA School of Medicine and Public Health, Salvador, Brazil*

Background: Some brain lesions have been described in association with maternal exposure to Zika Virus infection and have started with reports of microcephaly. Studies with rats suggest that mild infections in pregnancy can lead to lesions that are not apparent at birth, and then present as neurobehavioral deficits, such as locomotor and cognitive deficits, associated with the brain with thinner cortical layer 1 and increased astrogliosis. The correlation between viral infections in pregnancy and autism has been suggested for rubella, measles, mumps and influenza viruses. To date, no cases of autism related to exposure to Zika virus have been reported in the literature.
Objectives: Described cases of autism in wish mothers were affected by the Zika virus during pregnancy.

Methods: In this article, we described two cases of autism, in both mothers were affected by the Zika virus infection in the first trimester of pregnancy and the children did not present microcephaly.

Results: Case 1. Male child, 3 years old, 41 year old father and 28 year old mother. Autism Spectrum Disorder, nonverbal, presence of oppositional behavior. ADOS-2 score 10 (High); language and communication score 9; reciprocal social interaction score 17; Play score 6; repeated behavior and restricted interest score 7; other abnormal behavior score 1 (tantrums, aggression, negative or disruptive behavior). Case 2 Male child 2 years and 6 months. Age of the father: 30 years; Mother's age: 33 years. Autism Spectrum Disorder Mild, verbal few words. ADOS-2 score 6 (moderate); Language and communication score 5; reciprocal social interaction score 16; Play score 2; repeated behavior and restricted interest score 0; Other abnormal behavior score 0.

Conclusions: Neuro inflammation seems to modulate cortical and cerebellar functions through the activation of microglia and astroglia and the production of proinflammatory cytokines in some cases of autism. In the cases described, both mothers were infected with Zika Virus in the first trimester of pregnancy. In Case 1 autism symptoms are more severe, and the mother was also exposed to repetitive UTIs during pregnancy and to the use of antibiotics. This child also presents an anatomical alteration, with agenesis of fingers, which may be due to the use of antibiotics at the time of the entire pregnancy.

185 **210.185** Cytokine Alterations on Clinical Characteristics in Chinese Children with Autism Spectrum Disorder

ABSTRACT WITHDRAWN

Background:
Autism spectrum disorder (ASD) is a neurodevelopmental disorder in which genetics, together with environmental risk factor play a key aetiological role. Multiple evidence indicates a link between immune dysfunction and ASD. However, few data showed the relationships between cytokine level and clinical characteristics of Chinese ASD patients.

Objectives:

To investigate cytokines alterations in Chinese ASD children with regression and allergy.

Methods:

We reanalyzed our previously published data for case-control study. ASD children who were diagnosed and qualified for the inclusion criteria were recruited in the research as experimental group, typically developing children from a Kindergarten and early childhood education center as control group. Research method: 11 cytokines plasma levels were measured according to Miliplex BMS protocol. The clinical characteristics of ASD group: We recorded the medical history including regression and allergy.

Results:

The cohort included 65(55 male) ASD children and 42(28 male) TD children, aged 19 to 79 months.

1)The results of plasma cytokine levels showed: Plasma TNFα and Eotaxin levels were significantly higher in ASD group (TNFα: median 16.26, range 6.89–28.45pg/mL, P =0.016; Eotaxin: 72.18, 23.87–490.69pg/mL, P=0.045)than in TD group(TNFα: 14.19, range 7.40–25.21pg/mL, P =0.016; Eotaxin:55.72, 19.24-170.94pg/mL). There was a trend for Plasma TGF-β1(ASD: 5337.0, 931.67–34107.0pg/mL; TD: 2680.0, 574.08–18194.0pg/mL, P = 0.066).TGF-β1 was significantly increased in ASD male group than TD group(ASD: 5411.0, 931.67–34107.0pg/mL; TD: 2681.0, 838.28–16695.0pg/mL, P = 0.033).

2) 17 of 65 ASD children had regression. Compared with ASD children with no regression(ASDnr) and TD children, ASD children who had regression(ASDr) had higher trend for plasma TGF-β1(ASDr:7359.0, 1164.0–24649.0pg/mL; ASDnr:3413.0, 931.67–34107.0pg/mL; TD:2680.0, 574.08–18194.0pg/mL, P=0.070) and Eotaxin (ASDr:72.42, 23.87–490.69pg/mL;ASDnr:71.0, 23.87–192.31pg/mL; TD: 55.72, 19.24-170.94pg/mL, P=0.056). For male, the increase of TGF-β1 was most significant in ASDr, almost three-fold higher than TD (ASDr:7359.0, 1164.0–24649.0pg/mL; ASDnr:4452.0, 931.67–34107.0pg/mL; TD: 2681.0, 838.28– 16695.0pg/mL,P=0.039).

3)Since we did not have data of TD children for allergic history, we compared cytokines of ASD children with allergy (ASDa: 29/65) and non-allergy (ASDna: 36/65). Compared to ASDna, ASDa showed higher TNFα level (ASDa:17.14, 6.89–26.60pg/mL; ASDna:15.6, 7.93–28.45pg/mL, P =0.038).

Conclusions:

The pilot findings showed that TGF-β1,TNFα and Eotaxin may have associations with neurodevelopment progression of children, especially in boys. TGF-β1 and TNFα may have potential role in the mechanism of regression and allergy in ASD in Chinese population.

186 **210.186** Systematic Profiling of Viral Antibodies in Children with Autism Spectrum Disorder (ASD)

L. Hewitson[1], *M. Devlin*[1] *and H. B. Larman*[2], *(1)The Johnson Center for Child Health and Development, Austin, TX, (2)Johns Hopkins University, Baltimore, MD*

Background:

Animal studies suggest that maternal viral exposure results in immune activation altering the activity of multiple genes/associated pathways in the developing fetal brain. Importantly, many of these genes are key to developmental processes that occur before birth, demonstrating how maternal viral exposure could increase the risk of having a child with ASD. Similarly, post-natal viral exposures, particularly those that cause respiratory tract infections (RTIs), may also be an ASD risk factor.

Objectives:

The aim of this study was to use VirScan to perform a systematic analysis of viral antibodies in sera from boys (2-9 years) with and without ASD to examine their post-natal viral exposure histories.

Methods:

Subjects included 100 boys with ASD (mean age 5.92, SD 1.95 years) and 100 typically developing (TD) boys as controls (mean age 5.99, SD 2.17 years). An ASD diagnosis was confirmed using the ADOS and ADI-R. Analysis of viral antibodies in serum samples was performed using VirScan, which combines DNA synthesis and bacteriophage display and allows for the systematic detection of over 200 viruses from more than 20 different virus families. Data were analyzed using Fisher, t, and Wilcoxon rank tests.

Results:

VirScan detected antibodies that interacted with peptides from 266/499 (53.3%) viruses. Viral peptide hits reported for children both with and without ASD are shown in Table 1. Not surprisingly, 100% ASD and 99% control subjects had antibodies to rhinovirus, the common cold. There were also high frequencies of viruses that cause various gastrointestinal and RTIs such as adenoviruses, herpesviruses, RSV and enteroviruses. There were no significant differences between ASD and controls for any viral antibodies detected after adjusting for multiple hypothesis testing. Interestingly, very low numbers of viral peptides to hepatitis B, measles, mumps, rubella, and rotavirus (from either the vaccine or viral infection) were detected. This could be due to the original immune response being low, the antibody response to these vaccines waning over time, a depletion of long-lived memory B cells, or that VirScan cannot accurately capture this data. Further analysis of the effects of age on viral exposures in ASD is underway.

Table 1: Summary of the some of the most commonly detected antibodies in children with and without ASD. Data represents the percentage of subjects with antibodies detected against at least one peptide from each virus.

Virus species	**Control %**	**ASD %**
Rhinovirus_A	100.0	99.02
Human adenovirus_C	90.20	71.57
Human respiratory syncytial virus	88.24	87.25
Human herpesvirus-6B	75.49	73.53
Enterovirus_B	63.73	61.76
Human herpes virus-5	52.94	49.02
Enterovirus_A	50.98	51.96
Variola virus	50.00	32.35

Norwalk virus	49.02	53.92
Human herpesvirus-4	42.16	38.24
Enterovirus_C	29.41	33.33
Human adenovirus_B	27.45	14.71
Human influenza virus-3	21.57	16.67
Human herpes virus-7	21.57	22.55
Influenza A virus	20.59	14.71
Rotavirus_A	12.75	7.84

Conclusions:

These data suggest that VirScan may be useful in examining viral histories of children with ASD. Future studies should focus on comparing prenatal maternal samples with those of the newborn to further elucidate putative prenatal viral causes of ASD, as well as performing viral surveillance throughout post-natal development.

Poster Session
211 - Interventions - Non-pharmacologic - School-Age, Adolescent, Adult
5:30 PM - 7:00 PM - Room: 710

187 **211.187** Benefits of a Fitness Program for Individuals with Autism Spectrum Disorder: Physical, Cognitive, and Behavioral Outcomes

***S. L. Jackson**, T. Winkelman, E. Hamo, D. Stahl and J. McPartland, Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Individuals with autism spectrum disorder (ASD) engage in significantly less physical activities than typically developing peers (e.g. Pan, 2009). This sedentary lifestyle can result in serious negative consequences on physical (e.g. cardiovascular disease, obesity), behavioral (e.g. emotional regulation, sleep disturbance), cognitive (e.g. memory, concentration), and emotional (e.g. stress, depression, anxiety) well-being -- all common areas of difficulty in ASD. While there is an abundance of research demonstrating that regular physical activity can have a positive impact on the above issues in typically developing individuals (Fedewa & Ahn, 2011), research on this topic for individuals with ASD is limited.
Objectives: The current study examined the physical, behavioral, cognitive, and emotional benefits of a specialized physical exercise program in a sample of individuals with ASD.

Methods: Data was collected on 11 individuals with ASD (82% male; mean age=14.73 years, *SD*=6.59) from the ASD Fitness Center in Orange, CT, at baseline and following 15 workout sessions. Physical data (e.g. body mass index (BMI), exercise assessments) were collected by center staff. Behavioral/cognitive/emotional data were collected by research staff via parent-report questionnaires: the Child Sleep Habits Questionnaire (CSHQ; sleep disturbances), Social Responsiveness Scale (SRS-2; social abilities/restricted and repetitive behaviors), and the Behavior Assessment System for Children (BASC-3; behavioral and emotional problems/adaptive skills/executive functioning). The average duration between baseline and follow-up data collection was 14.5 weeks (*SD*=7.23). Additional data collection and BASC-3 analyses are ongoing.

Results: Preliminary analyses found significant improvement in core strength [increased time holding a plank position, $t(10)=-2.4$, $p<.05$] and marginal changes in lower-body strength [increased number of hurdles, $t(10)=-2.1$, $p=.06$; increased hamstring bridge time, $t(10)=-2.2$, $p=.06$]. Restricted and repetitive behaviors were significantly reduced following the 15 workout sessions [$t(10)=2.5$, $p<.05$]. Though average CSHQ scores were reduced from baseline ($M=43.3$, $SD=8.4$) to follow-up ($M=41.6$, $SD=6.8$), this difference was not statistically significant. Reductions in BMI following the program were associated with reduced sleepiness during the day ($r=0.64$, $p<.05$) and improved social cognition ($r=0.61$, $p<.05$).

Conclusions: Preliminary results provide empirical support for the effectiveness of an ASD-specific exercise program in improving physical strength and reducing restricted and repetitive behaviors in individuals with ASD. These preliminary findings additionally suggest that reductions in BMI may improve daytime sleepiness and social cognition in this population. Forthcoming analyses will explore the behavioral and emotional impacts of this exercise program, broadening our understanding of the benefits of regular physical activity for individuals with ASD. Considering the potential wide-ranging benefits that regular physical activity can have on the well-being of individuals with ASD, it is critical for more research to be done on this topic to inform development of, and participation in, exercise programs designed specifically for this population.

188 **211.188** Best Practices in Supporting Social Participation of Young Adults with Autism Spectrum Disorder (ASD) : A Systematic Review.

***M. Couture**[1], E. L. Bussières[2], J. Trépanier[3], O. Laverdière[4], M. H. Poulin[5], D. St-Laurent[6], J. Berbari[7] and C. Dumont[8], (1)Rehabilitation, Universite de Sherbrooke, Sherbrooke, QC, Canada, (2)Psychology, Université du Quebec à Trois-Rivières, Trois-Rivières, QC, Canada, (3)Faculté de médecine et des sciences de la santé, Université de Sherbrooke, Sherbrooke, QC, Canada, (4)FAculté de Médecine et des sciences de la santé, Université de Sherbrooke, Sherbrooke, QC, Canada, (5)Psychoeducation, UQAT, Rouyn-Noranda, QC, Canada, (6)Psychoeducation, UQAT, Royn-Noranda, QC, Canada, (7)FAculté de médecine, Unviersité de Sherbrooke, Sherbrooke, QC, Canada, (8)Rehabilitation, UQTR, Trois-Rivières, QC, Canada*

Background:

The majority of ASD studies focuses on early childhood and early interventionwhile the challenges associated with autonomy and independent living is a major issue for adults with ASD.

Objectives: The purpose of this systematic review (SR) is to document the effectiveness of interventions to support social participation of young adult with autism (16-40 years old).

Methods:

A comprehensive literature search was conducted to identify published articles and unpublished dissertations, using the following databases

ProQuest, Medline, PsycInfo, Cinhal, ERIC. The research covered the period from 1 January 2000 to 1 September 2018. Two persons independently screened articles for eligibility. Studies were included if they: 1) include more than 10 participants ; 2) focuses on at least one aspect of transition to adulthood, including social relations, employment and independent living. Critical appraisal of included studies was done using the Scientific Merit Rating Scale (National Autism Center, 2015) by two independent persons.

Results: Fourteen studies were retained, evaluating work-related interventions (10 studies), independent living programs (3 studies) and a leisure program (1 study). Methodological quality varies greatly across studies. Among high quality studies, three different interventions appear promising: a leisure program and two programs related to work, including a virtual training to job interviews, and a school-based employability program including an internship.

Conclusions: This SR suggests that interventions targeting transition to adulthood may be beneficial; it also highlights the need for more research, especially regarding the effectiveness of programs targeting independent living

189 **211.189** Beyond Fidelity: Measuring Implementation in a Multi-Faceted School-Based Intervention

J. R. Steinbrenner[1], *S. Odom*[1], *L. J. Hall*[2] *and K. Hume*[1], *(1)Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, Chapel Hill, NC, (2)Special Education, San Diego State University, San Diego, CA*

Background: Measuring implementation of interventions is a critical but understudied area in autism research. Many intervention studies report fidelity, but some types of interventions, such as complex service interventions (CSIs; Komro, 2018) warrant a more robust measure of implementation that captures process and content of these multi-faceted interventions (Cordrey et al., 2013. The Center on Secondary Education for Students with ASD (CSESA) developed a comprehensive treatment model for high school students with ASD that is a CSI (Hume & Odom, under review). The CSESA model involves professional development (training and coaching) to support a process of assessment, planning, implementation, and evaluation at the school and student levels. The CSESA model addressed four domains (academics, social, independence & behavior, and transition) using ten intervention components.

Objectives: The objectives of this study are to: (1) describe a multi-featured approach to measuring implementation for CSIs, (2) examine the variability in implementation profiles within the CSESA group, and (3) examine differences in implementation between the CSESA group and services-as-usual (SAU) group.

Methods: This randomized control trial included 60 schools that were randomly assigned to CSESA or SAU. There were 547 student participants and 579 school staff participants across the 60 schools. The CSESA implementation index measured implementation at three different levels of implementation and assessed 7 features across those three levels: (1) delivery of CSESA intervention to schools by CSESA research staff (training, coaching), (2) implementation of CSESA intervention by school staff (intervention quality, teaming, school-level planning), and (3) reception of CSESA interventions by students (intervention dosage, student-level planning). The seven features were measured using a variety of tools (e.g., coaching log, fidelity rating scales, planning artifacts) which provided an implementation profile (see Table 1 for further description). The feature scores were converted to scaled scores (0-3 range) based on a priori decisions about implementation quality for CSESA, and then the scaled scores were weighted and used to calculate a single implementation index score for each school.

Results: The implementation index profile scores for the CSESA schools showed variability within and across the raw and scaled feature scores (see Table 2 for descriptive statistics). Six out of the seven features had scaled scores that spanned from either 0 to 3 or 1 to 3, and the raw scores exhibited similarly wide ranges. However, most schools scored in the good (2) or ideal (3) implementation range for most features. For the single implementation index scores, there was a significant difference between the mean scores for the CSESA (2.07) and SAU (0.47) schools ($t=28.13$, $p<.001$).

Conclusions:

The multi-featured CSESA implementation index was successfully used in the context of a school-based RCT to capture a range of implementation within the intervention group, as well as differences between the intervention and control group. The development and use of an implementation profiles and index that captures information about the process and content of a CSI is critical in supporting intervention research, implementation science, and dissemination of comprehensive treatment models or other similarly complex interventions for individuals with ASD.

190 **211.190** Characteristics of Adolescent Girls with ASD Participating in a Social Skills Intervention

M. Ferland[1], *B. L. Ncube*[2], *J. M. Bebko*[3], *N. Bardikoff*[4], *M. Thompson*[4], *M. Spoelstra*[4], *J. Read*[5] *and S. Molica*[4], *(1)York University, Toronto, ON, CANADA, (2)Psychology, York University, Toronto, ON, Canada, (3)York University, Toronto, ON, Canada, (4)Autism Ontario, Toronto, ON, Canada, (5)Autism Ontario, Richmond Hill, ON, Canada*

Background: Research on the social relationships of adolescent girls with autism spectrum disorder (ASD) is limited. However, girls with ASD may have some social advantages over boys. For example, Kreiser and White (2014) suggests that social and cultural influences encouraging girls to be more empathic and nurturing can have an impact on the expression of ASD characteristics in females, as well as on how the behaviour of females with ASD is perceived by others. Cook, Ogden, and Winstone (2018) found that adolescent girls were able to "mask" their ASD symptoms by successfully adopting the tone and mannerisms of other neurotypical girls to fit in. However, while "masking" provided the girls with a superficial social competence, the girls continued to experience social isolation and peer conflict. Overall, despite some perceived advantages over boys, girls with ASD continue to struggle with social relationships (Fogo & Webster, 2017).

With the preponderance of males in the ASD population, less is known about specific outcomes for girls with ASD following social skills interventions. The Program for the Education and Enrichment of Relationship Skills (PEERS) is a 14-weeks manualized social skills training intervention for adolescents and young adults, which includes a teen and a parent component occurring simultaneously.

Objectives: The present study examines sex differences in the outcomes of adolescents with ASD who participated in the PEERS program through Autism Ontario.

Methods: 33 girls between the ages of 13 and 19 ($M = 14.90$, $SD = 1.44$) and 80 boys between the ages of 13 and 18 ($M = 14.75$, $SD = 1.45$) who participated in the PEERS program in Ontario between Winter 2015 and Summer 2018 were included. Parents and children complete several measures before and after participation in the program. Measures evaluated social skills knowledge, friendship quality, and social anxiety.

Results: At baseline, parents of girls rated their children as having significantly greater social anxiety than parents of boys; $t(51.46) = -3.035$, $p = .004$. Following intervention, both groups demonstrated decreases in social anxiety and, while parents of girls continued to rate their children as having greater social anxiety, the differences between the groups were no longer significant ($p = .182$). At baseline, girls tended to report less conflict between themselves and their "best friend" when compared to boys; however, this difference was not statistically significant ($p = .089$). Differences in how girls and boys rated conflict in their relationships with their best friends were maintained following participation in the PEERS program ($p = .086$). Lastly, adolescents demonstrated similar social skills knowledge at baseline ($p = .553$); however, girls demonstrated significantly greater improvements in social skills knowledge following the PEERS intervention compared to boys; $t(57.15) = -2.687$, $p = .009$.

Conclusions: Our results support the idea that adolescent girls and boys with ASD differ in their social experiences and skills, and, importantly, they may also differ in their response to a time-limited social skills intervention. A more refined approach, with information individualized for boys or girls may be warranted.

191 **211.191** Cognitive Behaviour Therapy for Anxiety in Children with Autism Spectrum Disorder: Predictors of NON-Response to Treatment

K. McFee[1], *J. Baraskewich*[2], *C. A. McMorris*[2], *K. Johnston*[1] *and M. McConnell*[1], *(1)BC Children's Hospital, Vancouver, BC, Canada, (2)Werklund School of Education, University of Calgary, Calgary, AB, Canada*

Background: Internalizing mental health issues, such as anxiety and depression, are common, often debilitating conditions for children and youth with autism spectrum disorder (ASD; Simonoff et al., 2008). The complex, pervasive, and heterogeneous clinical symptoms of youth with ASD and co-occurring psychiatric disorders makes treatment of mental health issues challenging (Wood et al., 2006). Facing Your Fears (FYF) is a well-established, evidence-based modified cognitive behaviour therapy (CBT) group that has been developed for children and youth with ASD (Reaven et al., 2009). Findings from randomized controlled trails have shown that anxiety symptoms, social difficulties, and emotion dysregulation improve in children and youth with ASD who participate in FYF, with these improvements maintained 12 months post-intervention (Reaven et al. 2012). While the majority of FYF participants show reductions in anxiety symptoms and less interference in daily life, a small subset of FYF participants (approximately 20% of children and adolescents) are not responsive to the treatment (Reaven et al., 2009). To date it is unknown why some individuals with ASD are responsive to FYF and others are not.

Objectives: The present study aims to examine the demographic and clinical predictors of responsiveness to FYF. Consistent with previous research in pediatric anxiety, it is expected that sex, type of anxiety disorder, severity of anxiety symptoms at pre-assessment, and presence of parental psychopathology will be associated with poorer outcomes after FYF.

Methods: 51 children and youth between 8 and 13 years of age participated in FYF groups over a 5-year period. Children/youth and their caregivers completed a variety of measures before (pre) and after (post) participating in FYF. Specifically, anxiety type, symptoms, and severity (Spence Children's Anxiety Scale and the Anxiety Disorder Interview Scale [ADIS]), presence of other psychiatric disorders (ADIS, Behaviour Assessment System for Children -2, Child Depression Inventory), parent psychopathology (State Trait Anxiety Inventory), and ASD symptom severity (Social Communication Questionnaire) were assessed. Demographic variables (age, sex) and other clinical variables (IQ) were obtained prior to starting the group.

Results: Data have been collected and analyses will be completed in Winter 2019. Using pairwise correlations and hierarchical logistic regression analyses we will identify which demographic and clinical factors are associated with non-response to FYF.

Conclusions: FYF has shown to be effective in reducing anxiety symptoms for most children and youth with ASD (Reaven et al., 2012). Determining what factors are associated with treatment non-response will be valuable in providing appropriate, effective, targeted treatment for youth with ASD and co-occurring mental health issues, ultimately improving the care, outcomes, and quality of life of youth with ASD.

192 **211.192** Cognitive Behavioural Therapy for Anxiety Disorders in Children with Autism Spectrum Disorder: A Randomized Controlled Trial.

T. R. Kilburn[1], *M. J. Sørensen*[2], *M. Thastum*[3], *R. M. Rapee*[4], *C. U. Rask*[2], *K. B. Arendt*[3] *and P. H. Thomsen*[1], *(1)Department of Child and Adolescent Psychiatry, Research Unit, Aarhus University Hospital, Psychiatry, Aarhus N, Denmark, (2)Department of Child and Adolescent Psychiatry, Aarhus University Hospital, Psychiatry, Aarhus N, Denmark, (3)Department of Psychology and Behavioural Science, Aarhus University, Aarhus C, Denmark, (4)Centre for Emotional Health, Department of Psychology, Macquarie University, Sydney, Austria*

Background: Autism spectrum disorder (ASD) is found in approx. 1-2% of the population and includes core symptoms that affect general and social development. A high risk of developing co-morbid disorders is prominent. It is thought that up to 60% of children with ASD suffer from different anxiety disorders which can further negatively influence educational, social and general development together with quality of life.
Objectives: The main goal of this study is to examine the effectiveness of a manualised cognitive behavioural therapy program (CBT) adapted to children with ASD in a non-English general psychiatric hospital setting.

Methods: The study is a randomized controlled trial with intention to treat analysis. Forty-nine children with ASD and anxiety, aged 8 to 13 years from a public child psychiatric health clinic are randomly assigned to either an intervention group or a waitlist control group. After the waitlist period the control group will receive intervention as well.

The group based manualised CBT intervention consist of The Cool Kids Anxiety Program: Autism Spectrum Disorder Adaptation, 2nd edition (Cool Kids ASD).

Outcome measures are collected pre, post-treatment and at 3 month follow up and include scores from a semi-structured diagnostic anxiety interview, together with parent, child and teacher questionnaires on children's anxiety symptoms, life interference, children's automatic thoughts, and social and adaptive skills.

Results: This is an ongoing study and final results will be available for presentation at the conference. However, results from a prior feasibility study showed that 55.5% of the children participating recovered and no longer met the criteria for their primary anxiety diagnosis after the treatment. This number rose to 77.7% at follow-up. Compliance to the program was high and 88.8% of the families found the program to be useful and would recommend it to other families in a similar situation.

Conclusions: This feasibility study suggests that the transition of the group program 'Cool Kids ASD' from research environments to non-English standard child psychiatric clinical settings is possible. The randomized study might confirm this efficiency and efficacy of the program in a larger sample.

Structured intervention like the manualised CBT group program might not only improve the main presenting difficulty, but also other aspects of the participants' functioning such as peer relationships. Training anxiety reduction skills and thus, decreasing anxiety in children with ASD using the manualised CBT program has the potential of preventing relapse and ensuring better psychosocial development for the child in general.

193 **211.193** Community Implementation of Facing Your Fears: A Cognitive Behavioural Therapy Program for Anxiety in Children with ASD

***B. Drouillard**, A. Solish, N. Klemencic, A. Ritzema, V. Nolan, M. Pilkington, E. Anagnostou and J. A. Brian, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

Background: Comorbid anxiety disorders are common among youth with high functioning Autism Spectrum Disorder (ASD; White, Oswald, Ollendick, & Scahill, 2009); however, there are few interventions demonstrated to be effective with this population. Facing Your Fears (FYF) is a manualized cognitive-behavioural therapy (CBT) program for anxiety, designed specifically for youth with high functioning ASD (Reaven, Blakely-Smith, Nichols, & Hepburn, 2011). Although FYF has demonstrated efficacy in research/hospital settings (Reaven, Blakely-Smith, Culhane-Shelburne, & Hepburn, 2012), its effectiveness when implemented in community settings is not well established.
Objectives: To evaluate the effectiveness of the FYF program implemented in community versus hospital-based settings.

Methods: Participants were 105 parent-child dyads (51 from the hospital setting and 54 from community settings). Children (76 boys, 29 girls; age range = 6.92 – 15.30 years; M_{age} = 10.47 years; *SD* = 1.75) had a diagnosis of ASD, broadly average cognitive functioning, and significant anxiety symptoms. Participants completed the Screen for Child Anxiety-Related Emotional Disorders (SCARED, Child and Parent; Birmaher, Brent, Chiappetta, Bridge, Monga, & Baugher, 1997) and the Spence Children's Anxiety Scale (SCAS, Child and Parent; Spence, 1998) pre- and post-intervention. Examination of baseline participant characteristics, using one-way ANOVAs, revealed that the only pre-treatment characteristic differing significantly across settings was child age, with children in the hospital setting being significantly younger (*M* = 10.08 years, *SD* = 1.71) than children in the community (*M* = 10.87 years, *SD* = 1.72; $F(1, 103) = 5.60$, $p = .02$). One-way ANCOVAs controlling for child age were therefore used to demonstrate pre-intervention equivalence between hospital-based and community-based participants on measures of anxiety and other behavioural difficulties.

Results: Within hospital-based groups, paired samples t-tests revealed significant reductions in anxiety from pre- to post-intervention on the SCAS- Parent Report, $t(50) = 4.75$, $p < .001$; SCAS-Child Report, $t(52) = 4.23$, $p < .001$; SCARED- Parent Report, $t(50) = 6.38$, $p < .001$; and SCARED- Child Report, $t(50) = 3.62$, $p = .001$. Similarly, within community-based groups, paired samples t-tests revealed significant reductions in anxiety from pre- to post-intervention on the SCAS- Parent Report, $t(48) = 3.97$, $p < .001$; SCARED- Parent Report, $t(46) = 5.05$, $p < .001$; and SCARED- Child Report, $t(45) = 2.58$, $p < .05$. Reductions in anxiety noted on the SCAS- Child Report in the community-based sample failed to reach significance, $t(49) = 1.62$, $p = .11$. ANCOVAs controlling for age revealed no significant differences in pre-post intervention change scores between participants in hospital and community-based FYF groups on the SCAS- Parent Report, $F(1, 97) = .189$, *ns*; SCAS- Child Report, $F(1, 100) = 1.124$, *ns*; SCARED- Parent Report, $F(1, 95) = .072$, *ns*; and SCARED- Child Report, $F(1, 94) = 2.139$, *ns*.

Conclusions: Findings provide support for the effectiveness of the FYF program when implemented in community settings. Given the similar reductions in anxiety symptoms observed among participants in hospital- and community-based groups, community implementation of FYF is a feasible and effective means of improving access to evidence-based anxiety intervention for children with high functioning ASD.

194 **211.194** Comparative Effectiveness of Therapeutic Riding and Stress Management Program on Salivary Cortisol and Heart Rate Variability of Youth on the Autism Spectrum

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Background: For youth who are transitioning into adulthood with autism spectrum disorder (ASD), elevated stress levels and lack of coping mechanisms (Plessow, Fischer, Kirschbaum, & Goschke, 2011) relating to the core symptoms of autism become barriers to health and wellness (Hong, Bishop-Fitzpatrick, Smith, Greenberg, & Mailick, 2016). Limited research with younger children, ages 5-15, suggests that therapeutic riding (TR) improves gross motor and postural skills (Hawkins, Ryan, Cory, & Donaldson, 2014), spontaneous verbalization (Holm et al., 2014), irritability, hyperactivity, social cognition, and receptive communication skills (Ajzenman, Standeven, & Shurtleff , 2013) as well as quality-of-life (Lanning, Baier, Ivey-Hatz, Krenek, & Tubbs, 2014). A paucity of research exists with regard to young adults (from 14-25) and the impact of TR on emotional regulation or stress level (O'Haire, 2012).
Objectives: The research question concerns the comparative effectiveness of stress management (SM) techniques and Therapeutic Riding (TR) on stress levels of adolescents with ASD. The objective was to better understand the impact of TR and SM program as compared to a control phase in the same adolescent.

Methods: The study compares an evidence-based stress management protocol (HeartMath) to a TR protocol to no treatment control for 27 young adults ages 13-22 with ASD in a randomized three-period crossover trial. All interventions were one hour in length for ten consecutive sessions and administered by the same CTRS with a certification appropriate to the intervention (PATH or HeartMath certification). Participants were randomly assigned to the order in which they receive TR, HeartMath (HM), and no treatment control. Before and after each of the three 10-week periods, self-reported stress levels (Cohen et al., 1983) and salivary cortisol levels were measured. Salivary cortisol was measured over two consecutive days at four time points (Rising, 30 minutes after, session, and bedtime). Cortisol levels were also measured before and after each intervention session. Heart rate variability (HRV) was measured during each session using an emwave Pro sensor. Multivariate analysis of variance with one within-groups factor (time) and between-groups factors (TR vs. HM vs. control) was used.

Results: Analysis revealed a greater difference ($p < .05$) of self-reported stress in the TR phase than the HM phase. Coherence levels (HVR) were higher during the HM stress management sessions than TR sessions. There was a statistically significant decrease ($p < .05$) between the pre to

post mean cortisol values for TR sessions and HM sessions. While the mean difference scores between pre and post TR cortisol are larger than mean difference scores for HM, no statistically significant difference exists (p = .17). When comparing mean baseline to follow-up for TR to control, cortisol was reduced during the 30 minutes post awakening in the therapeutic riding. Further analysis will be focused on trends in individual response over phases.

Conclusions: While it is temporary, TR and HM are equally beneficial in decreasing cortisol levels. Both programs are more effective in decreasing salivary cortisol and self-reported stress than a period without intervention. For adolescents with ASD, pre-screening may determine the more effective intervention.

195 **211.195** Comparison of Therapeutic Alliance across Informants: Therapist Versus Independent-Observer Ratings

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Background: The working relationship between a therapist and a client, known as therapeutic alliance, is recognized as an important contributor to treatment change, with a stronger therapeutic alliance predicting better outcomes following therapy (Karver, Handelsman, Fields & Bickman, 2005)**.** However, the association between therapeutic alliance and treatment outcomes has been found to vary depending upon the informant source (McLeod, Southam-Gerow & Kendall, 2017). Research has only recently begun to explore the role of therapeutic alliance in treatment for children with autism. To date, only one study using a multi-informant approach to assess therapeutic alliance exists (Kerns, Collier, Lewin, & Storch, 2017), which included ratings from those directly involved in the therapy process (i.e., child, parent and therapist). Research has yet to examine the association between independent-observer and treatment-involved informants on ratings of therapeutic alliance for children with autism.

Objectives: To examine association between therapist-rated and observer-rated therapeutic alliance in cognitive behaviour therapy (CBT) for school-aged children with autism.

Methods: Data were collected from 48 children with autism (91.7% male) and their therapists (90.9% female) who participated in a 10-session CBT program to improve emotion regulation. Children were 8 to 12 years of age (*M* = 9.60 years, *SD* = 1.25) with at least average IQ. Therapist-rated and observer-rated therapeutic alliances were assessed for four sessions (two early and two late). Therapists rated the alliance on a single-item using a 7-point Likert scale (1 = Very poor; 7 = Very good) at the end of each session. The Therapy Process Observational Coding System for Child Psychotherapy-Alliance Scale (TPOCS-A; McLeod & Weisz, 2005) was used to assess alliance through independent observation. Nine items measuring key aspects of the therapeutic alliance were rated on a 6-point Likert scale (0 = Not at all; 5 = A great deal). Observers reached excellent reliability for all items (ICC = .92, $p < .001$).

Results: Spearman's correlations showed that therapist-rated alliance across early and late sessions were moderately correlated ($rs = .46$, $p = .001$) and observer-rated alliance across early and late sessions was strongly related ($rs = .65$, $p < .001$). Spearman's correlations also indicated moderate, positive relations among therapist ratings and independent-observer ratings of early and late alliance: Session 2 ($rs = .44$, $p = .003$), Session 3 ($rs = .44$, $p = .004$), Session 8 ($rs = .54$, $p < .001$), and Session 9 ($rs = .44$, $p = .003$).

Conclusions: There is a moderate degree of consistency between therapist and independent-observer ratings of the quality of early and late alliance in CBT for children with autism. Differences may in part be related to therapist ratings reflecting subjective and motivational aspects of their alliance and observer ratings not taking this into account. In addition, therapist impression of child improvement during therapy could impact ratings. Future research should explore how parent-reported and child-reported ratings of alliance are associated with observational coding, designed for children with autism, and how these factors account for variability in child outcome.

196 **211.196** Does Participation in a Peer-Mentored Physical Activity Program Increase Health-Related Fitness in College Students with Autism Spectrum Disorder?

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Background: Many adults with ASD live sedentary lifestyles, which may contribute to an array of serious health problems including obesity, type 2 diabetes mellitus, cardiovascular disease, gastrointestinal issues, depression, and premature mortality. Individuals with ASD may have difficulty engaging in physical activity (PA) because they have poor motor skills, a lack of motivation to be physically active, and limited opportunities for exercise. Participation in regular PA is recognized as a leading indicator of health and a mediator for lifestyle-related diseases. Yet, to date, there are few PA programs designed specifically for young adults with ASD (even fewer for those in college). It is imperative to offer evidence-based PA interventions for people with ASD to help combat health-related problems and increase physical well-being.

Objectives: The purpose of this study was to examine: 1) the effects of a PA intervention on the health-related fitness (i.e., cardiorespiratory fitness, upper body muscular endurance, core abdominal muscular strength, flexibility) of college students with ASD, and 2) participant experience as a result of their participation in the fitness intervention.

Methods: IFiT (*I*nto *Fi*tness *T*ogether) is a 10-week peer-mentored individualized PA intervention designed to increase health-related fitness among college students with ASD. Data were collected during the Fall and Spring college semesters (2015-2017). A total of 34 college students with ASD (31 male, 3 female) between 18-29 years of age participated in the study. Participants were paired 1:1 with Kinesiology students (called Peer Mentors) and became dyads. Dyads met twice a week to engage in self-selected PA for a minimum of 120 minutes. At pre- and post-intervention we collected: anthropometric measures (height, weight, and waist circumference), fitness levels measured by cardiorespiratory endurance (VO^2 max), muscular endurance (sit-ups and push-ups), and flexibility (sit-and-reach). A subset of qualitative data from the larger dataset were analyzed. InVivo coding was used to generate themes from participant interviews about the IFiT experience.

Results: Twenty-six of 34 participants had Body Mass Index levels in the overweight to obese range. VO^2 max significantly increased from pre- (M = 37.49) to post-intervention (M = 42.50). Sit-and-reach scores significantly increased from pre- (M = 21.83cm) to post-intervention (M = 28.38cm). Upper body muscular endurance measured by total push-ups completed in one minute significantly increased from pre- (M = 10.29) to post-intervention (M = 13.32). There were no significant differences for core abdominal muscular strength, $p > .05$. Three main themes emerged from

participant interviews including their perceived: 1) gains in motor competence and knowledge of exercise, 2) improved overall health, and 3) sense of belonging. Participants expressed feeling "healthy and fit" and physically strong, and reported improved sleep, energy, and gastrointestinal health. Participants reported enjoying time socializing with other students with ASD and valued socializing with their Peer Mentors.

Conclusions: Regular participation in a 10-week physical activity program was beneficial to the physical health of college students with ASD. Our findings indicate that Peer Mentors offer invaluable support in helping young adults with ASD enhance their health-related fitness and social engagement.

197 **211.197** Effect of Mindfulness Training for Adolescents with Autism and Their Parents Moving to a Danish Context

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Background:

High levels of distress and comorbid health difficulties have been reported for persons with autism spectrum disorder (ASD) and their parents. The development and investigation of interventions for persons with ASD is increasing, but there is still a need to expand the access to relevant interventions, and to increase the evidence base of these interventions. There is an emerging evidence suggesting beneficial effects of mindfulness-based programs for children and adolescents with ASD and their parents. MYmind is a group training for adolescents combined with parallel mindfulness training for their parents that has been developed with the cognitive characteristics of ASD in mind.

Objectives:

The study objectives were to investigate the feasibility of the MYmind program for adolescents with ASD and their parents in a Danish context and to investigate the effect of the program on individually specified areas of focus as well as on emotional and behavioral measures.

Methods:

A total of six mindfulness groups were run at two different sites including 38 adolescents with ASD and 47 parents from 37 families. Information on adolescent and parental behaviour and well-being were collected using questionnaires, at baseline, pre- and, post-training, and at 2 and 6 months follow-up. Further, continuous registrations were collected on individually specified areas of interest and general well-being. Moreover, interviews were made with adolescents and parents focusing on their experience with the training. In this presentation analyses of the repeated emotional and behavioral measures will be presented.

Results:

Of the enrolled participants 24 adolescents (63%) and 26 parents (55%) stayed in the program while 14 adolescents and 21 parents dropped out of the program. Four families dropped out before the first session and seven dropped out after taking part in only one or two sessions. The reason for withdrawing was primarily due to difficulties fitting in the training without too much stress to the family.

Comparison of pre- and post-intervention measures of parent reports on the strength and difficulties questionnaire (SDQ) showed a significant reduction in adolescent psychological distress (SDQ total: p<.000) and the impact of this distress (SDQ impact: p=.001), but not in adolescent self-report on the SDQ (SDQ total: p=.083; SDQ impact: p=.806). A significant increase in well-being was found in adolescent self-report on WHO-5 (p=.030), but no significant difference was seen on self-report of stress (Chronic stress Questionnaire, p=.457).

A significant decrease was found in parental stress (Perceived stress scale: p=.004) but no significant change was found in parental well-being (WHO-5: p=.072).

To further investigate the change over time in the whole sample results from multilevel modelling will be presented. This analyses will look at the nesting of the subject within the family and group.

Conclusions:

Challenges with recruitment and high dropout were experienced. However the results show support the existing evidence base of beneficial effects of mindfulness based intervention for adolescents with ASD and their parents.

198 **211.198** Effectiveness of ABA Parent Training in Spanish for Children with ASD

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Background: Training in Applied Behavior Analysis for parents of children with ASD can be a critical support for both parents and their children (Bearss, Johnson, Smith, Lecavalier, & Swiezy, 2015). Parent trainings have been shown to be effective in helping improve problem behavior (Bearss et al., 2015), reducing feeding issues and parental stress (Sharp, Burrell, & Jaquess, 2014), and increasing children's skill generalization across settings (Ingersoll & Dvortcsak, 2006). Unfortunately, however, these trainings have not been extensively studied with non-English speaking populations.

Objectives: The current study seeks to examine the effectiveness in improving target problem behaviors using a 10 week parent training intervention program conducted in Spanish, for Spanish-speaking parents of school-aged children with ASD.

Methods: This study was conducted at a clinical site where 75% of families were exclusively Spanish-speaking. Families were recruited who had at least one child with ASD, aged 6-8 years old. Nine families participated in the training program (n = 11 parents overall, with two spouses attending), which consisted of 6 group sessions, followed by 4 individual sessions. Sessions focused on teaching ABA terms, strategies, and application for issues with their own children. Families completed both parent and child measures before the training began (Vineland-II, Aberrant Behavior Checklist, Parent Stress Inventory, Home-Situations Questionnaire, etc.), including a diagnostic evaluation (ADOS-2 and KBIT-2) with their child. Throughout the intervention, ABC data and parent implementation efforts were recorded, and parents repeated the self-report surveys at the end of the training.

Results: The majority of parents consistently attended sessions (84.46% attendance) and reported changes in their use of behavior strategies as a result of participation. Participating children had a variety of behavioral challenges, from non-compliance to toileting, pulling hair, or problems with outbursts at school. Each family successfully collected information on their child's behavior. Of the nine target behaviors, seven children (77.8%) showed improvements as a result of the intervention. Two parents did not report progress, as one family did not implement the intervention, and the other family discontinued participation before the end of the parent training sessions.

Conclusions: Parent training on ABA interventions was effective at reducing parent-nominated problem behavior in the vast majority of cases. Within this parent-group, there was a wide variety of parent knowledge, which was increasingly difficult for them to obtain with the language barrier. The parents who did not observe changes were those who did not choose to implement the interventions as designed. Additional resources are needed to better support non-English speaking families in learning about and implementing ABA interventions.

199 **211.199** Effectiveness of Improvisational Theater Intervention in a Community Setting in Improving Social Skills and Reducing Personal Distress

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Background: In the context of a community-university partnership we examined the effectiveness of an improvisational comedy theater in improving social interaction skills in teens with autism spectrum disorders (ASDs). These skills are taught during the 6-week program through various games and improvised scenarios designed to help individuals explore and laugh with each other. There is early evidence that theater interventions such as musical theater productions can improve socioemotional functioning in children with ASDs, including social awareness, social assertion, trait anxiety, and even cortisol levels (Corbett et al., 2013).

Objectives: To evaluate effectiveness of the Unscripted Learning (UL) Connections program, a community-based intervention program rooted in improv theater and comedy, on anxiety, social competence, empathy, and cognitive flexibility in teens with ASDs, using pre- and post-intervention design.

Methods: To date, thirteen youth with ASDs participating in the Connections program have been enrolled (with the new participants continuing to enroll as new Connections sessions commence). Results reported here are based on the longitudinal data from 9 adolescents who have completed the pre- and post-intervention assessments to date. Prior to the start of the program (baseline) and at the completion of the program (post-intervention) students completed the Social Skills Improvement System, Self-Report (SSIS-RS) and the Multidimensional Anxiety Scale for Children, 2nd Edition (MASC-2). Parents completed the MASC-2 parent-report, Social Responsiveness Scale, 2nd Edition (SRS-2), Behavior Rating Inventory of Executive Function, 2nd Edition (BRIEF 2), Social Communication Questionnaire, Current (SCQ), the Interpersonal Reactivity Index (IRI), and demographic forms. Follow-up assessment (at 4 months following the program completion) will be completed to test the long-term effects of the intervention.

This sample includes thirteen adolescents (10 male, 3 females) ages 13-19 years (mean = 16). Four out of thirteen participants indicated comorbid Bipolar Disorder, Global Delay, Brain Injury and Cerebral Palsy, and two of thirteen reported a diagnosis of Intellectual Disability.

Paired sample t-tests were conducted to examine the effects of the program on the SSIS-RS Social Skills, the MASC-2 Social Anxiety (measured with both self- and parent-reports), BRIEF-2 Shift and Self-Monitor subscales, SCQ Total Score, all four IRI subscales, and SRS-2 Social Awareness and Social Communication.

Results: Significant improvements post-treatment have been detected on the SSIS-RS Social Skills (effect size=0.99) and the IRI Personal Distress Subscale (effect size=0.84). Measures of Social Awareness (SRS-2), Self-Monitoring (BRIEF-2) and Shift (BRIEF-2) revealed moderate change (effect sizes=0.33-0.57). Other measures of socioemotional functioning did not reveal significant change.

Conclusions: These preliminary findings demonstrate that teens with ASDs showed some improvement in social competence, social anxiety, social responsiveness, empathy and executive function, following a 6-week improvisational theater program. This community-based improv theater intervention shows promise in improving the socioemotional functioning in teens with ASDs. These results are consistent with previously demonstrated effects of theater intervention on social awareness (e.g., Corbett et al., 2013) and further contribute to our understanding of improv theater as an effective intervention significantly impacting social skills and reducing personal distress in teens on the spectrum.

200 **211.200** Effectiveness of a Supports-Based Approach in Facilitating Peer Interactions in the Classroom Including Students on the Autism Spectrum

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Background: Peer interactions have been considered a major issue for students on the autism. They commonly experience challenges in developing friendships, and they have frequently been exposed to negative peer interactions (e.g., APA, 2013; Robertson, 2010). Several intervention programs have been proposed to address this issue. Most of them have taken a skills-based approach, which focuses on working toward normalizing individual skills. Despite reported effectiveness in changing individual behaviors, skills-based programs offer relatively limited evidence for successfully building peer friendships and expose concerns about social-emotional harms that have been associated with pressure to behave neurotypically (Bellini et al., 2007; DiSalvo & Oswald, 2002; Pellicano & Stears, 2011; Sibley, 2015). These Limitations have led to the development of a supports-based approach—based largely on a distributed model of communication (DeThorne et al., 2014, DeThorne et al., 2015, Hengst, 2015)—as an alternative way to facilitate peer interactions involving students on the autism spectrum (Vidal, Robertson, & DeThorne, 2018). This supports-based approach prioritizes egalitarian interactions, participation in shared activities, and flexible access to multimodal communicative resources.

Objectives: Because therapeutic programs that align with a supports-based approach are scarce, the present study uses a single-case experimental design to examine the effectiveness of a supports-based approach in promoting peer interactions in two children on the autism spectrum. For this purpose, the following research question was developed: Is there a functional relation between social supports and the increase of frequency of communicative offers between two children on the autism spectrum and one of their neurotypical classmates?

Methods: This presentation focuses on the analysis conducted within an ABAB design to measure the effectiveness on providing classroom-based social supports in increasing communicative offers observed within 2 peer dyads. Specifically, John and Ethan were a dyad of 8-9-yr-old boys observed in the context of a 3rd-grade art class. Max and Reagan were a dyad of 5-6-yr-olds observed within the context math class. Baseline phases (4-7 sessions per phase) consisted of video-recorded observations of peer interaction during classroom activities without any explicit support by the examiner. Support phases (3-7 sessions per phase) consisted in the implementation of 4 clinician strategies (i.e., direct prompt, scaffolding, behavioral interpretation, and environmental arrangement) during classroom activities. Analysis was conducted through visual

inspection.

Results: Increased communicative offers were observed during supports phases for both dyads (relative to baseline phases), which indicates a functional relation between the social support provided and the increased frequency of communicative offers. In both dyads, the average number of communicative offers doubled between baseline and social support phases. Additionally, for Max & Reagan dyad, a rise of communicative offers was observed during the second baseline phase compared to the first baseline phase, which might be indicative of a degree of generalization.

Conclusions: This is one of the first studies to provide experimental evidence for a supports-based approach to peer interaction in students on the autism spectrum. Generalizations results are encouraging in showing how this approach has impact on quality of life indicators such as friendship.

201 **211.201** Effects of Transdiagnostic Versus ASD-Only Therapy Groups for Children with ASD

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Background: Transdiagnostic approaches to social competence group interventions may best benefit children with ASD so that they learn to interact with children with disorders other than ASD. Weiss (2014) suggested that a transdiagnostic approach may be most efficacious for children with ASD because a disorder-specific approach may miss the underlying mechanisms that lead to co-occurring problems. Clarifying this issue may help inform both treatment and academic decisions, as parents and school administrators must determine whether a child with ASD should be placed in 'mainstream' or ASD-specific classrooms.
Objectives: The current study examines whether therapeutic effects are similar for a child with ASD whether they are in an ASD-only group or a transdiagnostic therapy group.

Methods: A sample of 45 children ages 7-12 years were enrolled in the Resilience Builder Program® (RBP) intervention, a 14-week, manualized, group intervention for children with social competence and self-regulation challenges (Alvord, Zucker, & Grados, 2011). Treatment was completed at a private practice in Maryland. RBP is a cognitive behavior therapy (CBT) group program designed for children with social deficits. Two types of groups were conducted: a 'mainstream' group wherein a child with ASD was integrated into a group with children with diagnoses other than ASD, including social anxiety and ADHD, or a group comprised of only children with ASD. Group assignment was based on severity of social deficits and ASD symptoms. 24 children with ASD were enrolled in 'mainstream' groups (mean age = 9.83 ± 1.93 years; 75% male; 79% Caucasian) while 21 children with ASD were enrolled in ASD-only groups (mean age = 9.24 ± 1.58 years; 81% male; 62% Caucasian). Parents completed the Behavior Assessment System for Children (BASC-2; Reynolds & Kamphaus, 2004) pre- and post-therapy to evaluate treatment impact on social, emotional, and behavioral functioning. Change scores of select subscales of the BASC-2 from pre- to post-therapy were calculated to compare groups on treatment efficacy.

Results: Groups were not significantly different based on gender, race, age, or family income. Independent samples t-tests indicated no significant difference in change scores between groups on multiple domains, including Social Skills, $t(29) = -.70$, $p = .224$, Adaptive Skills, $t(29) = -.46$, $p = .088$, Developmental Social Disorders, $t(29) = 1.02$, $p = .282$, Internalizing Problems $t(29) = -.44$, $p = .444$, and Externalizing Problems, $t(29) = -.67$, $p = .461$.

Conclusions: Change scores did not differ between the groups on multiple domains of functioning, including social skills, affect, and behavior. The results suggest that the efficacy of a resilience-based CBT group therapy may be comparable regardless of whether children with ASD are enrolled in transdiagnostic versus ASD-specific groups. This research may speak to the idea that it may be more beneficial to match children with ASD based on skill-level as opposed to diagnosis only.

202 **211.202** Efficacy of Synergized Cognitive-Physical Training for Children with Inattention

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Background: Children with issues of attention have difficulties in their everyday life and school function due to deficiencies in these abilities. Cognitive training and physical exercise have both been shown to improve attention, providing an alternative approach to prescribed medications. Here we posit that a synergistic training platform for children across the inattention spectrum, including children with ASD, may lead to improved cognitive control abilities.
Objectives: To use a custom-designed, motion-capture, video game-based intervention (pediatric body-brain trainer (pediBBT)) adapted for school-aged children and deployed at a local elementary school to evidence potential improvements in cognitive control. Our first aim was to determine whether pediBBT is feasible in a school based setting. Aim 2 was to determine if this platform improves cognitive control abilities in children with and without clinically significant inattention as measured behaviorally and neurally via electroencephalography (EEG).

Methods: Eight children (7 boys), aged 7-12 years, underwent 24 pediBBT sessions across eight weeks. 7 out of 8 completed all pre and post assessments. PediBBT consists of three modules aimed at training attention, working memory, and goal management in which subjects respond to stimuli by reaching, squatting, or running. ADHD symptoms and cognitive abilities, specifically sustained attention, response inhibition, and working memory, were assessed prior to and following intervention using parent report (Vanderbilt ADHD Diagnostic Parent Rating Scale) and direct assessment (Test of Variables of Attention (TOVA), Attend-Ignore Distractor (AID)). Additionally, we assessed for changes in midline frontal theta, an EEG marker associated with focused attention processing, using a custom designed perceptual discrimination task.

Results: Regarding Aim 1 (feasibility), 100% of children completed all 24 sessions. In response to the question: "Overall, how would you rate you/your child's experience with pediBBT?" on a scale of 1-100, the mean score was 87, with a range of 70-100. On parent report measures of inattention, 3 out of 8 participants scored in the clinically significant range for ADHD at baseline -- 1 Inattentive, 1 Hyperactive, and 1 Combined type. Out of the 3 participants with parent-report based ADHD, 2 participants no longer meet criteria after pediBBT intervention. Direct assessment using TOVA showed statistically significant improvement in response time in 6 out of 7 children ($p=.027$) and response time variability ($p=.01$) in all 7 children. On our test of working memory, all 3 of the children with issues of inattention showed improvement. Our neural analyses

using EEG event related spectral analysis showed an increase of midline frontal theta across the cohort.

Conclusions: These findings provide initial evidence that an eight week, in-school, synergistic cognitive-physical training is feasible in children 7-12 years of age. Furthermore, it may improve cognitive abilities in children with attention challenges. We continue to enroll participants and analyze data and will be able to present outcomes of a larger sample in May of 2019. We also plan to recruit control groups with cognitive only and physical only training to determine the most effective outcome.

203 **211.203** Emotion Regulation and Empathy in an Adult Social Skills Intervention

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Background: Empathy and emotion regulation (ER) are critical contributors to success in social and vocational settings for adults with autism spectrum disorder (ASD). Individuals with ASD often have difficulties both reading and regulating emotional states, which may interfere with their ability to react appropriately in social situations (Mazefsky, Pelphrey, & Dahl, 2012; Mazefsky & White, 2014). It is believed that impairments in ER may relate to challenges with perspective-taking, which is key to empathy (Baron-Cohen & Wheelwright, 2004). Empathy and ER are two treatment considerations and potential targets that may help to optimize outcomes in psychosocial interventions for adults with ASD.
Objectives: To examine baseline levels and resulting changes in empathy and emotion regulation endorsements in the context of the Social Tools and Rules for Transitions (START) Program for Young Adults with ASD.

Methods: Twenty-eight young adults with ASD and fluent language use (18-25 years, *M* = 20.72) participated in a young adult version of the START program, an experiential social competence and motivation intervention (Vernon, Miller, Ko, Barrett, McGarry, 2017). Participants were randomly assigned to immediate treatment (*n* = 12) or waitlist control (*n* = 16) groups for 20 weeks. The peer-mediated START sessions were facilitated by undergraduates and consisted of individual check-in/check-out meetings, free socializing periods, interactive topic discussions (e.g., conversation skills, relationships, social momentum, and employment), and structured social games. Participants and mentors also went on weekly social community outings. Participants completed self-report measures at baseline and post-intervention/post-waitlist, including the Empathy Quotient (EQ) and BASC-3. Higher scores on the EQ are associated with greater levels of empathy, while higher scores on the Emotional Symptoms Index (ESI) composite of the BASC-3 are associated with greater internal distress and emotional disturbance.

Results: For all participants, there was a significant negative correlation between the EQ and the BASC-3 ESI at baseline ($r(26) = -.543$, $p = .003$; Figure 1). For the treatment group, a linear regression revealed that baseline ESI scores predicted change in empathy scores from baseline to post-intervention ($r^2 = .595$, $F(1,9) = 13.25$, $p = .005$; Figure 2). A repeated measures ANOVA yielded a significant *Group x Time* interaction for the EQ, $F(1,23) = 5.41$, $p = .029$. The BASC-3 ESI scores did not change significantly from baseline to post-intervention.

Conclusions: Results indicate significant improvements in empathy in the context of the START socialization program. Findings also indicate that individuals with fewer symptoms of emotional dysregulation at baseline report higher empathy, suggesting a possible relationship between emotional control and the ability to infer and relate to the emotional states of others. Greater ER difficulties at baseline were linked to greater improvements in empathy scores. This finding suggests that ER profiles may be one predictor of individual difference in response to psychosocial interventions. ER may be addressed indirectly through practice enhancing emotional language in the START intervention (Mazefsky & White, 2014). Future research will explore ER as an important treatment target that underlies increased social understanding and relatedness for adults with ASD.

204 **211.204** Establishing Best Practices in the Implementation and Evaluation of Novel Employment Programs for High School Students with ASD: A Case Study

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Background:
Employment initiatives for youth with autism spectrum disorder (ASD) have increased within clinical, educational and community settings. Rigorous implementation and evaluation procedures are essential for advancing evidence-based research on effective vocational training and supports for individuals with ASD. Knowing how to demonstrate fidelity in program delivery, specifically with job supports, and what outcomes are identified to examine participant progress are critical but underdeveloped in research. This study describes the measurement model, outcomes, and lessons learned from the Job-Train Program (JTP), a community-based employment program that involved paid-summer employment for high school students with ASD on a university campus.

Objectives:

(1) Examine the implementation of job supports within JTP.

(2) Evaluate student participant outcomes within JTP.

Methods:

Examining employment supports involved procedures to prepare job coaches and worksites for their role with JTP participants. Job coach training and ongoing online support were provided through a manualized job coaching program. Fidelity evaluation of coaches supporting participants on job placements was measured using a fidelity checklist of 14 behaviours to evaluate 5-10 minute videos from the worksite. Fidelity checklists were completed twice for job coaches, at the start and towards the end of work placements.

Student primary outcome measures were collected to: examine performance and satisfaction in employment-related issues measured through the Canadian Occupational Performance Measure; and evaluate emotional and behavioral problems, measured by the Child Behavior Checklist. Secondary outcomes included areas of work readiness and everyday functioning of participants within JTP. Weekly observational data of

participants (over 5 weeks) were rated on a 5-point scale by Job Coaches, regarding job performance, conversation skills and safety awareness. Qualitative outcome data were collected from students, parents, and job coaches.

Results:

A total of 12 credit-bearing high school students with ASD participated in JTP (age: 16.2 [0.8] years; 92% males). Secondary diagnoses included anxiety (33%) and ADHD (42%). Campus job placements included roles within the library, office settings at various departments and research centers, campus mailroom and residential suites. Students were supported by three Job Coaches. Fidelity checklist ratings of multiple videos across all Job Coaches included an average score of 45.2% early on in job placement, and 90.5% towards the end. Qualitative feedback was provided by job coaches on job placement videos and the fidelity checklist (to be analyzed and presented at conference). Primary and secondary outcomes are currently being collected based on pre-post measures and will be analyzed using parametric and non-parametric methods (to be analyzed and presented at conference). Average participant observational data in the workplace demonstrated positive improvements from time 1 to time 5 for areas of job performance (2.7 to 4.5), conversation skills (2.9 to 4.1), and safety awareness (3.2 to 4.3).

Conclusions:

Evaluation of fidelity checklist outcomes demonstrated gradual improvement in Job Coaches' implementation of key behaviours when comparing ratings at two time points over job placement. JTP students improved in their job and conversation skills and safety awareness on their job placements. Quantitative and qualitative outcomes will be analyzed and reported in conference presentation.

205 **211.205** Examining Children with Autism Spectrum Disorder's Negativity/Lability: Teaching Emotion Regulation Strategies through the Stress and Anger Management Program (STAMP)

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Background: Emotion Regulation (ER) is critical in children's social and emotional development and is often delayed or impaired in children with Autism Spectrum Disorder (ASD). Poor ER has been associated with increased anxiety, irritability, and poor self-regulation, leading to behavioral outbursts and potentially more restricted and repetitive behaviors. The Stress and Anger Management Program (STAMP) adapts Cognitive Behavioral Therapy (CBT) for younger children with ASD (4-7 years; preschool/kindergarten developmental level) and adds a parent training component. STAMP teaches children ER strategies, specifically what they can do to manage their emotions, and views parents as co-facilitators. A pilot study indicated group level differences (STAMP vs. Waitlist control) in ER measured post-treatment.

Objectives: The current study expands the original sample (from 11 to 23 participants) to test if STAMP decreases negative affect expression in young children with ASD compared to a Waitlist group in order to provide stronger evidence of the efficacy of STAMP in a Randomized Control Trial (RCT) design.

Methods: Twenty-three parent/child dyads (19 boys; 100% Caucasian) ranging from 4 to 7 years old (M = 5.46; SD = 1.01) participated in STAMP groups. Each dyad was randomly assigned to the Treatment (TX; i.e., STAMP; n = 12) or Waitlist control (WL; n = 11) group. All completed more than 50% of sessions. Eleven families participated in the original pilot study (n = 5 TX, 6 WL), and 12 families were added post-pilot (n = 6 per group). To qualify, children were required to meet criteria for ASD on the ADOS or ADOS-2, communicate verbally, understand basic verbal instructions (e.g., sit here), have parent-reported difficulties managing anger or anxiety, and be able to tolerate a group setting. Parents completed the Emotion Regulation Checklist (ERC), which assesses two dimensions of ER: regulation (ER) and negativity (Lability/Negativity; L/N). The L/N subscale targets expression of negative emotions, inflexibility, and mood, which is the focus of the STAMP intervention. The ER subscale was not examined.

Results: Paired samples t-test for TX revealed a significant difference in L/N for Time 1 vs. Time 2, $t(9) = 2.45$, $p = .03$, with decreased L/N at Time 2. For WL, there was no significant difference in L/N for Time 1 vs. Time 2, $t(7) = 1.02$, $p = .34$. TX gains for all participants revealed a significant difference in L/N pre-treatment (Time 1 for Treatment group and Time 2 for WL combined; M = 39.28, SD = 5.34) to post-treatment (Time 2 for TX and Time 3 for WL combined; M= 35.11, SD = 4.46), $t(17) = 3.26$, $p < .01$, Cohen's d = .77, suggesting a medium effect size.

Conclusions: Results support previous findings regarding benefits of STAMP in improving ER in young children with ASD. This study provides further support for using CBT with young children's ER skills. Improvements in children's ER skills may be important in the development of social relationships as well as reductions in psychopathology and therefore, it is critical that future research continue to explore the most effective way to elicit these skills.

206 **211.206** Examining Use of CBT Strategies for Anxiety: A Pilot Study with Adolescents with ASD and Intellectual Disability

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Background: Cognitive Behavioral Therapy (CBT) has been used to address anxiety symptoms in youth with ASD with promising results (Reaven et al., 2012, 2018; Wood et al., 2009). However, few treatment programs have specifically used CBT to reduce anxiety in individuals with ASD *and* Intellectual Disability (ID; Rosen et al., 2016). The extent to which individuals with ASD and ID are able to learn and use CBT strategies is unclear, particularly given of the heterogeneity of this population. A pilot intervention assessing the initial feasibility, acceptability and efficacy of CBT for adolescents with ASD, ID, and anxiety was completed (Blakeley-Smith et al., submitted INSAR 2019). The purpose of this study is to evaluate the attainment of CBT skills in a subsample of this study.

Objectives: To determine whether adolescents with ASD, ID, and anxiety are able to develop core skills and strategies from a CBT program for anxiety as documented through individualized Goal Attainment Scaling (GAS; Ruble et al., 2013) and evaluate anxiety and mood in this subsample.

Methods: Seven adolescents (Mage=16.60 years, SD=2.13, range=12-18 years) with ASD, ID, and anxiety participated in a larger pilot study evaluating an adaptation of Facing Your Fears (Reaven et al., 2011), a 14-week group CBT program to treat anxiety. All participants completed treatment and met criteria for ID: Full Scale IQ (M=64.00, SD=9.17; range=54-79) and adaptive behavior scores (M=57.29, SD=20.48) and anxiety based on parent report on either the Screen for Childhood Anxiety and Related Disorders (SCARED; Birmaher et al.,1999) or the Anxiety, Depression, and Mood Scale (ADAMS; Esbensen et al., 2003).

GAS goals and ratings were determined for each participant across 5 treatment domains: somatic management, emotion identification and regulation, cognitive strategies, exposure practice, and behavior management. Ratings were based on a parent interview conducted pre- and post-treatment and direct observation based on recommended GAS procedures (Ruble et al., 2013). Two to five goals per domain were created for each participant with total number of goals ranging from 11-17. See Table 1 for scoring information.

Results: Results from GAS scores indicated variability in use of CBT skills within participants and across subdomains after participating in treatment (See Table 2). In addition, dependent samples t-test indicated significant differences on the ADAMS (pre-treatment=42.00, SD=11.66; post-treatment=26.14, SD=8.61; $t(6)=3.87$, $p=.008$), suggesting decreased mood and anxiety symptoms.

Conclusions: GAS scoring showed that all participants made gains in CBT strategy use following participation in modified CBT program for anxiety. Of note, six of the seven participants exhibited 'expected' or 'greater than expected' use of cognitive strategies. This is noteworthy as cognitive strategies are not well researched or addressed in this underserved population (Rosen et al., 2016). Decreases were also noted in anxiety and mood symptoms, although it is unclear to what extent this reduction is tied to increased strategy use. Further research is needed to examine the active ingredients of treatment and if GAS ratings can best capture teens' use of these skills. Limitations include a small sample size and lack of independent raters for the GAS scores.

207 **211.207** Examining the Impact of Physical Activity on Sleep Quality in Children with Autism through Melatonin-Mediated Model: A RCT

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Background: Sleep disturbance is commonly found in children with autism spectrum disorder (ASD) and is often accompanied by family distress. Disturbed sleep may exacerbate the core symptoms of ASD, including stereotypic behaviors, social interactions, and health problems. Therefore, it is important to develop effective intervention strategies to ameliorate sleep disturbance in children with ASD. Traditionally, behavioral interventions and supplemental melatonin medication are used to improve sleep quality. However, the poor sustainability of behavioral intervention effects and use of other medications (e.g., antidepressants and stimulants) that metabolize melatonin may degrade the effectiveness of these interventions. Alternatively, previous research supported physical activity as an effective intervention for treating sleep disturbance in typically developing (TD) children. It is therefore natural to extend the study to examine whether such intervention is also effective in children with ASD.

Objectives: In the present study, we aimed to investigate whether physical activity is an effective intervention to improve sleep quality for children with ASD. Moreover, we also investigated how physical activity impacts on sleep in children with ASD through a melatonin-mediated mechanism model. According to this model, it is suggested that physical activity could affect circadian rhythm by altering melatonin levels. Melatonin levels are generally lower in children with ASD than in their typically developing counterparts and supplemental melatonin medication is often used to treat sleep disturbance in this population.

Methods: We conducted a parallel-group randomized controlled trial of 28 child participants with ASD that compared a jogging intervention group and a control group receiving standard care. We have monitored the changes of their sleep quality as depicted by four sleep parameters (sleep onset latency, sleep efficiency, wake after sleep onset and sleep duration) through objective actigraphic assessment and parental sleep logs. To measure melatonin level, all participants were instructed to collect a 24-h urine sample. 6-sulfatoxymelatonin, a creatinine-adjusted morning urinary melatonin representative of the participant's melatonin levels, were measured from the sample. All assessments were carried out before the intervention (T1) and immediately after the 12 weeks of physical activity or regular treatment (T2).

Results: The present study revealed a significant improvement between T1 and T2 in sleep efficiency, sleep onset latency and sleep duration in the intervention group (all $ps < .05$) but not in the control group (all $ps > .05$). More significantly, there was a significant increase of the urinary 6-sulfatoxymelatonin (ng/ml) ($p < .05$) between T1 and T2 in the intervention group (4.65±5.27 vs 8.09±5.24) but not in the control group (3.31±4.87 vs 4.09±3.38) ($p > .05$).

Conclusions: The findings of this proposed study provided an insight to the mechanism by which physical activity impacts on sleep in children with ASD, which may ultimately lead to the design of an effective intervention to improve the sleep quality of children with ASD.

208 **211.208** Exploring New Outcome Measures to Assess Effectiveness of the PEERS® Social Skills Intervention

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Background: Most studies that indicate effectiveness of PEERS®, a manualized social skills intervention for adolescents with autism (ASD; Laugeson & Frankel, 2010), rely on parent-, adolescent-, and/or teacher-report questionnaires to document outcomes. This may introduce bias because participants are not blind to their study group.

Objectives: To utilize structured conversation probes coded by raters blind to study group and time point to compare change in (a) adherence to the rules for two-way conversations taught during PEERS, and (b) social likeability among participants who were randomly assigned to complete PEERS, a peer-mediated model of PEERS (PMP), or a delayed treatment control (DTC) group.

Methods: Participants were 34 adolescents with ASD (age $M = 15.23$, $SD = 1.18$; 82% male) and 16 typically developing (TD) peer mentors (age $M = 15.50$, $SD = 1.27$; 44% male). Participants with ASD met criteria for autism/autism spectrum on the ADOS-2 and had an overall or verbal IQ ≥ 70. PEERS was delivered as manualized to the PEERS group. It was delivered identically to participants in PMP, with the exception of the inclusion of TD peer mentors. DTC was assessed at 3 time points over 9 months.

Participants (ASD and TD) completed a videotaped 10-minute structured conversation probe with a novel research assistant pre- and post-intervention. Participants with ASD completed additional probes at 4-month and 1-year follow-ups. It was not possible to collect 1-year probes from DTC participants because they had already started treatment.

Adherence to 16 rules for two-way conversations was coded by trained raters using whole and partial interval recording. Higher scores indicated

greater adherence (second rater coded 43%: ICC = .92). To assess social likeability, four novice research assistants watched each video and responded to the statement "What is the likelihood that similar-aged teenagers would enjoy socializing with the participant" using a Likert scale ranging from 1-unlikely to 10-likely. Scores were averaged across raters (ICC = .88).

Results: There was a significant group by time interaction for adherence (Figure 1; $F(4, 62) = 2.95$, $p = .03$) and the group by time interaction for social likeability approached significance (Figure 2; $F(4, 62) = 2.42$, $p = .06$). Bonferroni post-hoc comparisons indicated that PMP demonstrated greater adherence at immediate and 4-month follow-ups (Times 2 and 3) compared to pre-intervention ($ps = .01$) and had higher social likeability scores at 4-month follow-up compared to pre-intervention ($p = .02$). Results from 1-year follow-up (Time 4) data indicated a significant increase from pre-intervention in adherence ($p = .01$) and social likeability ($p < .001$) in the PMP group. Adherence and social likeability in PEERS and DTC groups did not differ across time points.

Conclusions: Findings suggest that adolescents in PMP increased adherence to rules for two-way conversations, and that treatment gains were maintained at 4-month and 1-year follow-ups. Treatment gains in adherence were partially corroborated by gains in social likeability. Findings are consistent with previously reported results from adolescent- and parent-report questionnaires from the same sample that indicated a modest advantage for PMP relative to PEERS (blinded).

209 **211.209** Exploring the Factor Structure of Child- and Caregiver-Directed Treatment Strategy Delivery in an Individualized Mental Health Intervention for ASD (AIM HI)

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Background: AIMHI ("*An Individualized Mental Health Intervention for ASD*"), a parent mediated and child-focused behavioral intervention for children 5-13 years of age with ASD, has been shown to have a long-lasting impact in reducing challenging behaviors when delivered by therapists in publicly-funded mental health (MH) settings (Brookman-Frazee et al., under review). AIMHI intervention strategies are theoretically conceptualized into two broad categories (*Active Teaching* & *Within Session Elements*); however, statistical exploration of the factor structure of these treatment elements has not been conducted.

Objectives: The current study aimed to explore the factor structure of therapists' delivery of child- and parent-directed AIMHI intervention strategies during therapy sessions.

Methods: Data were drawn from a large-scale effectiveness trial of AIMHI; in the intervention condition therapists received training in AIMHI and delivered the intervention to their client for 6 months. Therapists' use of child- and parent-directed AIMHI strategy delivery was evaluated using observational coding of therapy sessions. Participants included 143 therapist-child dyads in the intervention condition of the trial. The child sample (n=143) consisted of 83% males, with a mean age of 9.05 (SD=2.5). Therapists (n=126) were 34 years of age (SD=8.30), and ranged in experience (0-55 years). Seventy-two percent of the children and fifty-nine percent of the therapists were from an ethnic minority background. The number of coded sessions per child was 8.06 sessions (SD=3.2). Multilevel exploratory factor analyses (MEFA) with geomin rotation were run on Mplus to explore the factor structure of child-directed and parent-directed therapist strategies in the delivery of AIMHI.

Results: The Root Mean Square Error of Approximation (RMSEA) and the Comparative Fit Index (CFI) were used to evaluate model fit, with an RMSEA of ≤ 0.08 and a CFI > 0.95 indicative of good model fit. For the child-directed strategies, MEFA indicated preference for a two-factor model with unrestricted within-level covariance. The two-factor model demonstrated excellent fit $X^2(19) = 97.55$, $p < .001$; CFI = .96., RMSEA = .02. Six items loaded onto the first factor, termed Engagement Strategies, while three items loaded onto the second factor, termed Active Teaching Strategies (see Table 1). For the parent-directed therapist strategies, a one-factor model with unrestricted covariance was revealed. Model fit was excellent $X^2(20) = 36.24$, $p < .05$; CFI = .99, RMSEA = .00. The factor included 8 items. See Table 1 for more details.

Conclusions: Findings based on MEFA suggest that AIMHI child-directed strategies are best characterized by a two-factor model, whereas a unidimensional model best captures parent directed strategies. These results confirm the importance of using active teaching strategies (modeling, behavioral rehearsal, feedback and reinforcement) to teach child and parent skills and highlight the importance of using specific engagement strategies in MH delivery for an ASD population. Next steps will include confirming the factor structure of child- and parent-directed strategy delivery in AIMHI using multilevel confirmatory factor analyses. Long-term, these factors might be used to understand which factors best predict AIMHI treatment response as well as to understand which child and parent characteristics best predict strategy delivery.

210 **211.210** Feasibility/Pilot Study of a School-Based Adaptive Intervention for Children with HFASD

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Background:

The core deficits of students with high-functioning autism spectrum disorder (HFASD) negatively affect social and academic performance (Kasari et al., 2016). Problems with skill generalization from clinic-based interventions have prompted calls for development and testing of social skills interventions within school environments (Kasari et al., 2012; Kretzmann et al., 2015). Adaptive school-based social interventions may be a viable option for students with HFASD, as they can be tailored to the student's needs, and the intensity can be adjusted based on treatment response (Reichow & Barton, 2014). However, no studies have examined the feasibility of a school-based adaptive social skills intervention for students with HFASD.

Objectives:

This study examined the feasibility and initial efficacy of an adaptive school-based social intervention for 1st through 5th grade students with HFASD.

Methods:

Participants. Thirteen children, aged 6-11 years with HFASD, were included. Specific inclusion criteria were: (1) short form IQ >70 (one major index score >80); (2) expressive or receptive language score >75; and (3) diagnostic confirmation using an ASD diagnostic interview, screening measure,

and/or clinical consensus.

Measures. Skillstreaming Knowledge Assessment (SKA); Adapted Skillstreaming Checklist (ASC); Social Responsiveness Scale, 2nd Ed., (SRS-2); Clinical Global Impression scale (CGI)

Procedures. After baseline testing, all participants received a low intensity social skills intervention (LI-SSI; 1x/30 min per week social skills group [SSG]) for 10 weeks. Following 10 weeks of LI-SSI, responders to the LI-SSI continued to receive the LI-SSI. Non-responders were randomly re-allocated to one of two intensified SSI conditions including a Moderate Intensity SSI (MI-SSI; 2x/30 min per week SSG) or a High Intensity SSI (HI-SSI; 2x/30 min per week SSG plus behavioral reinforcement system) for the remaining eight weeks of intervention. Rating scales, a global impairment rating of clinical progress, and child testing of social skills knowledge were completed pre- and post-treatment.

Results:

Feasibility was supported in high levels of treatment fidelity (SSG component >93%) and parent and SSG facilitator satisfaction. Satisfaction ratings averaged 61.5 out of 70 points for parents and 62.3 out of 70 points for SSG facilitators. Pre-post comparisons indicated a significant decrease in parent (SRS-2 p=.041, d=-.58) and teacher (SRS-2 p=.011, d=-.70) rated ASD symptoms, an increase in parent (ASC p=.002, d=1.05) and teacher (ASC p=.041, d=.59) rated social skills, and a decrease in parent (CGI p < .001, d=-1.22) and teacher (CGI p < .001, d =-1.49) global impairment ratings. Child testing showed an overall increase in number of social skills known (SKA p=.001, d=.91) and knowledge of the steps for the skills (SKA p=.002, d =.76)

Conclusions:

Results suggest the intervention can be conducted with a high degree of fidelity, parents/school staff find it acceptable, and participation is associated with significant symptom and skills improvements. These findings are especially promising as the effect sizes on some of the parent, teacher, and child measures were large. However, the small sample limits the ability to test the adaptive component of the intervention. Future work using a fully-powered sequential, multiple assignment, randomized trial (SMART) design (Nahum-Shani et al., 2012) is needed.

211 **211.211** How Do We Care for Children with Autism Spektrum Disorder When Coming for a Procedure Requiring Anesthesia?

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Background: Children with Autism Spectrum Disorder (ASD) have problems with communication and social interaction. They are also dependent on routines and sensitive to sensory stimuli. Due to the problem's children with ASD have it can be a challenge for the Health Care Professionals (HCP) to establish a rapport with the child. This can lead to an uncooperative behavior during anesthesia induction which might result in the child being physically restrained for anesthesia induction. Such a traumatic event can exaggerate a child's anxiety for the next anesthesia induction. Children with ASD pose a challenge for the HCPs tasked to provide the child with care. Preparing both the child and the environment to suit the child's needs may decrease anxiety in children with ASD. In order to achieve this, the use of family-centered care and evidence-based guidelines would be beneficial.

Objectives: The aim of this study was to describe current ways to prepare and care for children with ASD for procedures and oral health care with sedation or general anesthesia.

Methods: A web-based questionnaire was distributed to the head of Swedish dental departments of pediatric dentistry and to anesthesia departments in Sweden. The questionnaire investigated the existence of guidelines for preparing and care of children with ASD for procedures and dental treatment under sedation or general anesthesia. Descriptive statistics and content analyses was used to analyze the answers from the questionnaires.

Results: Six pediatric dental departments out of 37 had guidelines on how to prepare children with ASD for sedation or general anesthesia and 7 out of 68 anesthesia departments caring for children with ASD had guidelines on how to prepare and care for these children. The guidelines in the pediatric dental departments consisted of comprehensive planning together with the parents for the entire health care visit to suit the individual child. Many departments left the preparation of the child to the anesthesia department when it came to anesthesia for dental care for these children. From the anesthesia departments three categories emerged, those were: "care with specific consideration for children with ASD", "lacking the necessary conditions," and "no extra consideration needed". These three categories span a continuum in the care from a care that was based on family-centered care tailored for the specific child to actually have as a routine to physical restraining a child for an anesthesia induction.

Conclusions: Considering the lack of guidelines for preparation of children with ASD for procedures and dental treatment in sedation or general anesthesia, there is a necessity for evidence-based, guidelines that are specifically designed to meet the needs of children with ASD in order to give high quality care and avoid a traumatizing experience for the children.

212 **211.212** Human-Companion Animal Interaction and Parent Stress in Families of Children with Autism

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Background:

Extant literature on interaction of children with Autism Spectrum Disorder (ASD) and Companion Animals (CAs) found animals to be an alternative/adjunctive method of alleviating social skills deficits and anxiety. Parents report benefits of companionship, unconditional love, happiness and learning responsibility from animal care-taking. In one study, lower stress was associated with living with CAs for parents of children with ASD.

Objectives:

This study aimed to examine CA ownership patterns in families of children with ASD, and to identify potential health and safety risks to the CAs. We also explored the relationship between CA ownership and parental stress among families of children with ASD. Additionally, we sought to

assess characteristics of the relationship between children with ASD and the family CA, along with parental perceptions of potential benefits and barriers of human-CA interaction.

Methods:

Participants (N=747) were recruited via the Interactive Autism Network (IAN) Research Database at the Kennedy Krieger Institute, Baltimore. Instruments included a demographic survey, Parenting Stress Index Short Form, Animal Ownership for Families of Children with ASD Scale, Lexington Attachment to Pets Scale and the Companion Animal Bonding Scale. Participants who access the IAN were invited to complete the instruments anonymously online.

Results:

Preliminary descriptive findings revealed the following information: Parent age (Mean=44.9 years, SD=7.3), Gender (90% female), Child age (Mean=12.8 years, SD=7.3), Child Gender (78% male), CA ownership: (82% CA owners). Of the CA, 34% were dogs, 23% cats and 42% of participants had both a dog and cat. The Parenting Stress Index data revealed that 52% of parents believed their children were a major source of stress in their life. Health and safety risks to the CA include the report of 5% of all parents that a CA would be in danger in their household. Among CA owners 9% reported that their child "sometimes" harmed their pet. Barriers of CA ownership were also found for parents. Parents (25%) reported that their children were bothered or irritated by their pet. A small percentage (13%) of parents reported that their children were fearful of some CAs, and of those 9% identified dogs. Benefits of CA ownership included increased parental exercise, social interaction and relaxation. Parents reported that their children were attached to their CA (58%). The CA-owning children were reported most attached to dogs (38%) and cats (28%). A close relationship with their CA was reported by 78% of parents, and 94% reported that their CA made them feel happy. Parents (87%) indicated that their CA helped them stay healthy, and 82% reported their CA knew when they felt bad.

Conclusions:

Our findings reveal that CAs may be of particular benefit to parents of children with ASD by providing friendship and promoting health. This may be especially helpful given that the parents were under considerable stress, perceived to be largely associated with parenting.

213 **211.213** Impact of Autism-Focused Public Speech Training Using Simple Virtual Audience

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Background: The employment rate for adults with autism spectrum disorders (ASD) is quite low, highlighting the need for support, programs, and tools that can assist them in acquiring and retaining jobs. In their employment, they are required to engage in public speaking from time to time. In the public speaking situation, interpreting the facial expressions of the audience, awareness of their own body language as projected to others, and sensory overload issues caused by the speaking environment might be challenging for individuals with ASD. Previous studies have shown that many individuals with ASD show motivation and an aptitude for using technology. They have been shown to have a preference for electronic media, game-like elements, and computer-generated speech, and those with particular visual strengths may be especially adept at engaging with digital modalities. In an effort to help facilitate public speaking training for individuals with ASD, we developed the Autism-Focused Public Speech Training using Simple Virtual Audience (APSV).

Objectives: The present study was carried out to evaluate the efficacy of APSV for individuals with ASD.

Methods: The virtual audiences used in APSV were simple human face as shown in Figure 1. They could nod, smile, and blink eyes. Young adults with ASD (ages 18–25 years) were randomly assigned to the following two groups: one group received "APSV" and the other group received "independent training" The subsequent trial procedures were conducted from day 1 to day 7. On days 1 and 7, the participants in both groups participated in an approximately 10-min mock public speaking trial in front of ten people at the same time of day. Baseline and outcome measurement of self-reported performance/efficacy and salivary cortisol were obtained before and after the mock public speaking respectively. From day 2 to day 6, participants in the APSV group were encouraged to undergo APSV for a minimum of 10 minutes. Participants in the independent study group were encouraged to read and answer materials about responding effectively to questions frequently asked in public speaking daily for a minimum of 10 minutes.

Results: In total, 23 individuals with ASD participated in the study. In the APSV group (n=11), all participants completed the trial procedures without technological challenges or distress that could lead to session termination. In the independent study group (n=12), two participants dropped out of the trial procedures. Young adults with ASD participating in the APSV sessions reported improved self-confidence and demonstrated lower levels of salivary cortisol compared to controls.

Conclusions: The study provides preliminary evidence that use of virtual agent-mediated systems, such as simple avatar, may be acceptable/feasible and contribute to tangible improvements in public speaking performance. Future studies need to examine whether APSV is associated with completing more job interviews and obtaining employment.

214 **211.214** Improving Daily Living Skills in College Students with Autism Spectrum Disorder Using a Peer-Mediated Daily Living Checklist Intervention

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Background:

Research suggests individuals with Autism Spectrum Disorder (ASD) have difficulties with daily living skills that affect adaptive behavior, which are a major barrier to success in higher education settings and beyond. Few interventions target the improvement of daily living skills within this population, with even fewer targeting college students. Since interventions that integrate motivational and peer-mediated components have improved social communication in college students with ASD, it is possible that incorporating these methods into a daily living checklist, a type of self-management intervention, may lead to greater improvements in daily living skills for this population as well.

Objectives:

The purpose of this study is to assess whether the use of peer-mediated motivational components would increase the percentage of targeted daily living tasks completed per week. In addition, data was collected to systematically examine if this intervention will improve overall adaptive behavior, mental health, quality of life, and academics.

Methods:

Participants included three adults between 18 and 26 years diagnosed with ASD according to DSM-5 criteria. Participants were full time students in a four-year university, had average intellectual functioning, and demonstrated difficulties in at least one domain of daily living skills as measured by the Vineland Adaptive Behavior Scales- 3rd Edition (VABS-3).

A multiple baseline across participants design was used, where a baseline condition with a self-management daily living checklist without peer-mediation was compared to a peer-mediated intervention condition where individualized prompts are provided to complete the self-management daily living checklist. Participants were randomized to each baseline condition.

The primary dependent measure is the percentage of targeted daily living tasks completed per week. Additionally, secondary data was collected for the following measures pre and post intervention: (1) VABS-3 (2) Beck Depression Inventory-II (BDI-II); (3) Beck Anxiety Inventory (BAI); (4) Quality of Life Assessment for Adults with ASD; and (5) quarterly grade reports.

Results:

Preliminary data from two participants suggest that a peer-mediated daily living checklist intervention is effective in increasing frequency of daily living skills in college students with ASD (See Figure 1). At baseline, Participant 1 completed an average of 24% of targeted tasks per week. After the peer-mediated intervention began, Participant 1 increased the percentage of total targeted tasks to an average of 65%, which was maintained at one-month follow up. At baseline, Participant 2 completed an average 29% of targeted tasks per week. Preliminary data shows that Participant 2 is increasing in percentage of completed tasks, with an average of 78%. Additional analyses will confirm these findings in three participants and across pre-post measures.

Conclusions:

Preliminary results show promise that this peer-mediated intervention may be more effective in improving daily living skills among college students with ASD than without peer-mediation. The results suggest that future research on improving daily living skills for college students with ASD is likely to be successful.

215 **211.215** Improving the Social Interactions and Peer Perceptions of Adolescents with ASD: Results from a Randomized Clinical Trial of the START Socialization Program

***J. A. Ko**, A. R. Miller, A. Chiu, M. Allison, R. Graef, S. Said, A. Rathore, R. Rincon, A. Barrett, E. McGarry and T. W. Vernon, University of California Santa Barbara, Santa Barbara, CA*

Background: Social skill programs for adolescents with ASD rarely use live, real-world peer interactions as an outcome measure when these interactions are arguably the most important and socially valid evidence for meaningful socialization improvements. Instead, parent and self-report survey measures and structured social assessments are commonly used instruments to measure social skill gains (Miller et al., 2014). However, these tools may have limited value without converging evidence of real-world social improvements (Cunningham, 2012). Specifically, when these adolescents interact with similarly aged social partners, how are they perceived? Do they use the verbal and non-verbal skills that are generally associated with social competence? To date, no studies have examined if third party, untrained observers perceive social competence improvements in live peer interactions after completing a randomized clinical trial (RCT) of a social skills program.

Objectives: The current study evaluated the efficacy of an RCT of the Social Tools And Rules for Teens (START) program through directly observing and coding social skill use and obtaining peer perceptions of social ability based on brief video-recorded conversations.

Methods: Thirty-five adolescents (ages 12-17) and their parents participated in the RCT of the START program, which is a 20-week experiential social competence and motivation intervention. At pre- and post-intervention, adolescents engaged in 5-minute dyadic conversations with two unfamiliar, typically developing peers (one male and one female). Video-recorded conversations were coded for various social skills (i.e. questions asked, mutual engagement, speaking contributions, eye contact, listening behaviors, and positive facial expressions). Two video coders coded each behavior and reliability was established for 30% of the videos. The video-recorded conversations were also shown to peer observers (unknown to participants and blind to study objectives), who rated participants along several social domains (i.e. social skills, comfort during the interaction, awkwardness during the interaction, and perceived quality of existing relationships). Videos were counterbalanced to ensure that the pre-intervention video was not always viewed before the post-intervention video. Every participant video was rated five times by different raters to ensure consistency of ratings.

Results: Two-way mixed ANOVAs were performed to examine differences between the treatment and waitlist groups on video-coded social skills and peer perceptions of social ability across time. Results revealed significant improvements for adolescents who participated in the START program in the following social skills: questions asked (p = .035; medium-large effect), eye contact (p = .003; large effect), listening behaviors (p = <.001; large effect), and positive facial expressions (p = .009; large effect). Compared to a waitlist control group, adolescents who participated in the START program also demonstrated significant improvements peer perceptions of social ability made by observers unfamiliar with the study (p = <.001; large effect).

Conclusions: The START program resulted in significant gains in the adolescents' use of specific social skills, which in turn increased peer perceptions of their social competence. This is particularly promising, given that the social strategies one utilizes dictates how favorably one is perceived as a potential conversation partner and sets the foundation for building successful social connections and relationships.

216 **211.216** Inhibition Control Outcomes of a Music Intervention for Autism

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Background: Music is a complex, multimodal activity which depends on and may in turn enhance inhibition control (IC) during cognitive development (Holochwost et al., 2017; Jaschke, 2018). IC is an executive function important for regulating appropriate and inappropriate responses and for adapting behavior to shifting situational demands. Individuals with autism spectrum disorder (ASD) have shown impairments on standard IC tasks such as the Go-NoGo (Geurts et al., 2014) and Eriksen Flanker tasks (Christ et al., 2011). However, no study has yet examined the effects of a music-based intervention for children with ASD using IC measures.

Objectives: The object of this study was to evaluate changes in IC measures in children with ASD after 8-12 weeks of a music or non-music intervention, using the Go-NoGo and Eriksen Flanker tasks.

Methods: Data were collected as part of a larger 8-12 week randomized controlled trial of music for school-age children with autism (Sharda et al, 2018). Both the music and non-music therapies targeted social and communication outcomes. Music sessions were individual, semi-improvisational and participants could choose from several instruments. The Go-NoGo task consisted of 160 Go and 40 NoGo trials, and the Flanker task consisted of 100 congruent and 100 incongruent trials. Both tasks were adapted for children. The IC analysis was run on 32 participants who had pre- and post-intervention data for the Go-NoGo task (MT, n=18; NM, n=14) and 29 for the Flanker task (MT, n=15; NM, n=14). Groups had average IQ and were matched on age, sex, IQ and socioeconomic status in both analyses ($p \geq .274$). Mixed-effects analyses tested changes in IC performance in the NoGo and incongruent conditions of the Go-NoGo and Flanker tasks respectively. Main effects of time-point and treatment by time-point interactions were examined for both accuracy and reaction time.

Results: On the Go-NoGo task, 8-12 weeks of therapy showed no significant treatment by time-point interaction on NoGo accuracy ($p = .393$; Figure 1). On the Flanker task, there were no significant treatment by time-point interactions for incongruent condition reaction times ($p = .519$) or accuracy ($p = .869$; Figure 2). There were also no overall main effects of time-point for the NoGo trials or for the Flanker task conditions on either reaction time or accuracy ($p \geq .260$).

Conclusions: IC performance was not significantly greater in children with ASD who participated in 8-12 weeks of music intervention compared to those in the non-musical intervention, and overall no changes in IC performance were found in either intervention. In the larger RCT, positive effects were previously found on communication scores for the music group compared to the non-music group (Sharda et al., 2018). Although the intervention may simply have been too short to observe IC improvements, previous work on music and IC suggests that a greater focus on rhythmic activities and rhythm-based interaction may be beneficial in music-based interventions where IC is a targeted outcome (Holochwost et al., 2017; Vuust et al., 2011). As such, these results may help guide the effectiveness of future music-based interventions in ASD.

217 **211.217** Interventions for Transition-Age Students with Autism Spectrum Disorder: A Meta-Analysis

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Background: The Individuals with Disabilities Education Act (Individuals with Disabilities Education Act [IDEA], 2004) is a legislative mandate that was passed to enhance the educational opportunities available for students with disabilities. This law outlines the necessary steps to prepare students for a transitional period from high school to adulthood. Special educators are required to develop appropriate goals with each student that will assist them throughout this transitional period. Despite these advances, students with Autism Spectrum Disorder (ASD) consistently lag behind their peers in terms of educational achievement. When compared to typically developing peers, these students have lower rates of competitive employment, post-secondary school attendance, independent living, and opportunities for success within the community (Taylor & Seltzer, 2011). Synthesizing the available research that targets transition-age students with ASD will aid in determining whether these interventions have a positive impact on students with ASD, and the particular domains in which these interventions show evidence of effectiveness.

Objectives: In this meta-analysis we examined high school intervention studies, considered broadly, for individuals diagnosed with ASD, Intellectual Disability, or Severe/Multiple Disabilities. Our primary aim was to determine the summary effect of high school interventions, and the effect size estimates across all intervention types. For the purpose of this presentation, we will focus solely on the reports that included individuals with ASD.

Methods: Electronic databases were the primary method to search for published journal articles and dissertations/theses. Attempts to locate "grey literature" were also employed through hand searching past conference proceedings and peer-reviewed journals. Researchers who previously presented on topics related to transition-age youth, were emailed with a request to provide unpublished data relevant to the current analysis. A graduate student screened each article based on inclusion criteria. If studies did not meet the criteria, they were eliminated from the meta-analysis; however, articles that appeared to meet this inclusion criteria, went on for a complete review of the text.

Results: Our search yielded a total of 18 reports and 208 effect sizes (see Figure 1 for a detailed description of the elimination process). Of the 18 studies included in the overall analysis, 8 included adolescent or young adult participants with ASD ($n = 78$). The forest plot in Figure 2 reveals a significant summary effect size for studies that introduced interventions for high school students with ASD. Because there were fewer than five studies in each intervention category, the findings could not be parsed out based on the type of intervention that was administered.

Conclusions: The small number of studies included in this meta-analysis further highlights the lack of knowledge there is regarding the benefits of interventions for individuals with ASD as they prepare for adulthood. Future research should continue to use rigorous methodologies to investigate transition interventions, and their impact on social-ecological factors that are considered important to autistic adults (Anderson, Roux, Kuo, & Shattuck, 2018).

218 **211.218** Is It Enough?: Challenges Generalizing Social Skills Gains into Community Settings

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Background: Group social skills training (GSST) is an important intervention approach to help children and adolescents with autism spectrum disorder (ASD) find more success in social engagement and inclusion. There are a number of well-established interventions that have been shown to help adolescents with ASD foster social relationships and improve in their skills relating to social interaction. However, there is a lack of

research reporting how the gains reported as a result of GSST generalize to other settings. Social knowledge gains have been observed, but social competence gains may not necessarily follow.

Objectives: The objective of this exploratory study was to see how well participants who had received an evidence-based social skills curriculum could generalize the skills learned to a community group setting. To enhance the likelihood of generalization, we designed the study to observe social gains before and after implementing a brief peer inclusion intervention involving the participant and their peers in their community group.

Methods: We provided GSST to 25 adolescents with ASD (ages 12-17) using a curriculum shown to have positive effects (the UCLA PEERS® curriculum) and measured the effect of training by parent report via two questionnaires: The Autism Social Skills Profile (ASSP) and Social Communication Questionnaire – Current (SCQ-Current). We then provided seven participants (six males, one female) and their peers in their community groups with a brief intervention teaching principles and strategies for peers, aimed at inclusion of those with disabilities without focusing on autism or our participants exclusively (e.g. Boy Scouts of America Disability Awareness Merit Badge). We analyzed each of these seven participants' level of social engagement in their community groups before and after the intervention using a multiple baseline design.

Results: Per parent report, GSST showed minor improvements in some areas of social engagement such as reciprocal conversation, reciprocal smiling, and a decrease in socially inappropriate questions or comments. Overall social engagement of participants in the community groups was not significantly changed, however. Peer inclusion instruction produced mixed results across participants, but generally there was no significant effect as a result of additional intervention for peers in the community setting.

Conclusions: Results from this exploratory study show that GSST can result in positive effects in areas of social communication quality and reciprocity as reported by parents. However, GSST may not be sufficient to produce desired levels of social engagement in generalized settings such as community peer groups. A number of challenges were encountered, especially in working with community group leaders. Considerations put forth as a result of this study include the importance of adult community group leaders as models for social engagement, providing opportunities for social engagement in novel peer groups, as well as consideration of parents of the possible benefits of having their child's disability disclosed to such peer groups to improve the potential gains of a peer inclusion intervention such as that proposed here. These considerations highlight the important role of families of individuals with ASD in providing opportunities for their teen with ASD to thrive socially.

219 **211.219** Is Sensory Integration Treatment an Evidence-Based Intervention for Children with Autism?

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Background:

The DSM-5 identifies sensory features (hypo and hyper reactivity, and unusual sensory interests) as a diagnostic characteristic of Autism Spectrum Disorders. These sensory features often interfere with functional skills, socialization and the development of higher-level behaviors. One intervention that is often recommended for addressing sensory features and their related impact on function and behavior is Ayres Sensory Integration© (ASI). ASI consists of principles and practices that provide clear guidelines for appropriate implementation. Despite the literature and guidance for using ASI, controversy continues to exists regarding its effectiveness. This session will present data from an analysis of evidence for ASI using 3 sets of standards designed to evaluate evidence-based practices for ASD. These standards provide specific criteria that are used to evaluate existing research, and are designed to guide educators, therapists, researchers, parents, policy makers, and others to identify effective interventions.

Objectives: To report on findings from a systematic analysis of literature regarding the effectiveness of ASI for children with ASD, 4-12 years old, published from 2006 to 2017; and to extend these finding by subjecting studies to two additional standards for evidence based practices reviews and adding any new data from 2018.

Methods:

METHOD: An extensive database search was conducted in CINAHL, Cochrane Reviews, Cochrane Trials, Embase, ERIC, Medline, and PsychINFO databases to identify relevant studies using the following search terms: sensory integration, autism, interventions suggesting a sensory integration approach. A total of 4,930 references were retrieved after removing duplicates. Only studies that used a high quality study designs (described below) were included. The iterative process of record reduction resulted in nineteen studies that were identified for further evaluation of fit with inclusion criteria. Only six of those studies met criteria for inclusion: e.g. peer-reviewed, written in English, intervention that is consistent with ASI intervention, provided an assessment of sensory functions prior to intervention, and used a comparison group design or single subject design. Prior to further analyses, three articles were excluded because the study intervention was not consistent with the core principles of ASI, or because of major methodological flaws. The remaining three studies were rated by three independent evaluators using the Council for Exceptional Children's Standards for evidence-based practice in special education (CEC, 2014).

Results: Two randomized controlled trials met 100% and 85% respectively of the CEC criteria with moderate to strong average intervention outcome effect sizes; Cohen's *d* equals .93, eta squared equals .21. One additional study met more than 50% of the criteria with an effect size of .23 which was calculated from the data.

Conclusions:

This analysis concludes that Ayres Sensory Integration meets the criteria for an evidence-based intervention for children with ASD. Additional data will be added and it will include a recently published(Kashefimehr, Kayihan, & Huri, 2018) and the application of additional review standards using the U.S. Preventive Services Task Force criteria and the National Clearinghouse on Autism Evidence and Practice Standards. Findings will be discussed in light of their implications for practice and research.

220 **211.220** Autism Spectrum Disorder Interventions in Mainland China: A Systematic Review

O. A. Sullivan *and C. Wang, Nankai University, Tianjin, China*

Background: Research on effective interventions for autism spectrum disorder (ASD) has historically been focused on Western populations.However, research in low- and middle-income countries is severely limited.This issue is particularly relevant given the majority of ASD measures and interventions were developed in high-income countries, with potentially limited relevance to low- and middle-income countries such as China(Elsabbagh et al. 2012).

Objectives: In light of the growing interest in ASD interventions in China, we systematically reviewed the academic literature to identify interventions to support individuals with ASD and their families in mainland China. This literature review seeked to determine the current state of ASD intervention research in mainland China, as well as trends from the past 25 years.

Methods: Using an identical search string, four databases – PubMed, PsycINFO, ScienceDirect, and Web of Science – were methodically searched for peer-reviewed studies conducted in mainland China on ASD interventions from 1995 to August 8th, 2018. Although 1,012 studies were initially found, reading abstracts from each study yielded 35 potentially suitable papers. After removing duplicates and reading full texts, only 13 English-language articles and nine Chinese-language articles were found to be suitable for inclusion.

Results: Half of included studies (*n* = 11) were published in 2017 and 2018, indicating a recent surge in research. Participants in all studies were either children or adolescents. The most popular interventions researched included acupoint-based (*n*= 5) and theory of mind (TOM)-based (*n* = 5) interventions. Studies demonstrated a spectrum of cultural adaptation of each intervention. All but one study concluded that their interventions were effective in mitigating specific ASD symptoms.

Conclusions: Although there has been a recent surge in research on interventions for ASD in mainland China, future studies must be longer, randomized, and placebo-controlled if possible. Additionally, studies should strive to include larger sample sizes consisting of participants of more diverse geographic and ethnic backgrounds throughout the country. Meanwhile, increased support must be given to teachers, therapeutic specialists, and caregivers of dependents with ASD.

221 **211.221** Home-School Collaboration and IEP and Postsecondary Goal Attainment of Students with ASD

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Background: The school, student and family factors underlying poor postsecondary outcomes of students with autism spectrum disorder (ASD) are not well understood. Factors contributing to success for students with ASD who obtain employment or postsecondary education encompass three broad categories associated with transition planning: school, student, and parent-related variables. We collected measures representing each of these categories as part of an intervention to improve transition outcomes for students with ASD using the Collaborative Model for Promoting Competence and Success (COMPASS) a student-centered planning and teacher coaching intervention designed to support home-school collaboration. Because of the divergence of abilities in transition age youth with ASD, this framework accounts for the heterogeneity observed across the spectrum by emphasizing personalization of intervention plans and adaptation of EBPs.

Objectives: Our goal was to understand the relative contribution of student (IQ, adaptive and externalizing behaviors), parent (activation) and school variables (transition planning quality (TPQ), parent-teacher alliance) in predicting IEP and postsecondary goal attainment (a) in general and (b) by domain of postsecondary outcomes. We also wanted to know (c) who was responsible for implementation of plans for postsecondary goals? and (d) how progress of implementation of plans changed over time?

Methods: Twenty special education teachers and 20 students with ASD and their parents were recruited for an RCT of COMPASS. All students received special services under the educational category of autism and met the DSM criteria. Students mean age was 18.2 years. Forty percent were taught in general education full time; 20% in general and special education; and 40% in special education full time. Ninety percent of the students were male, 70% were White, 15% Black, 5% Asian, and 10% multi-racial.

Parents and teachers completed reliable measures of TPQ (Ruble et al., 2018), parent activation (Hibbard et al., 2005), and parent-teacher alliance (Abidin & Brunner, 1995). IEP goal attainment was evaluated at the end of the year by a rater unaware of group assignment. Postsecondary goal attainment was reported by teachers and parents. Pearson correlations controlling for group assignment were used to examine concurrent associations between variables. Friedman's multiple comparison test was used to understand progress in implementation of transition plans over time.

Results: Student IQ and adaptive behavior, TPQ, and alliance correlated with IEP progress, with postsecondary goal attainment generally and with student participation in training/education, specifically. However, only parent activation and student externalizing behavior correlated with employment. Families and students, rather than school personnel, were the primary persons in charge and in control of the implementation of postsecondary plans and required help across multiple coaching sessions to implement plans fully.

Conclusions: This preliminary study suggests that transition planning that integrates both home and school goals and implementation strategies is necessary. Interventions that support families and students should promote the accomplishment of postsecondary goals. These strategies include approaches that improve home-school alliance and transition planning quality.

222 **211.222** Trait Mindfulness in Treatment-Seeking Adolescents with Autism Spectrum Disorder and Comorbid Anxiety

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Background: Adolescents diagnosed with autism spectrum disorder (ASD) may face significant challenges in meeting social environment demands, potentially leading to distress (Russell, 2011). The co-occurrence of anxiety symptoms are common in adolescents with ASD; approximately 40% of youth with ASD have at least one comorbid anxiety diagnoses (van Steesel, 2011). Comorbidity in individuals with ASD shows relations to reduced quality of life (Chang & Wineman, 2014); thus, treatment to address comorbid diagnoses is crucial. Mindfulness-based stress reduction (MBSR) programs have shown promise as effective treatment for anxiety among both typically developing (TD) children (Zoogman, Goldberg, & Miller, 2015) and individuals with ASD (Conner & White, 2018; Sizoo & Kuiper, 2017). However, little is known about the clinical profiles of adolescents with ASD who present for MSBR treatment. Investigating these profiles may provide insight into factors impacting effective treatment for adolescents with ASD.

Objectives: Our aim was to develop an understanding of the relation between core symptoms of ASD and trait mindfulness in adolescents with comorbid anxiety presenting for MBSR treatment. We hypothesized that lower trait mindfulness would be related to higher pre-treatment

perceived stress scores and more severe autism symptoms.

Methods: A total of 27 patients participated in a group therapy that implemented the Mindfulness Based Stress Reduction for Teens curriculum (MBSR-T; Biegel, Chang, Garrett, & Edwards, 2014) for 10-12 sessions. Nine adolescents (M_{age} = 15.33 SD_{age} = 2.34) were included in this preliminary analysis. Prior to beginning the intervention, the Perceived Stress Scale (PSS; Cohen, 1994) was collected to determine perception of stress, the Social Responsiveness Scale -Second Edition (SRS-2; Constantino & Gruber, 2012) was completed by parents to measure ASD symptoms, and the Mindful Attention Awareness Scale-Adolescent version (MAAS-A; Brown, West, Loverich, & Biegel, 2011) was collected to determine trait mindfulness.

Results: An average PSS total score of 23.88 (n = 9; SD = 5.23) was in the moderate range at the beginning of intervention. The average pre-treatment MAAS-A score was 3.76 (n = 9; SD = 1.22), indicating moderate levels of trait mindfulness with a wide range across the clinical sample. The MAAS-A and PSS were negatively correlated (r = -0.86, p = .003). The SRS-2 Restricted and Repetitive Behaviors (RRBs) subscale had a negative association with the MAAS-A (r = -0.79, p = .010). A trend was observed between the Awareness subscale of the SRS-2 and the MAAS-A (r = -0.66, p = .053). No other SRS-2 treatment subscales were significantly correlated with the MAAS-A.

Conclusions: Results support prior research that reduced trait mindfulness is associated with greater perceived stress among adolescents with ASD. Average trait mindfulness for adolescents with ASD appears similar to TD peers (Brown, Loverich, & Biegel, 2011). Our study also provides preliminary evidence that lower trait mindfulness is associated with more RRBs in adolescents and less social awareness. Future research should examine whether RRBs and deficits in social awareness are impacted by mindfulness training or if these core autism symptoms function to moderate the therapeutic efficacy of MBSR.

Poster Session
212 - Late phase drug development
5:30 PM - 7:00 PM - Room: 710

223 **212.223** A Phase 2 Randomized, Placebo-Controlled Trial of Intranasal Oxytocin in Adults with Autism Spectrum Disorder

E. Anagnostou[1], *J. A. Brian*[1], *J. Goldberg*[2], *S. Prat*[3], *L. Capano*[4], *A. Iaboni*[1], *A. Solish*[1], *D. Frisch*[5], *R. Hastie Adams*[5], *L. Genore*[6], *I. Patriciu*[7], *F. Tran*[2,8] *and M. Woodbury-Smith*[9], *(1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Psychiatry, McMaster University, Hamilton, ON, Canada, (3)McMaster University, Hamilton, ON, Canada, (4)Autism Research Centre, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (5)Holland Bloorview Kids Rehab Hospital, toronto, ON, Canada, (6)Holland Bloorview Kids Rehab Hospital - ARC, Toronto, ON, Canada, (7)McMaster University, toronto, ON, Canada, (8)Neurology, Sunnybrook Hospital, Toronto, ON, Canada, (9)Newcastle University, Institute of Neuroscience, Newcastle upon Tyne, United Kingdom of Great Britain and Northern Ireland*

Background:
There are currently no medications with evidence supporting their use to treat the core symptoms of autism spectrum disorder (ASD). Convergent evidence, however, suggests a role for oxytocin in social function. Still, the data regarding potentially therapeutic potential of this compound remains mixed. Methodological limitations of previous studies include small sample sizes (median n = 18), variability in assay sensitivity of outcome measures used, and variability in dosing among others.

Objectives:

To evaluate the efficacy of intranasal oxytocin vs. placebo for the treatment of social deficits in adults with ASD, using a phase II Randomized controlled trial design

Methods: This is a phase II randomized, placebo controlled, multisite trial. Participants were recruited across 2 sites and were randomized to drug or placebo in 1:1 fashion. Safety was evaluated using the SMURF, safety blood work and ECG. Efficacy was evaluated using the CGI as a primary measure. Secondary measures included the ABC, SRS, WHOQOL, Vineland, and SCL-90 anxiety.

Results:

70 participants were randomized across 2 sites. Intranasal oxytocin was well tolerated with no related serious adverse events reported. Improvements were noted in self reported SRS (p=0.0006), WHOQOL psychological scale (p=0.08), anxiety (p=0.04) and Vineland total score (p=0.05)

Conclusions: Intranasal oxytocin was well tolerated in adults with ASD. Efficacy data is supportive of therapeutic potential for this mechanism.

Poster Session
213 - Medical and Psychiatric Comorbidity
5:30 PM - 7:00 PM - Room: 710

224 **213.224** Family History of Autism and Assisted Reproductive Technology As Risk Factors for Pregnancy Complications in the Chatterbaby Autism Risk Survey

J. A. Estabillo[1,2], *P. Kaur*[3], *B. H. Dang*[4], *D. Montoya-Williams*[5], *J. Parga*[5], *C. Kasari*[3], *S. Jeste*[3], *M. Dapretto*[6], *S. Y. Bookheimer*[6], *Y. Quezada*[3], *S. J. Poulhazan*[7], *S. Zhang*[3], *A. Razzak*[3], *S. Yoon*[3] *and A. Anderson*[3], *(1)Psychiatry, UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA, (2)Psychology, LSU, Baton Rouge, LA, (3)University of California, Los Angeles, Los Angeles, CA, (4)Department of Neuroscience and Psychiatry, UCLA, Los Angeles, CA, (5)Division of Neonatology, CHOP, Philadelphia, PA, (6)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA, (7)Biology, University of California, Los Angeles, Los Angeles, CA*

Background: Mothers who use assisted reproductive technology (ART) are at higher risk for pregnancy and birth complications. Use of ART, family history of autism spectrum disorder (ASD), and pregnancy complications such as hypertension and abnormal bleeding have all been associated with increased risk for ASD. Given that ART pregnancies share many correlates with ASD risk factors (e.g., increased parental age, higher education

level, pregnancy and birth complications), we examined whether ASD family history may be associated with an increased risk of pregnancy complications, after adjusting for ART, maternal age, and maternal education, and tested whether various ART methods showed different risk profiles for pregnancy complications.

Objectives: Examine the relationship between ASD family history, ART, and pregnancy complications, and assess whether survey participants with self-reported ASD family history had more pregnancy complications (holding constant ART, maternal age, and maternal education).

Methods: Data were collected as part of a voluntary survey completed by any user of the infant cry translation app, ChatterBaby (n = 1,782, infant age M= 91 days). The "ChatterBaby Autism Risk Survey" obtains participants' consent for their information to be used in research, and queries demographic information, family history, and pregnancy and delivery complications (Figure 1). Of the total participants, 7.6% reported using any ART, 12.5% reported a family history of ASD, and 52.6% endorsed maternal pregnancy problems. To examine the general relationship between ART and pregnancy complications, a binomial logistic regression predicted pregnancy complications based on ART, maternal age, maternal education level, and family history of ASD. Secondary models examined specific relationships within type of ART.

Results: Pregnancy complications were significantly increased for mothers who used any ART (OR=1.66;p<0.05) and for those who had a family history of ASD (OR=1.66;p<0.001), holding constant maternal age and education (Figure 2). Mothers with a family history of ASD were not more likely to use ART (p>0.05) after holding constant maternal age and education. The relationships between maternal age, education, and pregnancy complications were specific to the nature of the complications. Different ART types showed different risk profiles for pregnancy complications. IVF, sperm donation, and embryo adoption did not result in a significantly higher risk for various pregnancy complications. However, mothers who used ICSI were more likely to experience depression requiring use of antidepressants[a]; hypertension[a]; preterm labor[b]; cerclage, cervical incompetence or insufficiency[c]; placental abruption[b]; placenta accreta[a]; hyperemesis gravidarium[a]; treatment with opioids[b]; perinatal or post-partum psychosis[c]; use of anticonvulsants to treat seizures[c]; intrauterine growth restriction[b]; preeclampsia/eclampsia[b]; and anemia[b]. Mothers who used egg donation were more likely to have hypertension[a]. Mothers who used IUI were more likely to have a history of miscarriage[b] and experience cerclage, cervical incompetence or insufficiency[a]. [Note: [a] = p<.05, [b] = p<.01, [c] = p<.001].

Conclusions: Mothers who use ART or with an ASD family history were significantly more likely to experience pregnancy complications, but mothers with ASD family history were not more likely to use ART. This suggests that ASD family history is a unique risk factor for pregnancy complications.

225 **213.225** From Early Childhood to Adolescence: Persistence and Impact of Emotional and Behavioural Problems in ASD

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Background:

High rates of co-occurring psychiatric disorders have been reported in adolescents and adults with autism spectrum disorder (ASD), and recent studies have also shown high rates of emotional and behavioural problems (EBPs) in young children with ASD. These problems can have a significant impact on the individual's ability to cope with daily life, over and above their core ASD symptoms. While additional psychiatric problems have been shown to persist in older children with ASD, far less is known about the stability and impact of EBPs in young children with ASD. This study seeks to address this issue using a three time-point community cohort with repeated measures.

Objectives:

As part of the Improving Autism Mental Health (IAMHealth; www.iamhealth.kcl.net) research programme, we aimed to: (1) assess the stability of EBPs across three time-points from early childhood to adolescence; (2) consider the association between early EBPs and later outcomes such as adaptive functioning.

Methods:

Participants were part of the QUEST cohort, a community-based sample of children with a diagnosis of ASD. Children were assessed at a mean age of 6-years 9-months (time 1, total n=277), 13-years 5-months (time 2, total n=211), and 15-years 4-months (time 3, total n=207). Parent/carers completed the Developmental Behaviour Questionnaire at time 1 and 2, and the Strengths and Difficulties Questionnaire at times 2 and 3 as a measure of their child's EBPs. Children's IQ was assessed at time 1, and (on a stratified subsample) at time 2. The Adaptive Behaviour Assessment System (ABAS-II) was completed at time 2, and psychiatric outcomes were assessed at time 3. This study focuses on 185 participants with data at all 3 time-points.

Results:

Parent reports of EBPs showed an overall decrease in total scores from time 1 to time 2 (t=4.18, p<.0001), but no significant difference was found between scores at time 2 and time 3. However, for those with high levels of EBPs at time 1, these problems persisted through to adolescence: 74% of those above the clinical cut-off on the DBC at time 1, remained above cut-off at time 2 (X^2 (1) = 27.0, p<.001); and of these, 81% scored in the high/very high range on the SDQ at time 3. Furthermore, higher levels of EBPs at time 1 were associated with poorer adaptive functioning at time 2, independent of IQ (β = -.19, (SE .08, p=.014).

Conclusions:

Within this community sample of children with ASD, we found a high level of EBPs in early childhood, with 76% scoring above the clinical cut-off on the DBC. For the majority, these EBPs persisted into late childhood and adolescence and were associated with lower adaptive functioning. These findings highlight the importance of identifying co-existing EBPs in children with ASD at an early stage, to enable timely interventions to be put in place, potentially reducing impact on the individual and their families.

226 **213.226** Gender Identity in Autism Spectrum Disorder and Attention Deficit Hyperactivity Disorder

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Background: Evidence suggests a higher-than-expected co-occurrence of autism spectrum disorder (ASD) and gender dysphoria (GD) in children, adolescents and adults (van der Miesen et al., 2015). GD is characterized by distress due to incongruence between assigned gender and experienced/expressed gender. Recent studies have found that ASD is more common among children who are clinically referred for GD compared to those referred for other psychiatric/psychological concerns (Leef et al., in preparation). Among youth with ASD, elevated traits of GD have also been found (e.g., May et al., 2017). These findings imply a unique relationship between ASD and GD. However, one study reported similarly elevated GD traits among youth with ADHD (Strang et al., 2014), suggesting that elevated rates of GD traits may not be unique to ASD versus other neurodevelopmental conditions.
Objectives: To explore whether traits of GD are elevated in children and adolescents with ASD relative to ADHD and controls.

Methods: Data from 644 participants enrolled in the Province of Ontario Neurodevelopmental (POND) Network were analyzed: ASD (*n*=370, *M* age=11.02, *SD*=3.32), ADHD (*n*=115, *M* age=10.03, *SD*=2.90), and typically developing controls (TD; *n*=159, *M* age=11.35, *SD*=3.20). We used one conventional method of assessing the propensity towards GD by analyzing a parent-reported item on the Child Behavior Checklist (CBCL) "wishes to be of opposite sex" (Item 110).

Results: Fisher's Exact Test revealed no significant association between endorsement of Item 110 and group (Fisher's Exact=1.38, *p*=.48; 2.2% in ASD, 1.7% in ADHD, and .6% in controls). Notably, of those for whom this item was endorsed, 73% had ASD, 18% had ADHD, and 9% were controls. Compared directly to controls, the ASD group had an Odds Ratio of 3.50; compared to ADHD, the Odds Ratio for ASD was close to 1 (.80).

Conclusions: This is one of the largest studies to explore a specific GD trait in a research-based sample of youth with ASD, ADHD and TD controls. The rate of endorsement of CBCL Item 110 did not significantly differ between ASD and ADHD. This finding is in line with Strang et al.'s (2014) report of clinically-referred youth with ASD and ADHD. The rate in the current controls was consistent with the CBCL non-referred standardization sample (i.e., .7%). It is noteworthy that, among those with this particular GD trait, the vast majority had ASD, and participants with ASD were 3.5 times more likely to have this GD trait than controls. This is consistent with recent findings that a significant proportion of children with GD have ASD (>20%; Leef et al., in preparation). Although this is a large sample, the number of individuals with this GD trait was quite small, making it difficult to conclude whether the link between ASD and GD is unique to ASD compared to other neurodevelopmental conditions. Further analyses will explore associations with other characteristics, including participant sex (i.e., birth-assigned gender), birth weight, repetitive behaviours, and pubertal stage.

227 **213.227** Higher Rates of Gender Diversity in Children with ASD Based on Self-Report, Not Parent Report

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Background: Gender diversity refers to gender experiences that vary from common experiences of gender. One form of gender diversity is gender dysphoria, an incongruence between one's experienced gender and gender assumed at birth. Emerging research suggests an increased proportion of gender diversity in individuals with autism spectrum disorder (ASD), and over-representation of autism among individuals clinically referred for gender diversity and dysphoria. Previous research with youth has predominantly relied on parent-report based on a single parent-report item. Furthermore, the extent to which parent perceptions are consistent with child-report of gender diversity experiences is unknown.
Objectives: The current study compared the endorsement of gender diversity (i.e. dysphoria and agender experiences) in 147 children 10-to-13 years of age with ASD (11.31) and typical development (TD; 11.46). Additionally, parent perceptions of their child's gender diversity was compared between the groups. The prevalence of gender diversity and associations between self-and parent-report measures were investigated.

Methods: The Gender Development Scale Short Report (GDSSR) is a self-report (GDSSR-S) and parent-report (GDSSR-P) measure assessing the broad spectrum of gender-related characteristics in youth (Strang et al., 2017). Using the GDSSR, gender dysphoria and agender GDSSR-S variables were collected on 147 children with high-functioning ASD (N = 94) and TD (N = 53) and GDSSR-P from 122 parents of children with ASD (N = 78) and TD (N = 44). Item-level analysis of Child Behavior Checklist (CBCL) item 110, "Wishes to be the opposite sex" was also collected. Independent sample t-tests were used to compare group differences, Pearson correlations to examine associations, and cross-tab calculations to determine group proportions.

Results: There were significant differences between the groups showing children with ASD endorsing higher rates of experienced gender dysphoria t(145) = -2.63, p = 0.0001 and agender experiences, t(145) = -3.97, p = 0.0001. In contrast, there were no significant differences between the groups for GDSSR-P for gender dysphoria t(122) = -.73, p = 0.47 or agender experiences t(122) = -.52, p = 0.61 or CBCL Item 110 t(121)= -0.86, p = 0.39. Despite a lack of difference in parent reports between diagnostic groups, there were small-to-medium correlations between GDSSR-S and GDSSR-P dysphoria r = .26, p = 0.004; and CBCL Item 110 and GDSSR-S dysphoria r = .39, p = 0.0001 and GDSSR-P dysphoria r = .45, p = 0.0001. Using cross tabulation, the proportion of the ASD sample that reported gender dysphoria based on a strict cut-off of greater than 6 (Goldstein et al., 2017) was 4.3% whereas the TD sample was 0%.

Conclusions: Results extend recent reports showing increased rates of experienced gender diversity in children with ASD albeit based on self-report. There were no significant differences on parent-reports for children with and without ASD. Importantly, not all parents elected to complete the GDSSR-P due to religious or undisclosed reasons. Therefore, under-reporting of gender diversity is plausible. Findings corroborate clinical and research observations and underscore the need to better understand and support the unique and complex needs of children with ASD who experience gender diversity.

228 **213.228** Physical Exercise and Bone Fracture Rates in North American Children with Autism Spectrum Disorder

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Background: Physical exercise has been shown to improve motor skills, physical fitness and social skills in youth with autism. However, children with autism may not exercise as much and have lower bone density than their typically developing peers.
Objectives: The study examined the frequency of physical exercise and bone fracture rates as well as underlying factors in children with Autism Spectrum Disorder (ASD).

Methods: We compared the reported frequency of recent physical exercise activity between children with ASD in the Autism Treatment Network (ATN) sample and national data derived from the National Survey of Children's Health (NSCH). In addition, we compared lifetime bone fracture rates in children with ASD in the ATN sample with relevant prior publications. Furthermore, we examined the contribution of demographic, child, and family (parent) factors on reported frequency of recent physical exercise activity and lifetime prevalence of bone fractures in children with autism.

Results: The results confirmed that the overall distribution of physical exercise rates were significantly different between the ATN and NSCH samples for 6-11 year old males ($p < 0.001$). Compared to the NSCH sample in the male 6-11 year old group, children with autism tended to exercise less often. A similar effect was seen across other age groups and in females, which was not statistically significant. Although the fracture prevalence rate increased by age group, no differences were found between children with autism and the general population.

Conclusions: The findings confirm that 6-11 year old boys with autism exercise less frequently compared to the NSCH sample. Although older children and girls with autism showed decreased frequencies in physical exercise compared to NSCH, the findings did not reach statistical significance. Fracture rates depend on both bone density and nature and frequency of physical activity. Fracture rates for children with autism increased by age group, similar to reported fracture rates in the general population, despite a lower frequency of exercise in children with autism. Demographic, child, and family (parent) factors did not contribute to the findings in a meaningful way. Future studies should include more heterogeneous samples as well as objective measures of physical exercise activity and bone density assessments to better understand predictors of physical exercise and bone fracture rates in this population.

229 **213.229** Identifying Underlying Sources of Distress for Adolescents and Adults with Autism Spectrum Disorders and Other Neurodevelopmental Disabilities

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Background:
Individuals with Autism Spectrum Disorders (ASD) and other Developmental Disabilities (DD) who have low verbal ability often have difficulty communicating their sources of distress, discomfort or frustration. Often times these individuals communicate their needs indirectly through irritability and disruptive behavior. These behaviors can create a substantial barrier in their capacity to access appropriate medical care, participate in their community, and maintain residence with their parents or other caregivers. To address the needs of this population, medical providers must develop facility in translating observable behaviors to appropriate treatment protocols.

Objectives:

The primary objective of the current project is to convert parent and caregiver social capital (i.e. resources and knowledge) into improved behavioral and health outcomes for adolescents and adults with ASD and/or DD with minimal verbal ability. In addition, this project seeks to improve medical provider efficiency via a carefully designed and sequenced delivery of questions that focus on known behaviors associated with specific psychiatric and medical conditions in this population.

Methods:

The current study reports on qualitative data from six focus groups with 14 parents or caregivers of adolescents or adults with ASD and/or DD. Study participants completed an online assessment that was designed to indicate psychiatric or medical conditions using discreet behavioral indicators. The computer adaptive measure was created to follow a branching logic scheme where positive answers lead to expanded questions on specific topics. Our analysis followed a qualitative data methods outlined by Ritchie and Spencer (1994). Atlas.ti (version 5.1) software was used to organize and analyze the focus group data. The data interpretation plan followed several steps. First, we utilized inductive reasoning and the constant comparative method (Strauss & Corbin, 1998) by systematically comparing parent and caregiver statements within and across focus groups. Then, we focused on cross-group saturation in order to identify perspectives that represented community-wide beliefs among parents and caretakers. By analyzing data across the five focus groups, we were able to assess whether the perspectives that emerged from one group also emerged for the others, subsequently serving as a proxy for theoretical sampling in order to assess the meaningfulness of participant perspectives.

Results:

In the current study, all participants reported positive acceptability of the content of the measure. All participants also reported positive acceptability of the time required to complete the measure. Despite consistent positive remarks regarding the existing content, participants indicated a desire to expand content in several categories (e.g. gastrointestinal, self-injurious behavior, dental) and add categories that were not previously included (e.g. gynecological/menstruation).

Conclusions:

The current project documents the development and initial validation of a measure designed to support medical providers in caring for minimally verbal adolescents and adults with ASD and/or DD. This initial study showed positive acceptability for the content and structure of the question algorithm. While efficiency of the measure was a goal in the initial design, focus group participants called for expanded content in several key areas. This feedback has led to more comprehensive coverage of medical and psychiatric considerations that impact individuals with ASD and/or DD.

230 **213.230** Initial Somatic Assessment during the Autism Spectrum Disorder Diagnostic Process : A Systematic Review of International Clinical Guidelines

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Background: Autism Spectrum Disorders (ASD) are neurodevelopmental disorders highly associated with various somatic conditions that can be hidden by core symptoms of ASD and complicate diagnosis.
Objectives: Identifying co-occuring disorders challenges the best effective health and social care in this population and influence the long-term outcome[1,2]. Process of ASD diagnosis have to integrate systematic somatics investigations in order to adjust medical and social supports.

Methods: A systematic review of international clinical guidelines for ASD diagnosis assessment published from 1 January 2005 was performed. Thirteen international guides were selected. We first conducted a quality appraisal selection, according to the Appraisal of Guidelines Research and Evaluation, second edition tool[3]. Then, we performed a comparative analysis of selected documents on the basis of co-occurring somatic disorders investigations process.

Results: Although the international clinical guidelines are heterogenous in quality (methodological score lies between 33 for the American Academy of Pediatrics clinical report[4] and up to almost 100 for National Institute for Health and Care Excellence guideline[5,6]), they share homogeneous content concerning initial somatic assessment. Somatic disorders described in all guidelines are frequent and achieve consensus. In all guidelines, initial diagnosis processes are mainly recommended to be performed by a multidisciplinary team involving pediatric, neuropediatric and genetic specialists. Clinicals examinations appeared to be base for the assessment of somatic conditions in the guidelines. Systematic genetic investigations are recommended by 40% of the guidelines, and metabolic, electroencephalographic or imaging investigations were mostly recommanded when indicated by the presence of warning signs for clinicians.

Conclusions: In accordance with this results, to perform a systematic and comprehensive initial somatic assessment during the ASD diagnostic process, multiple specialists are required and consensuel warning signs must be screened. In order to help clinicians and coordinate between professionals in the process, an « addressing tool » that could be a coordination tool between professionals would be helpfull. This tool may provide support for a systematic screening that can reinforce epidemiological data on somatics co-occurring disorders in ASD.

Keywords : Autism Spectrum Disorder (ASD); Diagnosis; Comorbidity; Co-occuring condition; Somatic assessment; Guideline.

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231 **213.231** Investigating the Relationship between Social Anxiety and Social Insight in Autistic and Neurotypical Adults, Using a Novel Experimental Task.

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Background: Social anxiety is elevated amongst autistic adults. Despite the high prevalence rates, there is limited research exploring the cognitive mechanisms underpinning the development of social anxiety in autistic adults. Recent research has proposed that autistic individuals who show an enhanced awareness of their own social difficulties, termed social insight, may be at an increased risk of developing social anxiety. This enhanced social insight may bring to light the difficulties a person faces during social interactions, thus contributing towards increased anxiety of future social situations where these known difficulties may lead to a failure to interact with others. To date no research has explored the relationship between social insight and social anxiety at either a clinical or subclinical level. This is primarily due to the lack of robust experimental measures of social insight, compared to theory of mind or emotion recognition measures.
Objectives: In the present study, we developed a novel online dynamic video-based experimental task to measure social insight, called the Social Signals Task. Using our novel Social Signals Task, we aim to explore the relationship between social insight and social anxiety in autistic and neurotypical adults who experience varying degrees of social anxiety.

Methods: We employed a mixed experimental design using both cognitive tasks (Social Signals Task, word recognition task) and questionnaires (social anxiety, autistic traits, anxiety, depression, alexithymia and self-esteem). The Social Signals Task consists of 60 videos showing a listener in a conversational dialogue. Participants are asked to judge the non-verbal social cues of the person in the video across three dimensions 1) interest, 2) understanding and 3) agreement. Participants also rate their level of confidence in their response. The Social Signals Task measures an individual's ability to recognise naturalistic social cues, as well as an individual's awareness of their ability to recognise these social cues. A sample of 141 adults (81 autistic adults, $Mean_{age}$ = 39.16) took part in our online study.

Results: We have recently completed data collection for this project. As such, we will conduct analyses at both a group-level and individual-level to examine the relationship between social insight and social anxiety for autistic and neurotypical adults. Correlational analyses, multiple linear regressions and Receiver Operating Curve analysis will be reported and presented.

Conclusions: The present research will have important implications for understanding the cognitive mechanisms associated with social anxiety in autistic and neurotypical adults. Research investigating the impact of social insight in socially anxious autistic adults is important for understanding whether social insight is a distinct mechanism contributing towards the development of social anxiety in this population. This research hopes to inform interventions used to help alleviate symptoms of social anxiety in autistic adults, who often experience increased insight into their own social difficulties.

232 **213.232** Kids Who Are Missed: Parent and Provider Perspectives on the Challenges Identifying Anxiety Difficulties in Youth with ASD within School Setting

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Background: Children with autism spectrum disorder (ASD) tend to experience high rates of co-occurring anxiety disorders that impact their functioning across home and school settings. Identifying co-occurring anxiety symptoms within school settings is critical, and particularly for underserved and diverse youth who may not receive services elsewhere. Currently, little is known about parent and school personnel views regarding challenges tied to identifying anxiety in diverse youth within school settings.

Objectives: This study aimed to understand key stakeholders' (i.e., parents, school personnel) views regarding: 1) children with ASD whose anxiety symptoms tend to be missed; 2) why they perceive that these children are missed; and 3) potential strategies to better identify anxiety in diverse youth with ASD within school settings.

Methods: The present study presents a subset of data from the first phase of a large-scale, community-engaged implementation trial aimed at adapting a group CBT program for youth with ASD and co-occurring anxiety (i.e., Facing Your Fears-FYF; Reaven et al., 2018). A total of 14 focus groups were convened with parents (n=8) and school personnel (n=6) across three underserved school districts. Parents had at least one child with ASD and co-occurring anxiety and school personnel included a range of backgrounds (e.g., special education teachers, speech and language pathologists, school psychologists), but all had experienced working with youth with ASD. The focus group guide included semi-structured questions around identification of children with ASD who show anxiety related difficulties. Focus groups were audio-recorded and transcribed verbatim. Using an inductive, team-based approach, the transcripts were coded and analyzed by a multi-disciplinary team using standard qualitative methodology.

Results: Stakeholders reported that children with ASD have anxiety symptoms that are missed when they are: (1) from diverse backgrounds; (2) within a general education setting, and (3) not attending school due to avoidance. Stakeholders also indicated that children are missed because anxiety related difficulties are misinterpreted by school personnel as behavioral problems, and this misinterpretation might happen more with students of color, as school personnel may attribute anxiety related difficulties to problems in the students' home environment (e.g., living in poor neighborhoods). Additional factors affecting under-identification of anxiety symptoms include: (1) parents' lack of awareness or denial of their child's anxiety symptoms; (2) reluctance to label their child due to mental health stigma, and (3) limited knowledge on how to best advocate for their child. Finally, stakeholders noted that better training in identifying anxiety is needed for school personnel, as well as building families' understanding of mental health needs through family partnerships.

Conclusions: Findings from the present study suggest that a portion of children with ASD who experience anxiety are not identified. The findings highlight the challenges identifying anxiety in diverse youth with ASD, including biases associated with mental health and behavior. Strategies to better identify children with ASD and anxiety related difficulties were also identified. Future research is needed to explore ways to support school staff in identifying anxiety symptoms in children from diverse backgrounds and to support families in anxiety knowledge and mental health stigma.

233 **213.233** Links between Autism Spectrum Disorder and Sleep Difficulties

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Background:

Disturbed sleep is very common among children with ASD and can be conceptualized as a consequence of ASD. However, poor sleep may also influence behavioral or cognitive traits among individual with ASD.

Objectives:

To compare sleep of children with autism spectrum disorder (ASD) with that of typically developing (TD) children and to assess associations of sleep with quantitative measures of ASD-related traits and with intellectual disability.

Methods:

Participants included 151 children with high-functioning ASD and 294 TD children (ages 8-12 years) whose parents completed the Children's Sleep Habits Questionnaire (CSHQ). Multivariable linear regression models were used to: 1) Examine associations between ASD and CSHQ subscales and total CSHQ score, and 2) Examine associations of CSHQ total score with social responsive scale (SRS) total score and the WISC-5 full scale IQ, within both ASD and TD groups. All models were adjusted for age, sex, race, ethnicity, and family socioeconomic status.

Results:

Among children with ASD, 64% reached the CSHQ threshold for a pediatric sleep disorder (score >41) compared to 27% in the TD group (χ^2=56, p<0.00001). After adjusting for potential confounders, ASD was significantly associated with all CSHQ subscales and the total score. Specifically, compared to children with TD, those with ASD exhibited greater bedtime resistance (Beta=1.1), greater delays in sleep onset (Beta=0.5), shorter sleep duration (Beta=0.8), higher sleep anxiety (Beta=1.2), more night wakings (Beta=0.6) and parasomnias (Beta=0.8), greater daytime sleepiness (Beta=2.2), and a higher total score for sleep problems (Beta=6.7) (all p<0.00001). Children with ASD also had 5 times the odds of meeting the clinical threshold for a pediatric sleep disorder (OR = 5.0, p<0.00001). The only sleep item not significantly associated with ASD status was sleep-disordered breathing (Beta=0.1, p=0.4). In both the ASD and TD groups, CSHQ total score was significantly associated with SRS total score (ASD Beta=0.2, p<0.05; TD Beta=0.3, p=0.003). In both the ASD and TD groups, there was no significant association between IQ (WISC-V full scale) and CSHQ total score.

Conclusions:

Compared with TD peers, children with ASD show significantly worse parent-reported sleep problems, including: bedtime resistance, shorter sleep, greater delays in sleep onset, more sleep anxiety and wakings, as well as greater daytime sleepiness. Reports of sleep-disordered breathing did not differ between children with ASD and TD, consistent with previous literature showing low endorsement of sleep-disordered breathing items in ASD samples. We also found significant associations between total CSHQ score and total SRS score within both the ASD and TD groups, suggesting a relationship between sleep health and social-communicative behavior that is not specific to ASD. We did not find any evidence of an association between total CSHQ and IQ in either the ASD or TD group. Further research is needed to examine the role of sleep problems in ASD behaviors, comorbid psychopathology, and medical conditions.

234 **213.234** Links of Comorbid Medical Conditions for Autism Spectrum Disorders between Parents and Their Affected Children

ABSTRACT WITHDRAWN

Background:

Many medical conditions have been reported to co-occur with autism spectrum disorder (ASD) in the same individual. However, it is not well known if these conditions also present in the parents of ASD children and if the parents' conditions are directly associated with the medical conditions in their children. Given the prevailing broad autistic phenotypes in the parents of ASD children, we hypothesize that there is a shared etiology between ASD and some of its comorbid medical conditions, which links these conditions across generations in families with ASD-affected individuals.

Objectives:

To investigate if comorbid medical conditions in ASD-affected individuals could be attributed to the conditions in their fathers and/or mothers.

Methods:

From the Manitoba Population Research Data Repositoryin Canada, we identified all the ASD-affected individuals who were born between April 1979 and March 2010 and had the universal health care coverage for at least five years since birth. The ASD-affected individuals were matched with up to six controls using the propensity score method. An individual was regarded as an ASD case if he/she had at least two hospital and/or medical claims for ASD (based on the International Classification of Diseases, 9thedition code 299) after age two and at least one of the claims was made by a paediatrician or psychiatrist.

Information about the medical conditions, which affect the gastrointestinal, mental health, and neurological systems, was also collected from the Data Repository. Generalized linear mixed models were used to identify the ASD-associated medical conditions using the cases and their matched controls. Logistic regression was performed to estimate the contribution from the parents to the occurrence of the medical condition in the ASD-affected individuals.

Results:

After quality control, 1,933 ASD-affected individuals, 11,390 matched controls, and their parents were selected. Of the 100 medical conditions from the three disease categories, 30 had a prevalence ≥1% in either the ASD-affected individuals or their matched controls. Of these, 22 conditions were significantly associated with the increased ASD risk ($p<0.0016$ after Bonferroni correction for 30 multiple comparisons).

Five of the 22 medical conditions in the ASD cases could be attributed to one or both parents (all $p<0.001$): episodic mood disorders (ICD9 code 296 –mothers), anxiety, dissociative and somatoform disorders (ICD9 code 300 –mothers), depressive disorder, not elsewhere classified (ICD9 code 311 –mothers), and hyperkinetic syndrome of childhood (ICD9 code 314 –both parents), and functional digestive disorders, not elsewhere classified (ICD9 code 564 –both parents). The estimated effects (odds ratios) ranged from 1.93 to 3.45 for the mothers and from 1.59 to 5.42 for the fathers. Similar findings were obtained when our analyses focused on the parents' medical conditions before the birth of their first child and when the parents of the cases were compared to the parents of the controls.

Conclusions:

Our preliminary results show that some of the comorbid medical conditions in ASD-affected individuals could be linked to their parents' conditions, which suggests that genetic and/or environmental factors shared between parents and children may cause the occurrence of comorbid medical conditions in ASD-affected individuals.

235 **213.235** Loneliness Mediates the Association between Friendship, Autism Symptoms, and Mental Health in Young Adults with Autism

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Background: Mental health concerns are often tied to social experiences; psychological health can be supported by friendship and deteriorated by loneliness. Core challenges of Autism Spectrum Disorder (ASD) may hinder the development and maintenance of friendships, and, in turn, elicit loneliness and poor mental health. Few studies, however, have explored these associations. In adults with ASD, one study found that loneliness and friendship each explained unique variance in anxiety and depression (Mazurek, 2014). Another study identified a mediating role of social connectedness and loneliness in the association between the Broader Autism Phenotype (BAP) and internalizing symptoms among typically developing young adults (Stice & Lavner, 2018).

Objectives: The current study sought to replicate and extend these findings in a sample of young adults with ASD, and more specifically, test the mediating role of loneliness in the associations between 1) friendship and mental health and 2) ASD symptoms and mental health (Figure 1).

Methods: Fifty-two young adults with ASD completed a battery of questionnaires assessing social and emotional functioning as part of a larger study of the PEERS® intervention; pre-intervention data was used in the present analyses. ASD was confirmed using the ADOS-G (Lord et al., 2000). Measures included in the current study were the Friendship Questionnaire (FQ), the Social Phobia Inventory (SPIN), the Autism Quotient (AQ), the Beck Depression Inventory (BDI), and the Social and Emotional Loneliness Scale for Adults (SELSA). Analyses in MPlus Version 7.4 involved composite scores on the SPIN, AQ, and BDI, an item on the FQ on number of get-togethers, and the social loneliness subscale of the SELSA.

Results: A series of path analyses were used to test the hypothesized model for each anxiety and depression (Figure 1). Friendship (*b*=-0.47,

p=0.01) and autism symptoms (*b*=0.27, *p*=0.03) explained unique variance in social loneliness. Loneliness was a significant predictor of anxiety (*b*=0.53, *p*=0.00) and depression (*b*=0.50, *p*=0.00), controlling for the effect of friendship and autism symptoms (both *ns*). Results also indicated that there were indirect effects of friendship (anxiety: *b*=-0.25, *p*=0.01; depression: *b*=-0.23, *p*=0.02) and autism symptoms (anxiety: *b*=0.14, *p*=0.05; depression *b*=0.14, *p*=0.07) on mental health through loneliness. All direct and indirect effects were significant, except the marginally significant indirect effect of friendship on depression through loneliness.

Conclusions: Findings of the present study suggest that loneliness may be a vulnerability factor for mental health concerns among young adults with ASD. Based on the current analyses, loneliness may stem from a combination of core autism symptoms as well as secondary effects of autism, namely, less social contact. While these effects are likely related, they appear to contribute independently to loneliness. Moreover, in contrast to previous results in ASD and in parallel with findings on the BAP, the current study did not identify friendship and loneliness as independent predictors of mental health concerns, but instead found a mediational pathway. Thus, the current study highlights that loneliness is a core contributor of mental health concerns in ASD, which may be ameliorated by improving social challenges and facilitating the development of meaningful friendships.

236 **213.236** Medical and Physical Health in Children with Intellectual Disability of Genetic Aetiology with and without ASD

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Background: Intellectual disability (ID) is characterised by limited cognitive ability and adaptive behaviour. Children with ID of genomic origin have an excess of physical health problems, but little is known about the quality and severity of medical complications in those with an associated Autism Spectrum Disorder.
IMAGINE-ID is a national UK study of over 3000 children with ID of known genetic origin (CNV or SNV). Here, we present preliminary data on the frequency of physical health difficulties of a subset of children with and without ASD.

Objectives: To ascertain whether the range and severity of physical health problems is different in children with ID/ASD of genetic origin from those without associated ASD. To compare the genetic aetiology of physical health difficulties in these groups.

Methods: Caregivers of 209 participants (aged 4-18) completed the Development and Wellbeing Assessment (DAWBA) and a comprehensive Medical Questionnaire online (62.2% had a CNV and 37.8% an SNV). Diagnoses of ASD were made by experienced clinicians, based on the DAWBA standardized interview, which has been validated by ADI/ADOS algorithms. A standardized Medical Questionnaire was administered to record medical history, current physical health and developmental milestones.

Results: Most participants had moderate to severe ID**.** 44.5% met diagnostic criteria for ASD, 62.4% of whom were male (53.4% of non-ASD). Mean age was 9.36 (SD 4, range 4-18) years. There were no significant group differences in chronological, developmental or language age between those with and without ASD. Children with ASD had more stomach and/or gut problems (46.2% vs 29.3%, p = .035), sleep difficulties (75.3% vs 57.8%, p = .006) and food and/or eating problems (60.2% vs 39.7%, p = .007) than those with ID alone. ASD was also associated with extreme food rituals, habits or preferences (50% vs 26.1%, p = .016).

Eye problems were more frequently associated with SNVs than CNVs (66.2% vs 50%, p = .024), as were muscle or movement difficulties (79.7% vs 56.6%, p = .003), seizures (39.2% vs 18.9%, p = .005), genital problems (23% vs 11.5%, p = .025) and bone or skeletal difficulties (29.7% vs 14.8%, p = .036). A higher proportion of SNV-carriers (48.6%) than CNV-carriers (43.4%) met criteria for an ASD, but the difference was not statistically significant.

Conclusions: Our findings indicate that high rates of physical health problems are associated with ID caused by a pathogenic CNV or SNV. Children with ID of genetic origin with associated ASD are at much higher risk of gastrointestinal problems, disturbed sleep patterns and eating difficulties than those with ID alone. Regardless of ASD diagnostic status, children with SNVs are at an enhanced risk of physical health difficulties, including muscle/movement difficulties, bone/skeletal difficulties and genital problems compared to children with CNVs. Children with SNVs had twice the risk of developing seizures compared to those with pathogenic CNVs. Recent findings by others have identified a higher proportion of pathogenic SNVs than CNVs among families with an epileptic child (Tsuchida et al., 2018).

237 **213.237** Parental Perspectives on Psychiatric Comorbidities in 989 Preschoolers with Autism Spectrum Disorder: Findings from an Italian Multi-Centric Study

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Background: An increased prevalence of psychiatric comorbidity (PC) in individuals with Autism Spectrum Disorders (ASD) is consistently reported and it is associated with a poorer prognosis and with a great psychological distress in families. While several studies have examined PC in school-aged children, adolescents and adults with ASD, investigations on PC in preschoolers are lacking. The difficulty to find properly and easy-to-use diagnostic tools to detect PC in ASD preschoolers could contribute to the relatively sparse studies in this area.
Objectives: We explore the prevalence and type of PC in a wide sample of ASD preschoolers through the DSM-Oriented Scales (DOS) of the Child Behaviour Checklist (CBCL 1.5-5) and their possible links with the core features of ASD and cognitive functioning. The role of the psychiatric Multi-Comorbidity was also discussed.

Methods: The sample included 989 ASD preschoolers (age-range: 16-75 months; M: 44.0 months; SD: 13.8 months) recruited by three different Italian care centers for children. These children were selected among individuals who received a diagnosis of ASD based on DSM 5 criteria. Included subjects were assessed using ADOS (ADOS-G or ADOS-2) and a standardized cognitive evaluation (LIPS-R, GMDS-ER or WPPSI tests) while their mothers completed the CBCL 1.5-5. The severity of autism was measured through the Calibrated Severity Score based on ADOS Total score and Social Affect (SA) and Restricted Repetitive Behaviors (RRB) sub-scores. The borderline and clinical DSM-Oriented Scales (DOS) scores of CBCL

1.5-5 were used to explore psychiatric comorbidity.

Results: About 37.8% of the sample had at least one PC in addition to ASD; these subjects displayed significantly higher Total score (p=0.02) and Social Affect score (p=0.003) on the ADOS-based calibrated severity scores (CSS), as well as lower (p=<0.0001) performance IQ (pIQ) compared to ASD individuals without PC. As far as the specific DOS, Affective Problems (AP) were detected in 23.4% of the whole sample, ADHD Problems (ADHD) in 17.3%, Anxiety Problems (ANXP) in 16.7%, and Oppositional Problems (OP) in 7.9%. These different comorbidities were isolated in 195 subjects (Mono-Comorbid group: 19.7% of the whole sample), while 179 subjects (18.1% of the whole sample) had two or more types of PC (Multi-Comorbid group). One-way ANOVA revealed that the Multi-Comorbid group had statistically significant lower pIQ and higher Total score and Social Affect score on CSS-ADOS. The 10% of total sample had relevant sleep problems.

Conclusions: This study suggests that in people with ASD, PC occur early in life worsening ASD symptoms and cognitive functioning necessitating the need for their early detection in order to plan tailored interventions. The use of parental questionnaires as screening tools to investigate PC could anticipate the individuation of psychiatric symptoms different from autism, contributing in diminishing the consistent risk for mis- or under-diagnosis PC in young children with "ASD and PC".

238 **213.238** Parents' Perspectives of Physical Activity Participation Among Adolescents with Autism Spectrum Disorder

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Background: Adolescents with Autism Spectrum Disorder (ASD) are less likely to be physically active compared to their age-related peers. Given that adolescents with ASD become even less active during adolescence, they are at higher risk of developing debilitating health conditions. As such, they are more likely to develop obesity, cardiovascular disease, diabetes, musculoskeletal disorders, anxiety, and depression due in part to lower levels of physical activity. Given these potential health challenges among adolescents with ASD, there is a need to examine how to potentially enhance physical activity participation.

Objectives: Despite the health and social benefits of participation, little is known why they are predominantly physically inactive. Furthermore, there is a paucity of research that has examined the psychological, social, personal and structural mechanisms that influence their participation. With no previous research in Canada, this study examined parents' perspectives and experiences of physical activity participation to examine the barriers and facilitators of participation.

Methods: Ten in-depth interviews were conducted with parents of adolescents with ASD. Interviews were analyzed thematically.

Results: Findings suggest that parents prioritized behavioural and communication interventions over physical activity throughout their adolescent's life. This prioritization was most pronounced during childhood, and the lack of participation during their formative years shaped physical activity interests in adolescence. Second, parents also described experiencing systemic challenges when accessing physical activity programs, including a lack of awareness of ASD among service providers, funding challenges, and limited/few program options. Third, the lack of physical activity individualization and competing commitments contributed to tremendous strain on families. Fourth, the findings suggest early guidance is needed to help parents balance family life, schooling, and therapies with physical activity, as this may improve physical health and facilitate social development with peers.

Conclusions: The study suggests that a family-centred, multidisciplinary collaborative approach that includes health care practitioners such as physical therapists can potentially be used to facilitate the incorporation of physical activity into everyday life. Policy and community efforts are required to break down systemic barriers, along with training community service providers about ASD to potentially enhance participation.

239 **213.239** How Should We Talk about Obesity and Weight-Related Topics with Children with Autism Spectrum Disorders and Their Families?

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Background: Obesity is a global health concern and can significantly impact the physical and psycho-social health of children. Children with Autism Spectrum Disorder (ASD) appear to be at a higher risk of having obesity than their typically developing peers. Although it has been recommended that health care providers (HCPs) speak to families about the potential health risks of unhealthy weight in ASD, no previous research has explored exactly how HCPs communicate with children with ASD and their families about this topic.

Objectives: To explore the experiences of children with ASD, their families and HCPs when discussing weight-related topics in healthcare consultations.

Methods: Individual, in-depth qualitative interviews were conducted with children with ASD aged 10-18 years with verbal fluency who were attending a tertiary psycho-pharmacology clinic and whose Body Mass Index was greater than the 85th percentile. Their parents were also invited to take part in a separate interview, as were all HCPs who worked in the clinic. Thematic analysis using an interpretive phenomenological approach was used to analyze the verbatim transcripts. Themes were analyzed and discussed by the whole team comprising multi-disciplinary HCPs, researchers and a parent of two children with ASD.

Results: Eight children with ASD, eight parents, and five HCPs were interviewed. Three main themes were identified: 1) Layers of complexity: Weight and health issues were complicated by a combination of medication side-effects, social dynamics within the home, and overall quality of life considerations. Narratives of 'the lazy child' and 'non-compliant parent' were strongly rejected; 2) Uncertainties of communication: Clinicians were often hesitant to start weight-related conversations when families came to see them for other issues. Others worried what impact such a discussion would have on the therapeutic relationship with the families. Parents wanted HCPs to raise the topic early, but were frustrated when realistic solutions were not offered; 3) Wellness over weight: Parents, children and HCPs all identified a need to move from predominantly focusing on a child's weight, and instead promoting overall wellness throughout the life course. Overall recommendations included:

Acknowledging the complexity of the situation; Engaging child in the discussion where possible; Using clear visuals and examples; Establishing a trusting relationship with the family; Using a strengths-based approach.

Conclusions: Children, caregivers and HCPs all recognized the potential short and long-term health risks of overweight/obesity, and identified a need to work collaboratively to positively impact the health status of children. Tools are needed to help HCPs foster positive conversations about weight-related topics and lifelong wellness.

240 **213.240** Physical Health of Autistic Adults

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Background:

Currently, there are very few large-scale studies of physical health of autistic adults, despite evidence that autistic individuals have increased risk of premature mortality (Hirvikoski et al 2016; Pickett et al 2006). Previous research has found a higher health burden among autistic individuals in general, and specifically for neurological, psychiatric, gastrointestinal, muscular, metabolic, sleep, immune, and endocrine conditions (Croen et al 2015; Davignon et al 2018; Diallo et al 2017; Kohane et al 2012). In addition, it has been suggested that autistic females may be at even higher risk for medical comorbidities than autistic males (Croen et al 2015). Unfortunately, nearly all existing studies fail to sample autistic adults over the age of 35 years.

Objectives:

To identify common physical health comorbidities of autistic adults over the age of 35, and to determine if a sex bias exists regarding physical health conditions within this population.

Methods:

We developed an anonymous, online physical health survey via Qualtrics that inquired about demographics, lifestyle choices/ daily habits, personal medical history, and family medical history for first-degree biological relatives. As the survey attempted to be comprehensive regarding physical health conditions, it contained 512 questions on over 161 medical conditions and lifestyle choices, though it used a tiered structure to avoid survey fatigue. The survey was administered to individuals over the age of 16 years and individuals were asked to self-report any previous autism diagnosis. The AQ-10 was administered to individuals who did not report an autism diagnosis (henceforth 'controls') and individuals with an AQ score ≥6 were excluded. Participants included n=642 autistic individuals and n=361 controls, comprising a total of n=1,003 individuals. The mean age across both groups was approximately 43 years and there was a strong bias towards females, UK residents, and white individuals. Recruitment is ongoing, with efforts to recruit under-sampled demographics.

Results:

We conducted sex-stratified Fisher's exact tests to determine the prevalence of four non-communicable diseases identified by the WHO as accounting for nearly 70% of worldwide mortality (cancer, cardiovascular conditions, respiratory conditions, diabetes). Autistic females were significantly more likely to have respiratory conditions (OR: 1.92; p-value: 0.0015; FDR: 0.0059), with additional trends toward significance for both diabetes (OR: 1.65; p-value: 0.086; FDR: 0.114) and cardiovascular conditions (OR: 1.47; p-value: 0.060; FDR: 0.114), as compared with control females.

Conclusions:

The results suggest that autistic females may be at greater risk of non-communicable diseases than others, particularly for respiratory conditions. These results confirm previous findings; however, it is essential to conduct additional studies in larger samples and with more representative populations. As we are still recruiting participants for this study, we hope to recruit a total sample size of 4,200 individuals, with a greater number of controls in particular.

241 **213.241** Predicting Anxiety from Developmental Trajectories of Temperament in Children at Risk for Autism Spectrum Disorder: The Role of Reactivity and Regulation

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Background: The mechanisms underlying heightened levels of co-occurring anxiety in children and adolescents with ASD have been poorly understood. Evidence suggests that interplay between temperamental reactivity (behavioural inhibition; BI) and regulation (effortful control; EC) in the early years of life plays a substantial role in anxiety problems in the general population. Determining whether anxiety traits in ASD are underpinned by the same developmental mechanisms in the context of a cohort at familial risk for ASD as anxiety in the general population is important because it may impact on appropriate treatment strategies.

Objectives: To investigate this, we used structural equation modelling to (1) assess whether higher levels of BI predicts anxiety; (2) examine how BI and EC interrelate over the first two years of life and how this interrelation associates with later anxiety and ASD (Figure 1); also we used mediation analyses to (4) probe the relationship between BI, EC (24 months), and later anxiety/ASD (36 months).

Methods: The sample in this study includes 116 high-risk (due to having an older sibling with ASD) and 27 low-risk (due to having no family members with ASD) children. Parent-report measures used to measure temperament (9, 15 and 24 months), anxiety and ASD traits (36 months).

Results: Successful EC at 15 months was associated with lower levels of BI at 24 months and both lower levels of BI and higher levels of EC at 24 months were related to less anxiety as well as ASD traits at 36 months (Figure 1). Exploratory mediation analyses also showed that BI was more strongly associated with anxiety whereas EC more strongly related to ASD symptoms.

Conclusions: The findings suggest that BI may be an early predictor of later anxiety in children at high and low risk of ASD, and that lower levels of EC in children who later develop ASD may contribute to the higher expression of anxiety within this population.

242 **213.242** Predicting Response to Sleep Aids Using Genetic and Comorbidity Data

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Background:

Individuals with autism spectrum disorder (ASD) are significantly more likely to endorse challenges with sleep than their peers. In the setting of ASD, sleep has been found to modulate numerous other comorbidities, such as causing flares in aggressivity and anxiety. The symptom-burden of individuals with ASD and the challenges for caretakers can increase significantly if relief from sleep challenges is not found. Despite our increasing understanding of medical factors influencing sleep in ASD, a recent analysis was could only explain~19% of the variance in sleep dysfunction using environmental and medical comorbidity factors. Additionally, while many studies incorporate drug-usage features, to our knowledge, no study has modeled risk factors influencing sleep-associated drug response.

Objectives:

To begin to address these shortcomings, we (1) estimated the heritability of sleep dysfunction in ASD, and (2) performed a comorbidity analysis of sleep-associated drug-response.

Methods:

The foundation of this proposal is an unpublished dataset we generated by re-contacting 5,686 families enrolled in the SPARK genetic study of ASD. SPARK is the largest study of its kind, with whole exome sequencing, genotypes, and medical comorbidity data recently released (November 2018) on over 27,000 individuals. Our unpublished dataset expands the SPARK medical comorbidity data to include quantitative measure of sleep dysfunction (CSHQ; children's sleep habits questionnaire) and questions regarding drug-response to five major classes of drugs used to treat sleep dysfunction in ASD (melatonin, antihistamines, non-benzodiazepines, antidepressants, PM-variant over the counter (OTC) medicines).

Results:

Within our dataset, ~50% of individuals reported sleeping issues, with a further 14% not finding relief of their sleep symptoms through any medicines they tried. Interestingly, we found that melatonin and antidepressant sleep-associated drug response could be significantly modeled using medical comorbidity data (P < 5.6E-06 & 4.4E-02, respectively). These outcomes were influenced by a range of comorbid diagnoses, such as schizophrenia, intellectual disability, and blindness. Through modeling sleep dysfunction, we found a significant SNP-based heritability for the CSHQ score in our cohort (h2 = 0.26; S.E. = 0.15), suggesting that polygenic, common variant risk influences sleep dysfunction in ASD.

Conclusions:

From our analysis of the largest genetic sleep cohort of ASD to date, we find significant evidence for the SNP-based heritability of sleep traits in ASD. Further, by modeling the success of leading therapeutic options for sleep dysfunction in ASD, we gain valuable insights into the ideal medical profile of individuals taking either melatonin or antidepressants to alleviate their sleeping issues. Going forward, this dataset will be used to model the polygenic risk profiles of traits influencing sleep dysfunction and drug response, bringing a novel genetic-based approach to comorbidity analyses. These findings advance our understanding of the etiology of sleep dysfunction in ASD, and provide an early glimpse of factors which could be leveraged in a personalized-medicine treatment strategy for sleep dysfunction.

243 **213.243** Predictors of Psychiatric Hospital Readmission for Children and Adolescents with Autism Spectrum Disorder

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Background:

Previous research has shown that children and adolescents with ASD have higher rates of inpatient psychiatric hospitalizations than children with intellectual disability or other psychiatric diagnoses, and youth with ASD have longer psychiatric hospital stays on average. Though recent studies suggest that specialized inpatient units may produce positive treatment outcomes for serious behavioral problems in children and adolescents with ASD, readmissions remain a problem and contribute to the ongoing shortage of adequate psychiatric beds for this population.

Objectives:

To examine the demographic and clinical predictors of short-term hospital readmissions after an inpatient stay in a specialized inpatient psychiatry unit.

Methods:

Participants were selected from the Autism Inpatient Collection (AIC): a multi-site study enrolling children and adolescents admitted to six specialized psychiatric inpatient units. Data include demographic information, medical and psychiatric histories, parent rating scales at time of admission, discharge, and 2 months after discharge, direct assessments performed on the participants during stay, and repeated measures for those who are readmitted. The sample (n = 236; 79% male; mean age = 12.9) was divided to compare differences between participants who were re-hospitalized within 2 months of discharge(n = 59) and those who were not (n = 177). A multiple logistic regression model was applied to examine the relative contribution of different demographic and clinical factors to the likelihood of being readmitted.

Results:

No differences were found among the demographic characteristics of the two groups (age, gender, IQ, minimally verbal status, adaptive functioning, severity of autism symptoms, caregivers' marital status, place of residence). Re-hospitalized participants had significantly more lifetime psychiatric hospitalizations (t (226) = 3.18, p = 0.002). At time of discharge, re-hospitalized participants had higher ABC-Irritability scores (t(198) = 1.9, p = 0.05) and ABC-Hyperactivity scores (t(195) = 2.1, p = 0.047). No differences were found in the type of psychiatric diagnoses given at discharge, nor number of psychotropic medications, but re-hospitalized participants had more psychiatric diagnoses overall (t(234) = 2.6, p = 0.01). A logistic regression model revealed that the total number of psychiatric diagnoses at discharge (OR = 1.66, p = 0.013) and previous psychiatric hospital admissions (OR = 1.15 , p = 0.014) independently predicted the likelihood of being re-hospitalized within 2 months of discharge.

Conclusions:

Results indicate that approximately 25% of participants admitted to one of six specialized inpatient psychiatry units across the country were re-hospitalized within 2 months of discharge. Re-hospitalized participants had a higher number of lifetime psychiatric hospitalizations, more

psychiatric diagnoses at discharge, and higher irritability and hyperactivity scores at discharge. An improved understanding of patients at risk for short-term readmissions could help guide providers to better individualize plans for discharge and follow-up care, and, in turn, lead to a reduction in short-term readmissions. Further research is needed to better understand the needs of this subset of individuals and how to promote improved outcomes.

244 **213.244** Psychiatric Comorbidities in Children with Autism Spectrum Disorder and Intellectual Disability

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Background: Intellectual disability (ID) is characterised by significant limitations in cognitive functioning, adaptive behaviour, and with significant behavioural difficulties or mental health problems. IMAGINE-ID is a UK national cohort study exploring psychiatric risk in children with ID of known genetic aetiology (CNV and SNV).
Objectives: IMAGINE-ID is a genotype-first study of psychiatric risk. We conducted deep-phenotyping, subsequent to the identification of pathogenic CNV or SNV as a cause of developmental delay. Our objective was to assess the prevalence of ASD in an ID cohort identified through NHS genotyping, and to contrast psychiatric comorbidities in those with and without ASD.

Methods: 2,381 children with ID of known genetic aetiology, confirmed by microarray, have been recruited from UK Regional Genetic Centres. Caregivers completed a standardised psychiatric and developmental history interview (the Development and Wellbeing Assessment - DAWBA). The DAWBA generates probability scores for DSM-5 diagnoses, which are then validated by clinical review. Additional measures include the Strengths and Difficulties Questionnaire (SDQ; child emotional and behavioural adjustment); and the Everyday Feelings Questionnaire (EFQ; parental emotional wellbeing). All measures have been used in national UK studies of child mental health. 1,850 assessments have been completed and 1,049 have been rated by clinicians to date. Mean age of cohort was 9.21 (SD 3.87, range 4-18 years).

Results: Overall, 39% met criteria for ASD, with no significant differences in age, mental age or language ability between children with and without ASD. There was a significant gender bias in children with ASD than without (males predominated; 62.5%, $p<0.01$). Children with ASD were significantly more likely to meet DSM-5 criteria for any additional psychiatric disorder than children without ASD (44% vs 27%, $p<.001$): with a significantly higher prevalence of Attention-Deficit/Hyperactivity Disorder (ADHD; 28% vs 17%, $p<0.001$), Oppositional Defiant Disorder (ODD; 17% vs 5%, $p<0.001$), Anxiety Disorders (15% vs 8%, $p<0.001$) and Tic Disorders (5% vs 1.7%, $p<0.005$). There were no significant prevalence differences between the groups in terms of Obsessive Compulsive Disorder, Depression or Conduct Disorder.

Within-group comparisons on the basis of SDQ total scores showed that emotional and behavioural problems were significantly more severe in children with ASD than those without ($p<0.001$). A comparison with national UK population data showed that 41% of those with ASD had scores above the 95th centile in total SDQ score. EFQ scores were significantly higher in caregivers of children with ASD ($p<0.001$) than in families whose child had ID alone.

Conclusions: A high proportion of children with ID of genetic aetiology meet DSM-5 criteria for an ASD, irrespective of the specific CNV or SNV. Compared with children whose ID is not associated with ASD, and who are of equivalent mental age, there is an excess of specific psychiatric comorbidities, including ADHD, ODD, Anxiety Disorders and Tic Disorders. Parents of children with ID of known genetic origin that is associated with ASD have an enhanced risk of stress-related disorders of mood and feelings, and their parents have an enhanced risk of stress-related disorders of mood and feelings.

245 **213.245** Psychopathological Comorbidity in Children with Autism Spectrum Disorder: The Executive Function Mediator

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Background: Autism spectrum disorder (ASD) presents high prevalence of psychiatric disorders which worsen ASD core symptoms, and these disorders are associated with different components of executive function (EF). Previous studies articulate just one or two commodities in children with ASD. However, it is unclear which comorbidities are related to worsening ASD core symptoms in the system of various psychiatric disorders and the basis of the EF components remains unknown for these relationships.
Objectives: The study aimed to identify which psychiatric disorders worsen ASD core symptoms and examine the role of daily EF in comorbid psychopathology in children with ASD.

Methods: The present study analyzed 100 children with ASD (79 males, age: M=10.6 SD=1.6 years) and 180 typically developing (TD) children (94 males, age: M=10.4 SD=1.3 years). Achenbach's Child Behavior Checklist (CBCL), Behavior Rating Inventory of Executive Function (BRIEF) and Social Responsiveness Scale (SRS) were applied for assessing parent-reported comorbid psychopathologies (affective disorder, anxiety disorder, somatic disorder, attention deficit/hyperactive disorder-ADHD, oppositional defiant disorder-ODD, conduct disorder-CD), EF (including two systems: behavioral regulation index, BRI; metacognition index, MI), and ASD core symptoms (social interaction and communication, SIC; repetitive restricted behaviors; RRB), respectively.

Results: The present study found that there were three psychopathological comorbidities (affective disorder, anxiety disorder, and ADHD) independently related to worsening ASD core symptoms, and observed full mediating effect of different EF systems in multivariate models. After controlling for the two other disorder domains, 1) affective disorder damaging SIC related to MI (indirect effect size=0.31, 95%CI= 0.11, 0.54); 2) anxiety disorder was mediated by BRI to worsen SIC (indirect effect size=0.42, 95%= 0.21, 0.69) and RRB (indirect effect size=0.42, 95%CI=0.21, 0.67); 3) ADHD was mediated by both EF systems (BRI, indirect effect size=0.26, 95%CI=0.09, 0.48; MI, indirect effect size=0.21, 95%CI=0.06, 0.40) to aggravate SIC and by BRI (indirect effect size=0.39, 95%CI=0.18, 0.65) to deteriorate RRB. In the meantime, the relationship between pathopsychological symptoms and the core symptoms of ASD was not full mediated by EF in TD children.

Conclusions: Our findings suggest that comorbid with affective disorder, anxiety disorder, and/or ADHD will worsen ASD core symptoms, in which association different EF components play a diverse mediating effect. Our study sheds light on the behavioral mechanism underlying to comorbid psychology in children with ASD.

246 **213.246** Relationships Among Restricted Interests and Repetitive Behaviors, Internalizing and Externalizing Symptoms, and Oral Language in ASD

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Background: Up to 72% of children with autism spectrum disorder (ASD) have at least one comorbid internalizing (e.g., anxiety) or externalizing (e.g., ADHD) disorder. Varying oral language abilities are related to different comorbid psychiatric symptoms. However, little is known about how oral language relates to restricted interests and repetitive behaviors (RRBs) and comorbid internalizing or externalizing symptoms. Even less is known about how different *types* of RRBs (i.e., "insistence on sameness" [IS] and "repetitive and sensorimotor behaviors" [RSM]) impact symptom manifestation. Understanding interactions between these RRBs and comorbid internalizing and externalizing symptoms may elucidate clinical presentation and inform more effective ASD interventions.

Objectives: To examine how oral language affects relationships between specific RRBs, internalizing and externalizing symptoms.

Methods: Data were analyzed from a subsample of children in Phase 1 Simons Variations in Individuals Project (Simons VIP) (52% male; ages 6-18 years old) who had 16p11.2 deletions/duplications or 1q21.1 deletions/duplications + ASD (*N*=90). Two types of RRBs (RSM, IS) were measured using the *Behavior and Sensory Interests Questionnaire* (BSI). Oral language was measured via the *Comprehensive Assessment of Spoken Language* (CASL), and caregiver-reported internalizing (INT) and externalizing (EXT) symptoms were measured with the *Child Behavior Checklist* (CBCL/6-18). CASL oral language ability was examined as a potential moderator of RSM and IS with INT and EXT, respectively.

Results: Overall, BSI RSM scores were in the higher range (*M*=9.66, *SD*=8.62), while BSI IS scores were in the lower range (*M*=5.50, *SD*=6.20) compared to scores in the validation study. Mean CASL core composite standard scores were in the lower borderline range (*M*=74.19, *SD*=17.21). Mean CBCL T-scores were in the average range for INT (*M*=56.45, *SD*=10.78) and elevated for EXT (*M*=61.26, *SD*=10.60). Four multiple regression models were estimated using BSI scores (IS, RSM) as predictors of INT and EXT scores, respectively. CASL scores were included as potential moderators. In the two multiple regression models for INT scores, results were significant for both types of RRBs: RSM: R^2=.100, F (3,86)=3.19, p=.03; IS: R^2=.09, F (3,86)=2.89, p=.04. For EXT scores, regression model results were not significant. RSM predicted INT (β=.29, p<.01) and EXT (β=.23, p=.04). IS scores predicted INT (β=.27, p<.01) but not EXT (β=.21, p=.06). CASL scores did not moderate the relations of RSM and IS with EXT and INT, respectively.

Conclusions: Findings revealed that both types of RRBs predicted internalizing symptoms in children with ASD. Children with high RSM had more internalizing *and* externalizing symptoms; however, IS predicted only internalizing symptoms. Contrary to our hypothesis, children's oral language ability did not moderate the association between RRBs and either internalizing or externalizing symptoms. It is possible that this relates to the overall low oral language ability in our relatively small sample. However, findings are nuanced, and the forthcoming examination of specific types of internalizing (anxious/depressed, withdrawn, somatic complaints) and externalizing symptoms (rule-breaking, aggressive behaviors) or of facets (index scores) of oral language ability will provide further information about relationships between these domains. Additional analyses will also examine these relationships between the duplication+ASD and deletion+ASD groups.

247 **213.247** Self-Injury in Autism: Predictors, Perceptions, and Links to Suicidality

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Background:

Self-injurious behaviours (SIB), such as cutting or burning, are closely related to mental ill-health and suicidality [1]. One preliminary study (Maddox et al., 2017) suggests that autistic people without intellectual impairment, the group who are at highest risk of suicidality, are a high-risk group for self-injury, too. These individuals engage in SIB in a qualitatively different way than autistic people with intellectual impairment, a way that shares many features in common with non-autistic people. Unfortunately, despite the links between SIB and suicidality in the non-autistic population and the increased risk of both in autistic people, understanding of self-injury and its relation to suicidality in this subgroup of the spectrum remains very limited.

Objectives:

We attempted to expand on this previous work by a) corroborating the previous description of autistic SIB with a bigger sample; b) exploring predictive factors for self-injury, and factors predictive of self-injury for specific functional goals; c) qualitatively exploring how autistic people perceive their self-injury and what helps them control or overcome it; d) and, in a second follow-up study, exploring relationships between self-injury and suicide ideation or attempts.

Methods:

One hundred and three (n = 103) autistic participants were recruited for this online study from the Cambridge Autism Research Database (CARD) and from advertising on social media. Participants completed the Non-Suicidal Self-Injury Assessment Tool (NSSI-AT[5]) and were classified as current, historic or non-self-harmers. In a theory-driven approach, a number of variables were of interest led by the literature on SIB in autistic and non-autistic people, and therefore participants completed measures of alexithymia, anxiety, depression, mentalizing, autistic traits, and sensory experiences. In a follow-up study we asked participants to complete the Suicide Behaviours Questionnaire-Revised.

Results:

Our data corroborated many of the features and reasons for SIB as described in Maddox et al., but multinomial regression furthermore revealed that alexithymia and sensory-sensitivity significantly predicted the self-injury status of participants. Alexithymia was the only variable to predict SIB for any of the functional roles delineated by the NSSI-AT, specifically predicting SIB engaged in for regulating high energy states (e.g. agitation, anger) and communicative purposes. An interesting dichotomy emerged in the qualitative data between those distressed by their SIB and those who viewed it methodically as a tool (for instance, "to achieve homeostasis"). However, whereas current and historic self-harmers were significantly more likely to endorse statements indicating suicide ideation and attempts, there was no relationship between the distress participants felt at self-harming and their responses to the suicidality questionnaire.

Conclusions:

Our findings highlight certain features, such as alexithymia and sensory sensitivity, as particularly notable for clinicians who might have concerns about self-injury in their autistic patients. A relationship between SIB and suicide ideation and attempts exists regardless of how autistic people feel about their self-injury, corroborating the idea of self-injury as a 'time-invariant' risk factor or 'gateway' for suicidality'.

248 **213.248** Sensory Sensitivity and Intolerance of Uncertainty Separately Influence Anxiety in Adults with Autism Spectrum Disorders

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Background: Anxiety affects at least 50% of adults with autism spectrum disorders (ASD) and can lead to significant impairment in day-to-day life for these individuals and their families. In addition, an increase in ASD traits is linked with an increase in anxiety. Research has sought to elucidate the mechanisms by which ASD traits influence an individual's anxiety in order to provide context and support for interventions. Two factors that have emerged as potentially influential are sensory sensitivities (SS) and intolerance of uncertainty (IU). SS can make the natural environment of an individual with ASD more challenging to experience and can even result in physical pain. IU can be distressing and lead to negative evaluation as well as influence restricted/repetitive behaviors. While both SS and IU have been shown to influence anxiety, research has not yet looked at their influence together in an adult ASD population.

Objectives: We examined the influence of SS and IU on anxiety in adults with ASD using structural equation modeling (SEM). We assessed whether SS and IU can exert this influence alone and what level of influence they have.

Methods: A dimensional sample consisting of 214 typically developing adults and 71 adults with a confirmed diagnosis of ASD completed self-report questionnaires. ASD traits were identified using the Autism Spectrum Quotient (AQ), IU was identified using the Intolerance of Uncertainty Scale – Short Form (IUS-12), sensory sensitivity was assessed using the Adolescent/Adult Sensory Profile (AASP), and anxiety was identified using the Penn State Worry Questionnaire (PSWQ).

Results: The first SEM analysis supported the hypothesis that SS and IU play a mechanistic role in the relationship between ASD traits and anxiety. The relationship between ASD traits and anxiety was significant when modeled individually but this relationship was eliminated by adding SS and IU as mediators (explaining 33.6% and 54.3% of the influence, respectively). Neither mediated the relationship when included individually. The second SEM analysis attempted to model the influence of SS, IU, and ASD traits on anxiety. All factor loadings were in the expected direction and there was converging evidence for excellent model fit. This model suggested that SS and ASD traits largely operate on anxiety via IU with SS still having a direct influence on anxiety. Importantly, including SS and IU in the model removed the direct influence of ASD traits on anxiety. Finally, replicating previous research that looked at whether anxiety itself mediates the influence of IU on SS, but with an adult population, showed a small influence of anxiety which was more pronounced in an ASD-only population.

Conclusions: The influence of ASD traits on anxiety operates via IU. Both SS and IU are necessary to explain this influence. Our model suggests that both SS and IU largely explain increases in anxiety and that SS functions both independently and through IU. This provides further evidence for the importance of addressing these specific challenges in order to reduce anxiety and the impairment associated with it.

249 **213.249** Sleep Dysregulation and Circadian Electrodermal Activity in Children with Autism Spectrum Disorder

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Background: Up to 80% of children with an autism spectrum disorder (ASD) experience sleep dysregulation. A breadth of research documents the behavioral correlates of sleep dysregulation—including increased ASD symptoms, aggression, and other challenging behaviors (e.g., Goldman et al., 2011). These associations are documented in both home and treatment settings (e.g., Abel et al., 2018). However, the physiological correlates of sleep dysregulation are poorly understood and likely to contribute to daytime behavior problems and potentially treatment progress.

Objectives: The goal of the present study is to understand the physiological correlates of sleep dysregulation in ASD by assessing child sleep and electrodermal activity during daytime center-based treatment.

Methods: Thirteen children (mean age of 6.19 years, *SD* = 2.24) with a medical diagnosis of ASD participated in this study for one treatment week. Children received treatment in an applied behavior analysis center for up to 8 hours per day from roughly 09:00 to 17:00. Each child wore an Empatica E4 multi-sensor during treatment, resulting in over 10,000 minutes of electrodermal activity (EDA) data. Skin conductance responses (SCRs) were extracted from the EDA data following guidelines from Kleckner et al. (2017). Actigraphy was used to measure sleep for five consecutive 24-hour periods (which corresponded with the EDA data collection). Each child's sleep was classified as either regulated (n = 7) or dysregulated (n = 8) based on the following criteria: (1) slept less than the American Academy of Sleep Medicine recommendations for their age, (2) woke for more than an hour on a least two nights, and/or (3) had morning rise or bedtimes that varied by more than two hours. Child ASD symptoms was indexed with the Social Communication Questionnaire (SCQ).

Results: A series of regression analyses were conducted across the regulated and dysregulated sleep groups, predicting average SCRs per minute across each treatment hour. Children in the dysregulated sleep group had fewer SCRs as the treatment day progressed (Figure 1). When the covariates of child ASD symptoms, age, and maternal education were considered, these associations were attenuated and no longer significant. Children in the dysregulated sleep group were older and tended to have more ASD symptoms when compared to the regulated sleep group (Table 1). Due to small sample size, we were unable to fully detect how these covariates influence the relations between sleep and SCRs. However, we were able to document distinct circadian SCR patterns for a subgroup of children with ASD.

Conclusions: SCRs often reflect sympathetic arousal to environmental stimuli. Fewer SCRs may indicate less engagement with the environment (as indexed by lower arousal). This preliminary study requires replication before treatment or clinical recommendations can be drawn. However, our results clearly suggest that SCRs follow a circadian or daily cycle. The roles of child age, ASD symptoms, and sleep warrant further investigation to understand their relations with arousal and ultimately daytime behaviors during treatment.

250 **213.250** Sluggish Cognitive Tempo Profiles Among Young Adults with ASD

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Background: Sluggish cognitive tempo (SCT) refers to a set of behavioral and cognitive symptoms characterized by a sluggish activity level, slow processing, daydreaming, and mental fogginess (Becker et al., 2016). Despite similarities between SCT and attention-deficit/hyperactivity disorder (ADHD), research has shown SCT to be distinct from ADHD with its own behavioral phenotype and independently associated psychiatric comorbidities (Barkley, 2012; Becker et al., 2017; Reinvall et al., 2017). Despite the high comorbidity of ADHD for individuals with autism spectrum disorder (ASD), limited research has explored SCT symptomology in an ASD sample.
Objectives: The current study aimed to characterize the relationship between SCT and ADHD in an ASD sample. We also sought to determine if SCT symptoms are independently associated with co-occurring symptoms of anxiety and depression in adults with ASD, controlling for ADHD symptoms.

Methods: Participants included 30 young adults with ASD (Mean age (in years) =20.10, SD =2.00). Participants' parents completed the Adult Behavior Checklist (ABCL; Achenbach & Rescorla, 2003), a parent-report measure of behavioral, emotional, and social problems for adults. T-scores for the SCT, ADHD, anxiety, and depression scales were used as measures of participants' psychiatric symptoms.

Results: Descriptively, there was variability in participants' SCT scores, with 20 percent of participants meeting borderline clinical cut-offs for SCT symptoms and an additional 40 percent meeting for clinically significant cut-offs. Participants' ADHD and SCT T-scores were significantly correlated, $r = .689$, $p < .001$. Partial correlations revealed that participants' SCT scores were significantly correlated with depression symptoms when controlling for ADHD symptomology, $r = .495$, $p < .010$. However, participants' SCT scores were not significantly correlated with anxiety symptoms when controlling for ADHD symptomology, $r = .190$, $p > .050$.

Conclusions: Results suggest that individuals with ASD experience a range of SCT symptoms, which are strongly positively related to ADHD symptoms. Despite this strong association with ADHD, SCT symptomology appears independently related to depressive symptoms, with adults with ASD and high SCT symptoms experiencing more depressive symptoms. Given the shared behavioral symptoms between SCT and depression (e.g. lack of motivation, cognitive dulling, fogginess) and previous studies finding SCT and depression to be related in non-ASD samples (Becker et al., 2016), SCT and depression may be uniformly related and not specific to ASD. These findings also support the theory that SCT may be its own construct distinct from ADHD. However, SCT was not independently associated with anxiety symptoms, contrary to findings on children and adolescents from the only other study to analyze SCT in an ASD sample (Reinvall et al., 2017). Additional research with a larger sample size is necessary to further distinguish SCT as an independent behavioral construct related to ASD and identify if SCT independently affects functioning among young adults with ASD. Determining how SCT symptomology impacts the behavioral and emotional ASD profile could lead to better understanding of the disorder and improved efficacy of interventions to maximize positive outcomes for this population.

251 **213.251** Social Competence Predicts Anxiety Symptoms in Girls but Not Boys with ASD

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Background: Children and adolescents with ASD have an estimated 39.6% prevalence rate of anxiety disorders (van Steensel, Bogels, & Perrin, 2011), much higher than the general population. Poor social functioning is related to increased anxiety in youth with and without ASD (Kerns et al., 2015; Settipani & Kendall, 2013). Recently, Johnston and Iarocci (2017) found that more internalizing symptoms (i.e., depression and generalized anxiety) were related to lower social competence in youth with and without ASD; however, gender differences were not possible to examine. Girls are more socially competent and have higher anxiety than boys (Crocetti et al., 2015; Dunsmore et al., 2008). Gender differences in social competence and anxiety in ASD may be especially helpful in understanding the difference in symptom profile between boys and girls with ASD
Objectives: The objective of the current study was to examine the relations between anxiety symptoms and social competence in girls, as compared to boys, with and without ASD.

Methods: Four hundred and eighty-four youth (ages 6-14), all with IQ>80, and their parents were included in this study. Parents completed the Behaviour Assessment System for Children (BASC-2; Kamphaus & Reynolds, 2004) and the Multidimensional Social Competence Scale (MSCS; Yager & Iarocci, 2013). The BASC provides an anxiety T-score and the MSCS provides an overall rating of social competence. Four groups were established using gender and diagnostic status: TD girls (n=108, mean age=9.41, mean IQ=113.07), ASD girls (n=42, mean age=9.87, mean IQ=108.45), TD boys (n=153, mean age=9.31, mean IQ=109.4), and ASD boys (n=181, mean age=9.91, mean IQ=104.9).

Results: Separate hierarchical multiple regressions were conducted for ASD and TD groups for each gender, with IQ and age included in the first block, MSCS total score included in the second block, and the anxiety subscale T-score of the BASC-2 as the dependent variable. Significant positive correlations were found between IQ and MSCS scores in girls in both groups (TD: r=.23, p=.007; ASD: r=.381, p=.006), and between age and anxiety T-scores for TD boys (r= .141, p=.042). A significant negative correlation was found between anxiety T-scores and MSCS total scores in girls with ASD (r=-.496, p<.001). No significant prediction was found for IQ, age, or MSCS scores for TD girls, TD boys, or ASD boys. However, the MSCS had significant predictive value for anxiety among girls with ASD ($\Delta R2=.294$, p<.001).

Conclusions: The results are consistent with previous research indicating that poorer social competence predicts greater anxiety symptoms in youth with ASD; however, this effect was only found in girls with ASD. These results indicate that poorer social competence predicts greater anxiety symptoms in girls with ASD, but not boys with ASD or typically developing youth. This suggests there may be important differences between these groups, such that deficits in social competence may have a greater effect on the mental health of girls with ASD compared to their same-gender TD peers and boys with and without ASD. Implications for future research will be discussed.

252 **213.252** Suicidality in Adults with Autism Spectrum Disorder: The Role of Depression and Alexithymia

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Background: Individuals with autism spectrum disorder (ASD) have a higher risk of depression and suicidality than individuals without ASD. Alexithymia, a personality construct characterized by a lack of emotional awareness, that is highly linked to depression, is also more prevalent among people with ASD than in the general population. Few studies have so far examined the increased risk of suicidality in people with ASD and none have looked into how alexithymia could be a significant risk factor for suicidality in ASD.

Objectives: The aim of the present study is to explore more closely the relationship between alexithymia, depression, and suicidality in ASD. It is hypothesized that there are higher rates of depression, suicidality, and alexithymia in people with ASD compared to neurotypical adults. Because the risk of suicidality can be explained by high levels of depression and alexithymia in the general population, this is also hypothesized for the group of people with ASD.

Methods: In the present study, 53 adults diagnosed with ASD and a control group of 132 adults without ASD were compared on their self-reported scores on autistic traits (AQ-short), depression (CES-D), suicidality (SBQ-R), and alexithymia (TAS-20). Participants were aged between 18 and 60 years. The ASD group was significantly older (M = 33.75; SD = 11.02) than the control group (M = 29.08; SD = 8.74), $t(183) = -3.04$, $p < .01$ and there were significantly more men than women in the ASD group (21 men, 31 women, 1 other) than in the control group (31 men, 101 women), $\chi^2(2) = 7.72$, $p < .05$.

Results: The results revealed that the ASD group had significantly higher levels of autistic traits [$F(1, 181) = 394.61$, $p < .001$, $\eta_p^2 = .69$], depression [$F(1, 181) = 51.86$, $p < .001$, $\eta_p^2 = .22$], suicidality [$F(1, 181) = 71.51$, $p < .001$, $\eta_p^2 = .28$], and alexithymia [$F(1,181) = 143.44$, $p < .001$, $\eta_p^2 = .44$] than the control group. A hierarchical linear regression analysis including age, gender, autistic traits, depressive symptomatology, and alexithymia also revealed that the severity of autistic traits and depressive symptomatology were significant predictors of suicidality (autistic traits: $\beta = 1.24$, $p < .001$; depression: $\beta = 1.30$, $p < .001$). Furthermore, alexithymia played a moderating role in the relation between autistic traits and suicidality: a significant relation was found between autistic traits and suicidality on participants with high levels of alexithymia [$b = 1.61$, $SE = 0.31$, $p < .001$], but autistic traits were not related to suicidality on participants with low levels of alexithymia [$b = -0.54$, $SE = .45$, $p = .24$].

Conclusions: The present results show that individuals with ASD are vulnerable to suicidal ideation and that the severity of autistic traits, depression, and alexithymia are important factors in the occurrence of suicidal ideation in ASD. Because of the high risk of suicidality in ASD, interventions that take into consideration depression, and particularly alexithymia, could potentially benefit people with ASD.

253 **213.253** The Association between Somatic Comorbidity and ASD Among Discordant Twins

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Background:
Individuals with autism spectrum disorder (ASD) show higher prevalence of co-occurring somatic disorders than the general population, including immune dysregulation, gastrointestinal problems, and neurological problems. The co-existence of somatic problems in ASD is associated with more burden and lower quality of life. In addition, it also suggests the possibility of an underlying genetic and/or environmental perturbation affecting multiple systems that might lead to both somatic disorders and ASD. However, except some specific genetic disorders and the current findings of gene pleiotrophy, there is still little information regarding the relationships between somatic comorbidity and the symptoms of ASD.

Objectives:

This study aimed to use a monozygotic (MZ) twin sample, which has the advantage of well-controlled genetic background, to investigate if somatic comorbidity is involved in the etiological mechanism of ASD symptoms.

Methods:

Seventy-five MZ twin pairs (including 18 twin pairs discordant for ASD diagnosis and 18 typically developed (TD) twin pairs) and 60 dizygotic (DZ) twin pairs with varying autistic traits were selected for analysis in this study. A questionnaire asking past medical history and current physical problems were used to collect the information of the participants' somatic comorbidity. All the physical problems were categorized into infectious diseases, neurological problems, gastrointestinal problems, immunological problems, and cardiovascular diseases. The Social Responsiveness Scale, Second Edition (SRS-2) was used to measure the participants' ASD symptoms. The differences of somatic comorbidity among twins discordant for ASD and TD twins were examined. The somatic problems identified with significant within-pair differences were then tested in relation to autistic traits in both MZ and DZ twin pairs quantitatively discordant for ASD, which was defined as at least 6 points for the intra-pair difference of SRS-2 total score.

Results:

The twins with ASD in discordant MZ have more neurological problems compared to their co-twins and TD twins. However, there are no differences in infectious diseases, gastrointestinal problems, cardiovascular diseases, and immunological problems among MZ twins discordant for ASD and TD twins. For the MZ twins quantitatively discordant for ASD, the intra-pair differences of neurological problems are significantly correlated with the differences of total score of SRS-2 ($r = 0.40$, $p = 0.001$). In addition, with the conditional model for within-pair effect analysis, there is significant association between neurological problems and total score of SRS-2 ($\beta = 11.66$, $p = 0.002$) after adjusting for ADHD and IQ.

Conclusions:

Our findings suggest that neurological problems could be considered as a non-shared environmental factor for MZ twins discordant for ASD symptoms. In addition, organic neuropathy might play a pathogenic role in the development of ASD. However, we did not find association between somatic comorbidity of other physical systems and ASD symptoms in our twin sample. Further population-based studies are warranted to validate our results.

254 **213.254** The Impact of Associated Anxiety Symptoms on Emotion Recognition in Individuals with Autism Spectrum Disorder

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Background: Some autistic individuals experience emotion recognition difficulties, as compared to neurotypical populations. Furthermore, anxiety disorders have also been related to emotion recognition difficulties, potentially due to heightened state arousal in response to some expressions, such as high intensity emotions/threat cues. Despite the high prevalence of anxiety symptoms in autism – over 40-50% - few studies have

examined the impact of co-occurring anxiety on emotion recognition.
Objectives: To investigate the relationship between anxiety symptoms and emotion recognition in autism.

Methods: 612 6-30-year-olds with (*N*=363) and without (*N*=249) Autism Spectrum Disorder (ASD) from the EU-AIMS Longitudinal European Autism Project were included. At Time 1, anxiety symptoms were measured using the Development and Wellbeing Assessment (DAWBA), with a 'high anxiety' cut-off implemented (see Goodman et al., 2010). 105 participants (29%) in the ASD group had high anxiety. Emotion recognition difficulties were assessed using an emotion-matching paradigm (Palermo et al., 2013), whereby participants selected the non-matching expression from an array of three faces, oriented left/right, or front-facing. At Time 2 (~18 months later) anxiety symptoms were re-assessed using the 'emotional symptoms' subscale from the Strengths and Difficulties Questionnaire (SDQ). Concordance between anxiety measures was good (r>0.63, p<2.2e-16). Emotion recognition difficulties were assessed in a basic emotion recognition paradigm using the Karolinska Directed Emotional Faces stimuli, including neutral, positive (e.g. happy) and negative (e.g. angry) expressions. We report effect sizes for Mann-Whitney U tests (r) and Spearman's correlations (r_s).

Results: At Time 1, individuals with ASD and low, compared to high, DAWBA-rated anxiety did not differ on age (effect size r=0.01, p=0.92), nor IQ (effect size r=0.05, p=0.38). A higher proportion of females than males had high anxiety (X^2=5.65, p=0.02, φ=0.12). Individuals with ASD and high anxiety were significantly less accurate at emotion-matching than those with lower anxiety on *front-facing* trials (effect size r=-0.30, p=0.01; Figure 1). In other words, the relationship between anxiety symptoms and emotion recognition – confirmed by simple correlations (r_s=-0.27, p=0.02) - was only present when stimuli were oriented to the front, with direct gaze. At Time 2, higher self-reported anxiety symptoms, according to the SDQ, were also marginally related to basic emotion recognition difficulties, specifically for trials depicting anger (r_s=-0.23, p=0.05), a socially and evolutionarily relevant threat cue. This effect was significant at the p<0.05 threshold but did not survive Bonferroni correction.

Conclusions: We found that co-occurring anxiety symptoms in ASD are related to emotion recognition accuracy for stimuli with direct gaze and displaying threat cues (anger). The ability to recognise and respond to the emotional expressions of others is fundamental for building successful interpersonal relationships. Therefore, our results emphasise that the management of co-occurring anxiety symptoms in ASD is important, not only for enhancing the quality of life of autistic individuals, but also facilitating social functioning and development. Future research should incorporate state arousal measures (e.g. heart rate) to further elucidate how anxiety symptoms modulate reactivity to social stimuli in ASD. This is particularly relevant given that stimuli with direct gaze/threat cues increase physiological responsiveness in neurotypical populations.

255 **213.255** The Impact of Sleep Variability on Sleep Duration and Daytime Behavior in Children on the Autism Spectrum

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Background: Children with autism spectrum disorder (ASD) have sleep difficulties at a rate of 40-80 percent, compared to 25-40 percent of typically developing (TD) children, affecting daytime behavior and quality of life. Sleep difficulties can be measured objectively through actigraphy or polysomnography or through subjective report, with both methods providing comparable accuracy (Baddam et al., 2018). In typical development, sleep duration decreases with increasing age, yet this trajectory is poorly understood in children with autism.
Objectives: To examine relationships among variability of sleep cycle with sleep duration and daytime behavior across development in children with ASD and TD.

Methods: Participants were children aged 7-18 with ASD (*n*=34, Mean IQ=96.3, Mean Age=12.4 years) and TD (*n*=16, Mean IQ=112.0, Mean Age=12.8 years). Parents completed the Yale Developmental Sleep Questionnaire, which asks for the earliest, latest, and usual time of their child's bedtime routine (BR), lights out (LO), and wake time (WT) for the most recent weekdays and weekend. Clinician-administered and parent-reported measures provided information on intellectual function and symptomatology: Differential Ability Scales, Autism Diagnostic Observation Schedule, and Child Behavior Checklist. Children were given variability scores (VS) consisting of the sum of the differences in earliest and latest times for BR, LO and WT, and difference between weekend and weekday usual BR, LO, and WT. Children were placed in either a low variability (LV; VS≤7h, *n*=18: 12 ASD, 6 TD) or high variability (HV; VS> 7h, *n*=32: 22 ASD, 10 TD) variability group. The mean ages and IQs did not significantly differ based on sleep variability. For both ASD and TD children, variability scores were normally distributed.

Results: Consistent with the literature, a negative correlation between sleep duration and age was seen in the TD group (r=0.773, p=0.000). However, this trend was not observed overall in the ASD group (r=0.185, p=0.295). When contrasting LV and HV participants with ASD, the expected developmental pattern was observed among LV ASD participants (r=0.740, p=0.006) but not HV ASD participants (r=0.040, p=0.861). Within the ASD group, parents of children with HV reported significantly less inattention (p=0.052) and hyperactivity (p=0.040) than the LV group.

Conclusions: High and low sleep variation in ASD children were associated with distinct developmental patterns of sleep maturation and different daytime behaviors. These differences were not observed in TD children. Children with ASD and high sleep variation failed to display the expected association between sleep duration and age and, counter to predictions, were less likely to display inattention and hyperactivity. Future studies can build on these findings by using objective measures of sleep such as polysomnography or actigraphy (Hodge et. al., 2012) to further explore the relationship between sleep variability and daytime behaviors.

256 **213.256** The Impacts of SSRI Medication and Comorbid Anxiety on Brain Function in ASD

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Background: Resting state functional connectivity of fMRI data identifies co-activated brain networks and is a promising method for defining biologically similar ASD subtypes and new treatment strategies. However, efforts to characterize alterations in functional connectivity among individuals with ASD are hindered by confounding factors that impact brain function and are variably present across individuals, including medication usage and comorbid psychiatric conditions. Quantifying the impacts of known sources of variability in ASD on functional connectivity will directly inform interpretation of existing findings and guide ASD neurobiological models.
Objectives: Our goal was to quantify functional connectivity characteristics in ASD associated with medication use and psychiatric comorbidities in the context of serotonergic systems.

Methods: Four primary samples were identified from the Autism Brain Imaging and Data Exchange. ASD+SSRI (N=19) were taking an SSRI and no other psychoactive medications, and had no comorbid disorders; ASD-Unmedicated (N=19), an age, sex, IQ, and severity matched ASD comparison group with no medications or comorbidities; ASD+Anxiety (N=19) had a comorbid anxiety disorder and no medications; ASD-NoComorbid (N=19), an age, sex, IQ, and severity matched ASD comparison group with no medications or comorbidities. The four ASD groups will also be compared to typically developing age, sex, and IQ matched controls. Resting state fMRI data was analyzed using the Configurable Pipeline for the Analysis of Connectomes. Whole brain cross-correlation was performed using 116 cortical, subcortical, and cerebellar regions of interest from the Eickhoff-Zilles anatomical template.

Results: SSRI use was associated with reduced cerebellar-cortical and intra-frontal connectivity. In ASD patients taking an SSRI relative to unmedicated ASD Controls, cerebellar-default mode network (DMN) connectivity was increased (cerebellum and posterior cingulate, precuneus), and fronto-cerebellar connectivity was decreased (cerebellum and inferior frontal gyrus, rectal gyrus). In addition, SSRI use was associated with increased connectivity between right ventromedial prefrontal cortex and both left inferior frontal gyrus and right rectal gyrus.

Conclusions: Results indicate pervasive changes in functional connectivity associated with SSRI use and with comorbid anxiety in ASD. Altered cerebellar function has been implicated in ASD, and our findings suggest that SSRIs may mitigate cerebellar-DMN disconnections, an important finding because the DMN may be related to theory of mind and social impairments. We have also shown that comorbid ASD+Anxiety was associated with altered temporal pole connectivity. Anxiety comorbid with ASD includes more atypical symptoms than anxiety without ASD, and the marked changes in social-emotional and fear processing network connectivity provides important markers of ASD+Anxiety that may provide insight into unique neural mechanisms associated with anxiety in ASD.

257 **213.257** The Relationship between Autistic Traits, Eating Disordered Behaviours and Anxiety in the General Population

ABSTRACT WITHDRAWN

Background:

The high co-occurrence of autism and anorexia nervosa is well established (e.g. Huke et al., 2013), with higher levels of autistic traits commonly found in anorexic populations (Westwood et al., 2016). Further, general population studies show significant positive correlations between autistic traits and eating disorder traits relating to both anorexia nervosa and bulimia nervosa (e.g. Coombs et al., 2011).

However, studies investigating traits have predominantly relied on the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001), which has not enabled specific examination of the impact of restricted and repetitive behaviours (RRBs) on eating disordered traits. In addition, anxiety is highly co-occurring with both autism and eating disorders (Kim et al., 2000; Swinbourne & Touyz, 2007) but little is known about how anxiety may influence the shared presentation of both autistic and eating disorder traits. Further, whether cognitive anxiety (i.e. related to thoughts such as worry and indecisiveness) or somatic anxiety (i.e. related to physical symptoms such as dizziness and shaking) is more relevant also remains unexplored.

Objectives:

1. To explore the specific associations between social communication difficulties and RRBs and eating disorder traits in the general population.
2. To additionally examine the effect of cognitive and somatic anxiety on these associations.

Methods:

Three-hundred and forty five adults (87% female; mean age 29.7 years, SD = 13.3) completed four online questionnaires: the AQ, the Adult Repetitive Behaviour Questionnaire-2 (RBQ-2A; Barrett et al., 2015; 2018), the Eating Attitudes Test-26 (EAT-26; Garner et al., 1982), and the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA; Grös et al., 2007). Mediation analyses were used to explore the mediating effects of cognitive and somatic anxiety on the relationship between autistic traits (social and communication difficulties, repetitive sensory motor behaviours (RSMB) and insistence on sameness (IS)) and three types of eating disordered behaviour (dieting, bulimia and food preoccupation, and oral control).

Results:

Preliminary analyses show that social and communication difficulties, RSMBs and IS all indirectly influenced dieting behaviour through their effect on cognitive anxiety. Similarly, social and communication difficulties, RSMBs and IS all indirectly influenced bulimia and food preoccupation behaviours through their effect of cognitive anxiety. A direct effect of social communication difficulties on bulimia and food preoccupation was also identified. There were no indirect pathways between autistic behaviours and oral control, but there was a direct pathway between IS and oral control.

Conclusions:

Using a general population sample, we found: 1) Social communication and RRBs independently contribute to the presence of eating disorder behaviours; 2) Anxiety generally has an important role in relationship between autistic and eating disorder behaviours. The data suggest the importance of considering the full spectrum autistic traits in those with high levels of eating disorder behaviour. Further, anxiety may be important clinical consideration for treatment approaches.

258 **213.258** The Role of Child and ASD Characteristics in Caregiver-Reported Anxiety: Correlates and Cluster Analyses from a Large Pooled International Database of Autistic Young People

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Background: Anxiety is one of the most common co-occurring conditions in ASD. However, studies that have investigated associations between child characteristics, ASD symptoms and anxiety are mostly of small sample sizes, tend to report inconsistent findings and have mostly explored overall (total) autism symptom severity scores. More in depth analyses of group clusters based on anxiety and ASD symptomatology profiles would enable greater understanding of the relationship between specific ASD characteristics and anxiety.
Objectives: This study pooled together data from 13 existing studies to examine the relationships between child characteristics (age, gender, cognitive/ adaptive functioning and ASD traits) and anxiety in a large sample. We also aimed to combine a variable-centered and person-centered approach in order to provide better understanding of the relationship between individual differences across anxiety subtypes with age, gender and core ASD traits.

Methods: A large international sample of 870 children and adolescents with ASD (763 males, 107 females, mean age 11.6 years, SD=2.77) was pooled together from 13 studies in the UK, Singapore and the US, all of which used the Spence Children's Anxiety Scale- Parent Version (SCAS-P) total and subscale scores. Several other different measures of functioning and ASD characteristics were employed by the different studies (i.e. WISC, WAIS, SCQ, SRS, etc.) and harmonized scores were created for these. Regression and moderation analyses using child characteristics and ASD traits as predictors were conducted for SCAS-P total and subscale anxiety scores. Latent profile analysis (LPA) with item level SCAS-P data will be used to identify profiles (groups) of individuals with distinct constellation of ASD symptoms. Models with 1-8 profiles will be estimated and the decision on the optimal number of profiles will be guided by the combination of information criteria, likelihood-based statistics and entropy. Derived anxiety based profiles will be further defined by exploring their association with core ASD traits, age and gender.

Results: Age was positively associated with social and generalized anxiety. No consistent gender differences were found. ASD symptoms, especially Repetitive and Restricted Behaviors and Interests (RRBIs), were positively associated with anxiety. At the item level, autistic symptoms relating to adherence to routine, intense special interests, sensory hypersensitivity and being aloof/ not showing feelings, together with participants' chronological age, were the most consistent predictors of SCAS-P anxiety symptoms. Tentative support that some moderation effects exist was also found, but effects were small. Cluster analyses are currently being carried out and these will also be reported.

Conclusions: The findings of this study strengthen existing literature examining the specific relationships between ASD symptomatology and anxiety in young autistic people. Implications of identifying distinct profiles/ groups and how this could enable more individualised targets for anxiety interventions are also discussed.

259 **213.259** The Structure of Co-Occurring Depression in Youth with ASD Living in Residential Care

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Background:
Children with Autism Spectrum Disorders (ASD) more often exhibit co-occurring psychiatric conditions than not (Rosen et al., 2018). Frequently, ASD youth experience depression symptoms (Ghaziuddin et al., 2002). Some individuals with ASD express profound symptom presentation, requiring comprehensive care within inpatient or residential settings (Croen et al., 2006; Siegel at al., 2015). Individuals with ASD in these settings are underrepresented in the overall ASD literature, as well as the comorbidity literature more specifically (Lerner et al., 2018). There is evidence, though, that youth in in-patient settings display significant and observable challenges such as self-injury and suicidality (Siegel, 2018; Cassidy et al., 2014); this may indicate that inpatient youth experience significant difficulties related to depression, even though these observable challenges are not necessarily conceptualized as such. Youth in psychiatric inpatient settings experience co-occurring psychiatric symptoms differently than those in the community (Mandell, 2008; Siegel et al., 2018), suggesting that symptom presentation in ASD may be dependent on treatment setting. Though research regarding inpatient populations is emerging, symptom presentation in a residential setting remains to be explored. Though there may be similarities between the settings, residential settings are typically long term, while in-patient settings are frequently acute. Therefore, symptom presentation in residential settings is likely to vary from in-patient or community settings.

Objectives: To determine how ASD youth in a residential setting experience depression symptomology.

Methods:

Data were collected via the Child and Adolescent Symptom Inventory (CASI-5; Gadow & Sprafkin, 2013) from teachers of 146 youth (M_{age} = 15.27, SD_{age} = 3.12; 119 male) in state-funded residential facilities across New York state. Participants had severe intellectual (IQ ≤ 70) and adaptive ($M_{Vineland}$ = 43.25, $SD_{Vineland}$ = 14.11) difficulties. An exploratory factor analysis (EFA) of the CASI-5 depression scale using Maximum Likelihood estimation and Geomin rotation was conducted.

Results:

The EFA supported a 5-factor model of depression symptoms, which accounted for 72.2% of item variance (Table 1). The factors were, anhedonia/difficulty concentrating, /verbally mediated symptoms, low energy level, suicidality and functional changes (Table 2).

Conclusions: Whereas outpatient and non-treatment seeking youth have depression symptoms that form only one or two factors (Bitsika et al.,2016; Lecavalier, Gadow, Devincent, Houts, & Edwards, 2011; Uljarević et al., 2017), these residential samples evince depression symptoms that consist of five factors. These results indicate that ASD youth in residential settings may experience multi-faceted symptomology compared to inpatient and outpatient ASD youth. Obtained factors, such as functional changes related to depression (i.e., change in activity level, sleep, appetite etc.), and anhedonia and fatigue (acts unhappy or sad, shows little enjoyment in pleasurable activities), may be less verbally mediated, and therefore more easily observed and coherently identified in patients with lower verbal abilities (Righi et al., 2017, Siegel et al., 2018), such as those receiving residential care. Understanding this population's symptom presentation will inform and guide treatment practices for this understudied population, as it may be useful for treatments to be targeted to these multi-faceted and specific symptom domains, rather than to discrete diagnostic categories.

260 **213.260** Trends in Psychotropic Medication Use for Canadian Children and Youth with ASD from 2012 to 2016: A Pharmacoepidemiologic Study

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Canada, (2)Department of Psychiatry, University of Calgary, Calgary, AB, Canada, (3)IQVIA, Kanata, ON, Canada, (4)IQVIA, Kirkland, QC, Canada

Background: The majority of children and youth with autism spectrum disorder (ASD) experience a co-occurring mental health issue, such as anxiety or depression. Pharmacological interventions are commonly used to manage and treat these psychiatric issues, as well as aggression or self-injurious behaviours that are common in individuals with ASD. While psychotropic medications are used quite extensively, these drugs often have variable treatment response, and the US Food and Drug Administration (FDA) has only approved two drugs, risperidone and aripiprazole, for use in individuals with ASD. Although it is well established that children and youth with ASD are a highly medicated group in various countries, no study has examined recommendations for psychotropic medication in Canadian children and youth with ASD exclusively, nor described how these patterns may be changing over time.

Objectives: The objective of this study is to describe the frequency and psychotropic prescription trends for behavioural challenges and mental health issues in children and youth with ASD in Canada from 2012 to 2016.

Methods: The present study used data from IQVIA's Canadian Disease and Therapeutic Index (CDTI), which is survey-based dataset that collects treatment data from a representative sample of office-based physicians related to drug recommendation, indication and patient demographics. Quarterly, during a 48-hour period, participating Canadian physicians complete an anonymized record of all patient visits including patient age, gender, drug recommendation (prescribed medication), and reason for recommendation. Statistical weighting adjustments are made to the sample-based estimates to extrapolate drug recommendations to national totals.

Results: The analysis will focus on drug recommendations for antidepressants and ADHD medications for children and adolescent (under 18 years of age) with ASD from 2012 to 2016, and for antipsychotics from 2010 to 2016. Data has been collected and the analysis will be completed in Winter 2019. Preliminary data analysis showed that within the three medication classes, antipsychotics were the most commonly prescribed psychotropic medications in children with ASD. Risperidone was the most commonly recommended medication, followed by aripiprazole. Between 2010 and 2016, drug recommendations for antipsychotics grew steadily, from 35,010 recommendations in 2010, to 90,288 recommendations in 2016. The use of antidepressant medications remained fairly steady between 2012 and 2016, with a total of 26,053 drug recommendations in 2016; sertraline was the most commonly recommended antidepressant. ADHD medication use also remained steady between 2012 and 2016, with a total of 52,929 drug recommendations in 2016. Clonidine and methylphenidate were the most commonly recommended medications in this class.

Conclusions: Psychotropic medication is used extensively with children and youth with ASD. This is the first study to show an increase in antipsychotic use in Canadian children and youth with ASD. Findings will help to inform prescription guidelines for psychotropic medications, and highlight the importance of medication monitoring.

261 **213.261** What Do Autistic People Who Experience Anxiety Tell Us about Existing Interventions and Services for the Treatment of Anxiety?

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Background: Anxiety is a common mental health condition experienced by autistic people, with the potential to negatively impact on many aspects of daily life. The development of effective treatments for anxiety is a key priority for autistic people. Clinical guidance and policy documents recommend that interventions should be adapted to meet the needs of the autistic person. To inform the development of effective treatments it is important to learn about the lived experiences of autistic adults who experience anxiety including those who have accessed existing interventions and services.

Objectives: To conduct a UK survey to learn about autistic adults' experiences of anxiety and any treatments received; and to explore autistic adults' perspectives about what types of adaptations to mental health interventions and services would meet their needs.

Methods: Autistic adults aged 18 and over were recruited via the Adult Autism Spectrum Cohort-UK (Newcastle University). 824/1587 cohort participants reported an anxiety diagnosis (51.9%) and a further 23.4% reported a suspected but undiagnosed anxiety disorder. Of the 998 with a pre-existing diagnosis (or suspected diagnosis) of anxiety, 449 (45%) completed a survey about their experiences of anxiety and treatments they have accessed. Their mean score on the Social Responsiveness Scale (measuring autism severity) was 111.5, exceeding the suggested cut-off for autism. Analyses were principally descriptive and correlational.

Results: 60.3% had completed psychological therapy for anxiety; 72.1% had been prescribed medication. Of those who had completed psychological therapy for anxiety just 5.8% reported they had made a full recovery and 53.9% a partial recovery. The treatment made 'no difference' for 28.4% of respondents and 11.9% 'felt worse' (supporting qualitative data available). These outcomes are poorer than observed in the general population. Autistic people rated adjustments to treatments and services as being very important but rarely available. For example, 'having a therapist who understands autism' was rated as an important key adjustment by 98.4% of the sample (86.8% very important, 11.6% somewhat important) but 31.6% of participants reported that this was 'never available' and a further 39.7% reported it was 'rarely available'. Similar patterns of high importance and low availability were observed across a number of key adjustments such as altering the sensory environment of therapy locations and adaptations to the therapeutic intervention itself. Overall, the more important that an adjustment was rated, the less likely it was to be widely available ($r = -.20$, $p < .01$) and a significant correlation was observed between availability of adjustments and therapeutic outcomes ($r = .34$, $p < .01$).

Conclusions: This study demonstrates some of the shortcomings of therapeutic interventions for anxiety experienced by autistic people. Understanding the range and types of adjustments valued by autistic adults can inform hypothesis driven research and lead to more clinical and cost effective treatments for anxiety experienced by autistic people. Building on the findings of this survey, our research team is currently undertaking a pilot feasibility trial for a personalised, modular psychological intervention for anxiety experienced by autistic people.

262 **213.262** Waveform Morphology in EEG Parses Heterogeneity in Autism and Schizophrenia

A. Naples[1], *J. Foss-Feig*[2], *K. S. Ellison*[1], *B. Lewis*[1], *V. Srihari*[3], *A. Anticevic*[3] *and J. McPartland*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (3)Division of Neurocognition, Neurocomputation, and Neurogenetics (N3), Yale University School of Medicine, New Haven, CT*

Background: Autism (ASD) and Schizophrenia (SCZ) share core and comorbid symptoms such as sensory sensitivities, reward processing impairments, and social difficulties. Electrophysiological (EEG) investigations of these symptoms have primarily focused on oscillatory activity; however, recent research suggests that important aspects of EEG are not strictly rhythmic. Instead, they include non-stationary bursts and waveform shape, biophysically meaningful features used often in clinical evaluation of the EEG. Nevertheless, these features are infrequently used to assess brain activity between and within diagnostic groups.
Objectives: To use innovative metrics of EEG shape to quantify resting brain activity and its association with diagnosis and clinical characteristics in ASD and SCZ. Specifically: (1) the slope of the resting power spectrum (PSD); (2) the presence of oscillatory "bursts;" (3) Nonsinusoidal features of EEG shape.

Methods: Resting EEG was collected in 105 individuals: 33 ASD, 28 SCZ, and 44 typically developing (TD) controls. EEG was recorded for 4 minutes with eyes open and 2 minutes with eyes closed. Slope of the PSD was calculated from 1-30Hz. Waveform shape was quantified as the symmetry between the peak and trough, or rise and decay, of a cycle, aspects of the EEG that reflect underlying physiology but are not captured in frequency analyses (e.g., the symmetry between the rise and decay influence the EEG's tendency to exhibit a "sawtooth" shape). Bursts were defined as at least three cycles that exhibited the same symmetry characteristics. These EEG metrics were calculated cycle-by-cycle across frequency bands, and averaged, per-person. A regression tested EEG association with diagnosis and correlations assessed EEG association with symptomology.

Results: Compared to TD, SCZ had fewer bursts in alpha across the scalp, in beta across occipital regions, and in gamma frontally [parameters ranging b=-.14, p=.017 to b=-.20, p=.001]. Compared to ASD, SCZ exhibited fewer bursts in alpha [parameters ranging b=-.13, p=.03 to b=-.18, p=.006]. With respect to waveform shape, compared to TD, both SCZ and ASD exhibited increased peak-trough symmetry in frontal theta (ps<.005), indicating waveforms with sharper troughs. Individuals with SCZ exhibited faster oscillatory bursts (higher peak frequency) in the theta, alpha, and beta bands [parameters ranging b=2.9, p=.03 to b=10.1, p=.02]. Waveform shape correlated with symptomology, with faster rises in frontal theta (r=-.28, p=.004) and drops in occipital beta (r=.24, p=.015) predicting greater ADOS severity scores. With respect to PSD shape, SCZ differed from TD with more negative slope (b=-.07, p=.03) in the occipital regions, indicating more high-frequency power associated with increased excitatory activity.

Conclusions: The shape of EEG waveforms reflects underlying cortical activity. While assessment of EEG shape is common clinical practice, research has focused, primarily, on oscillatory approaches. We show, for the first time, that objective, non-oscillatory measures in clinical groups strongly associate with diagnosis and symptoms. This approach offers insight into low-level activity generated by cortical inhibition and excitation, supporting a better understanding of the biological substrates. Ongoing analyses incorporating sensory and ASD symptomology will further explicate these relationships and allow us to better differentiate subgroups of individuals exhibiting similar brain activity and symptom profiles.

Poster Session
214 - Molecular Genetics
5:30 PM - 7:00 PM - Room: 710

263 **214.263** A De Novo Truncating Mutation of the Gene Encoding Nucleolin in an ASD Individual Disrupts Its Nucleolar Localization

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Background: Nucleolin (NCL / C23; OMIM: 164035) is a major nucleolar protein that plays a critical role in multiple processes including ribosome assembly and maturation, chromatin decondensation, and pre-rRNA transcription. Due to its diverse functions, nucleolin role has frequently been implicated in pathological processes, including cancer and viral infection.
Objectives: To study the functional effect of a *de novo* frameshifting indel mutation (Gly664Glufs*70), identified through whole exome sequencing in an autism spectrum disorder trio.

Methods: Nucleolar localization and real-time protein dynamics studies using constructs encoding either wild type human nucleolin or a mutant nucleolin with the same C-terminal sequence predicted for the autism proband into mammalian cells.

Results: Using co-localization with nucleophosmin (NPM; B23) protein, we have shown that the mutant nucleolin leads to mislocalization of the NCL protein from the nucleolus to the nucleoplasm. Moreover, a construct with a nonsense mutation at the same residue, p.Gly664*, shows a very similar effect on the location of the NCL protein, thus confirming the presence of the nucleolar location signal of NCL protein in this region. Real time fluorescent recovery experiments show significant changes in the kinetics and mobility of mutant NCL protein in the nucleoplasm of HEK293Tcells.

Conclusions: Several other studies report *de novo* mutations in NCL in ASD or neurodevelopmental disorders. The altered mislocalization and dynamics of mutant NCL (p.G664Glufs*70/ p.G664*) may have relevance to the etiopathlogy of NCL-related neurodevelopmental phenotypes.

264 **214.264** Air Pollution Exposure Alters Expression of Genes in Human Neurons Previously Implicated in ASD

K. C. Lewis*, S. M. Bilinovich and D. B. Campbell, Pediatrics and Human Development, College of Human Medicine, Michigan State University, Grand Rapids, MI*

Background: The link between air pollution and an increased risk of autism spectrum disorder (ASD) is well established. While some forms of ASD originate due to genetic mutations, environmental factors play a large role in epigenetic changes leading to altered brain development. There exists a need for better understanding of molecular changes and biological pathways impacted by model air pollutants.
Objectives: Expose cortical neural progenitor cells to diesel particulate matter (DPM; concentrations 10, 20, 50, 100 ug/mL) to understand the impact on molecular and biological pathways, and the expression of genes associated with ASD. RNA-seq differential gene expression (DE) contrasting each DPM exposure concentration versus control determined biological pathway enrichment using Gene Ontology.

Methods: ReNcell CX neural progenitor cells were exposed to DPM for 24 hours. Following exposure, four biological replicates of each DPM dose

were used to extract RNA for RNAseq.

Results: Comparison of DE genes (pval < 0.05) to the Simons Foundation Autism Research Initiative (SFARI) database showed the number of ASD-related genes increased as DPM dose increased. Dose 10 ug/mL and 20 ug/mL had 30 genes, 7 classified as syndromic. Dose 10 ug/mL had two genes associated with Rett Syndrome, *CDKL5* and *FOXG1*, as well as *FOXP1*. Dose 50 ug/mL had 34 genes and 8 syndromic genes, including *DEAF1*. Dose 100 ug/mL had 46 genes and 9 syndromic genes including *DMD*, *CHD2* and *CDKL5*. The majority of these genes were expressed higher in DPM-treated samples than control. In addition, pathway overrepresentation included chromatin remodeling, regulation of telomere maintenance, translation initiation factor activity, DNA replication regulation and endocytosis.

Conclusions: Neural progenitor cell exposure to DPM resulted in a dose dependent increase in differentially expressed genes associated with ASD. The rise in syndromic genes is particularly interesting and warrants further investigation. Furthermore, pathways associated with modifications to DNA were overrepresented due to DPM exposure showing this environmental factor does influence the biological pathways.

265 **214.265** Altered Gene Expression Levels in mTOR Signaling Pathway and Their Association with Cytokine Levels in Idiopathic ASD

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Background: In addition to mTOR/Akt/PI3K Signaling being implicated in single gene causes of ASD, we and others have reported aberrant gene expression levels of genes from the mTOR Signaling pathway in idiopathic ASD. mTOR Signaling is a principal pathway that regulates cellular metabolism, growth, survival, and autophagy. It plays important roles in both innate and adaptive immune responses, such as promoting differentiation, activation and function of B-cells and regulatory and effector T-cells, development and activation of NK cells, in monocyte and neutrophil function, and in regulating cytokine production in the immune system. Thus, we investigated the expression of several mTOR signaling genes we have previously shown to be differentially expressed in ASD vs. TD (typically developing controls) and correlated their expression levels to cytokine/chemokine levels in the same subjects.

Objectives: 1) To validate in a new cohort our previous findings of differential expression of mTOR signaling genes (AKT3, EIF4A2, FNBP1, NAPEPLD, PIK3C3, PPP2R2A, PPP2R1B); 2) to investigate the correlation between the expression of these mTOR signaling genes in whole blood, and the levels of cytokines/ chemokines in PBMC (peripheral blood mononuclear cells), as well as following stimulation by PHA or LPS.

Methods: qRT-PCR was performed on the selected mTOR Signaling genes on RNA isolated from whole blood from 23 male and 7 female children diagnosed with ASD (average age 3.8 yrs), and on age-matched 38 male and 7 female TD children (average age 3.6 yrs); age was not significantly different between ASD and TD. Cytokine/chemokine production levels were measured on the same subjects from isolated PBMC (peripheral blood mononuclear cells) stimulated with PHA, LPS, or media alone. Mixed Regression analysis using PCR batch as a random factor, and Dx as a fixed factor, was used to identify differentially expressed genes between ASD and TD in a sex-specific manner (FDR $p<0.05$). Pairwise Pearson correlation coefficients were calculated for all mTOR-gene – Cytokine/chemokine comparisons ($p<0.05$ considered significant) in ASD male, ASD female, TD male, and TD female separately.

Results: Our previous array study identified differential expression in the tested 7 genes in idiopathic ASD male compared to TD male. In the current study, in a separate cohort, we validated this finding in 5 (AKT3, EIF4A2, FNBP1, NAPEPLD, PIK3C3) of the 7 genes, which showed differential expression in ASD males vs. TD males (FDR $p<0.05$, up-regulated in ASD vs TD) (Fig. 1a). No gene was differentially expressed in ASD females vs. TD female (Fig. 1b). Both male and female ASD showed altered correlation association between mTOR-genes and many of the cytokines/chemokines tested in comparison to control subjects for both non-stimulated and stimulated conditions.

Conclusions: The aberrant expression of mTOR signaling genes may affect the immune system, as evidenced by changes in the correlation network between mTOR genes and cytokine/chemokine levels in ASD compared to TD. Due to the role of mTOR signaling as a central integrator of extracellular and intracellular growth signals, as well as cellular metabolism and immune system function, these genes and pathways may ultimately affect behavior.

266 **214.266** Analysis of Circular RNAs Identified from iPSC-Derived Cortical Neurons from Individuals with Idiopathic Autism

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Background: Induced pluripotent stem cells (iPSCs) provide an attractive model of the cellular and molecular changes that underlie autism (AUT). Previous RNAseq analysis in our laboratory from cortical neurons derived from iPSC lines of individuals with idiopathic AUT and typically developing controls identified sets of differentially expressed genes enriched in pathways including neuronal differentiation, axon guidance, cell migration, and neural region patterning (De Rosa 2018). However, these protein coding RNAs represent only a fraction of the total transcripts identified and the non-coding repertoire, including circular RNAs (circRNAs), remains mostly unexplored. circRNAs are abundantly expressed, formed by alternative splicing of pre-mRNA, and have functions including post-transcriptional regulation, RNA binding protein sequestration, and transcriptional machinery scaffolding. These diverse functions suggest that differential expression of these molecules may have important developmental roles related to AUT.

Objectives: The goal of this study is to compare differentially regulated non-coding circRNAs in idiopathic AUT-specific iPSC-derived cortical neurons vs neurons derived from iPSCs from typically developing controls. Moreover, we aim to identify temporal regulation and differential expression of circRNAs by examining their profiles over a developmental time course in both AUT and control neurons.

Methods: iPSC lines were created from peripheral blood mononuclear cells (PBMCs) and developed from six individuals with autism and five typically developing controls. These iPSC lines were differentiated into cortical neurons and RNA was extracted at three time points post initiation of differentiation (day 35, 85, and 135). Total RNA was ribosomal RNA depleted and sequenced to at least 50 million paired end 100bp on the HiSeq2500. Following processing and alignment of reads to the hg19 reference genome with the TopHat2 aligner, three separate methods were used to detect circRNA in the samples: CIRI2, CIRCexplorer2, and circRNA_finder. Intronic and intergenic circRNA were discarded and exonic circRNAs with ≥ 3 junction spanning reads in ≥ 3 samples were considered expressed.

Results: In total, we identified ~11,000 expressed circRNA across all of the samples. Only 35% of circRNAs were identified by all three callers, but that number increased to over 70% when including only those with at least 15 junction reads. Individual sample counts rangd from 1200-8000 with

the counts highly correlated with number of total reads (Pearson correlation coefficient = 0.86). There was no difference in overall circRNA counts between AUT and controls, nor were there differences between samples or groups across time points. Looking at specific circRNAs, we did identify the well characterized CDR1-AS, a circular RNA highly expressed in the central nervous system that functions as a sponge for miR-7 (Memczak, et. al., 2013, Nature). Moreover, we identified 445 circRNAs from 103 genes considered either syndromic or a strong candidate according to the SFARI Human Gene database. We are currently investigating the differential expression of these candidates.

Conclusions: The results of this study show that there is a diversity of circRNAs are expressed in cortical neurons derived from AUT-specific and control iPSC lines. Continued exploration of these and other noncoding transcripts will identify novel gene regulatory roles in autism.

267 **214.267** Analysis of Phenotypes Associated with De Novo Pathogenic Loss-of-Function (pLOF) Variants in the Developmental Brain Disorder Gene Database: Are There Autism-Specific Genes?

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Background: Pathogenic variants involving the same genes are identified in a variety of different clinical disorders, including autism spectrum disorder (ASD), intellectual disability (ID), epilepsy, schizophrenia, and other neurodevelopmental and neuropsychiatric conditions. It has been asserted that some genes are more ASD-specific (or ASD-predominant) and others are more specific for ID and other severe neurodevelopmental disorders (NDD) with or without ASD, based on whether the individuals were ascertained from ASD studies or ID/NDD studies (Satterstrom et al., bioRxiv 2018; doi.org/10.1101/484113).
Objectives: We examined whether there is evidence in our Developmental Brain Disorder Gene Database (DBD Gene Database) that pathogenic *de novo* LOF mutations in DBD-associated genes preferentially or exclusively cause ASD but not ID.

Methods: We used our DBD Gene Database (https://geisingeradmi.org/care-innovation/studies/dbd-genes/; Gonzalez-Mantilla et al., 2016), which integrates genomic data, including structural and sequence pLOF variants from exome and genome sequencing, copy number arrays, and targeted genomic studies published through March, 2018, with phenotype data on 6 clinically-defined disorders (including ASD and ID) to examine the phenotypes associated with pathogenic *de novo* LOF variants in DBD-associated genes. Analysis was limited to genes with ≥10 total probands with *de novo* variants in the database. The subset of these genes for which there were ≥10 ASD cases in the database, excluding individuals without ASD, was also evaluated.

Results: Among the 49 genes for which there were at least 10 total probands with *de novo* variants in the DBD Gene Database, none were associated exclusively with ASD (Figure 1). For 3 genes, *CHD8*, *SHANK3*, and *SCN2A*, there were more individuals with ASD-only than with ID-only, but many had both diagnoses, and for each gene there were more individuals with ID than without ID (ID rates 59%, 57%, and 58%, respectively). We separately examined the subset of these genes (*ADNP*, *CHD8*, *NRXN1*, *POGZ*, *SCN1A*, *SCN2A*, and *SYNGAP1*) for which there were ≥10 ASD cases, excluding individuals without ASD, and there was no evidence of enrichment for the ASD-only phenotype (Figure 2). Among these individuals with ASD, the rates of concurrent ID were as follows: *ADNP* 69%, *CHD8* 56%, *NRXN1* 64%, *POGZ* 73%, *SCN1A* 56%, *SCN2A* 48%, and *SYNGAP1* 64%.

Conclusions: We found no evidence of ASD specificity for genes with ≥10 total probands with *de novo* variants in the DBD Gene Database, even when limiting the analysis to individuals with ASD. Mutations that cause ASD also cause ID in most individuals, and for some genes in this database the phenotype is exclusively or predominantly ID (without ASD). However, answering the question of whether rare pathogenic variants in certain genes confer risk that is ASD-specific requires adequate phenotyping of all affected individuals studied, providing equal opportunity for diagnosis of each condition. Among individuals whose developmental brain dysfunction is attributable to a rare variant of large effect size, factors such as background polygenic risk (conferred by many common variants of small effect size) and developmental stochastic variation may be more important determinants of the specific neurodevelopmental phenotype(s) expressed than the gene(s) involved in the primary etiology.

268 **214.268** Cadherins Matters to Autism Spectrum Disorders: Which Ones?

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental condition with a known strong genetic component. Genomic analysis have shown that de novo and rare loss-of function mutations are important for the etiology of ASD and oligogenic/multifactorial models is expected to be associated with most of the cases. It has also been shown that disruption of genes functionally important for neuronal cytoskeletal and synaptogenesis contributes to the phenotype, but one currently challenge is to identify which are the variants with clinical effect.
Objectives: Identify novel ASD loci or to confirm previous CNVs hits.

Methods: CMA analysis was performed in 121 ASD cases (105 cases using an aCGH 180K platform that was previously customized and validated in our lab, and 16 cases using different CMA platforms). All CNVs detected were characterized by size, type, population frequency and gene content. Common polymorphisms (CNVs occurring in more than 1% of the population) or without genes were excluded from further analysis. International Standard Cytogenomic Array (ISCA) and the American College of Medical Genetic (ACMG) standards were taken into account to classify the remaining CNVs as pathogenic, benign, or variant of uncertain clinical significance (VOUS). Finally, our findings were validated in a cohort of 1,029 Brazilian patients with neurodevelopment disorders

Results: CNV analysis in a Brazilian cohort of 121 patients by chromosomal microarray analysis (CMA) revealed 31 potentially pathogenic CNVs. Of these, 26 contained 27 ASD candidate genes and 15 CNVs contained genes not yet described in ASD patients. Two out of these 31 CNVs embraces genes of the cadherin family (*CDH11, CDH8*and *CDH13*). Screening of a Brazilian cohort composed by 1,029 patients with neurodevelopmental disorders revealed one CNV embracing *CDH13*, TRIM16 and *PTPNR2*genes, thus reinforcing the association of *CDH13*with neurodevelopmental disruption. *CDH11*and *CDH8*have been pointed out as possible ASD candidate genes and are listed in SFARI database, but with minimum evidence (score 4; http://sfari.org), however, *CDH13*, which plays an important role in axonal pathfinding and synaptogenesis is not yet included in this database neither suggested as a good ASD candidate.

Conclusions: Our findings suggest that disruption of these cadherin genes may represent a predisposing hit in ASD and CDH13 should be included as a novel ASD candidate gene.

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269 **214.269** Identifying NRXN1 Function during Neural Differentiation of iPSC

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Background: Neurexins are a family of presynaptic adhesion molecules that interact with post-synaptic proteins to regulate synapsis formation and maintenance. NRXN1 mutations have been strongly associated with a range of neurodevelopmental conditions including autism, attention deficit and schizophrenia (Kasem et al., 2017; Shehhi et al., 2018). Specific mutations such us NRXN1 determine autism likelihood but any particular phenotype is an emergent property of regulatory interactions that combines genetic and epigenetic regulation in a functional genome (Karlebach & Shamir, 2008; Huang et al. 2009; Gomez et al. 2011; Vashishtha et al., 2015). For instance, it has been demonstrated that inhibition of NRXN1 in neuronal progenitors derived from iPSC leads changes in the expression of genes enriched that regulate cell biological functions such as cell adhesion and neuronal differentiation, suggesting a potential role for NRXN1 during early neural development (Zeng et al., 2013). Hence, to unravel the molecular mechanism that lead to the autism phenotype in individuals with NRXN1 mutations, it is necessary to identify NRXN1 protein interactions and the cell biological processes regulated by these gene modules during neuronal development.
Objectives:

- To use induced pluripotent stem cells (iPSC) as an *in vitro* system to recapitulate the regulatory interactions underlying the transition from pluripotency to neural competence in humans.
- To capture the early molecular differences of neurotypical and NRXN1 mutated iPSC lines as they undergo during neuronal differentiation.

Methods: We used iPSC lines derived from 3 neurotypical and 3 autistic individuals with NRXN1 deletions and induced neural differentiation by dual SMAD inhibition (2i). RNA was extracted at 6 time points during the initial 12 days of neural induction and cDNA was synthesized to obtain transcriptome data. The expression patterns of NRXN1a, NRXN1b and genes that have been associated with NRXN1 was analysed in control and NRXN1 mutated lines trough real time PCR

Results: NRXN1 is expressed during early neural induction, suggesting a potential role during neural development. We identify a number of genes that are expressed during this stage that might interact with NRXN1 including neuroligins and other adhesion molecules. We detect systematic changes in the expression levels of genes that have been related with NRXN1 in the mutated cell lines compared with control lines undergoing neuronal differentiation. We identify potential cell biological functions regulated by these sets of genes including cell adhesion and neural rosettes formation.

Conclusions: iPSCs provide a novel approach to study the impact of NRXN1 mutations during neural differentiation in humans, highlighting the utility of iPSC model in understanding the functional role of specific mutations that are associated with autism risk. We show that NRXN1 gene mutations can impact biological networks that are important for neural differentiation.

270 **214.270** Modeling the Effect of Diesel Particulate Matter on Human Induced Pluripotent Stem Cell Derived Cerebral Organoids and Mixed Neural Cultures

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Background: Diesel particulate matter (DPM) exposure during fetal development has been implicated in the increased risk of autism spectrum disorders (ASD).[1] However, current methods dissecting the molecular effects of DPM on neural development are often performed in cell lines or non-human models instead of the multicellular environment of the developing human brain. To overcome this challenge, we used a combination of cerebral organoids and adherent differentiated neurons derived from human induced pluripotent stem cells (hiPSC) to study the effect of DPM on human neuronal development. Our data suggest a potential molecular model of DPM action in human brain development.
Objectives: To study the structural and molecular changes to neurons developing within cerebral organoids and mixed neural cultures to better model the impact of DPM on human brain development.

Methods: We used commercially derived hiPSC lines differentiated into cerebral organoids and mixed neural cultures. The cerebral organoids were treated with DPM for a length of ten days after reaching maturation and analysis of gene expression was determined using RNA-seq and immunocytochemistry. The differentiated mixed neural cultures were treated with DPM for 24 hours and analyzed by RNA-seq and immunocytochemistry.

Results: Genes shown to be downregulated (137 genes) in cerebral organoids treated with DPM based on gene ontology analysis (pval <0.05) showed an enrichment in biological processes including regulation of synaptic activity, regulation of Schwann cell differentiation, and axonal transport. Upregulated genes (453 genes) with a biological process enrichment based on gene ontology analysis (pval <0.05) include SNARE complex disassembly and TORC2 signaling. Analysis of cerebral organoids identified several genes differentially expressed of interest in ASD such as *SGCE* (a MECP2 binding target). Other differentially expressed genes include *TBL1XR1* and *KANSL1* that are implicated in intellectual disability disorders. As additional data is collected on the mixed neural cultures we expect to continue resolving mechanisms for DPM.

Conclusions: Diesel particulate matter is a known environmental factor that increases the risk of ASD. The use of hiPSCs derived cerebral organoids and mixed neural cultures show that they can be used to study the environmental effects of DPM on autism, and that organoids can be used as a 3-D model of exposure risk in neurodevelopmental disorders.

[1] Volk, H.E.; Lurmann, F.; Penfold, B.; Hertz-Picciotto, I.; McConnel, R (2013). Traffic related air pollution, pariculate matter, and autism. *JAMA psychiatry. 70*(1):71-77

271 **214.271** Protecting DNA Is a Family Affair: Telomere Length and Cognition in Affected Individuals, Unaffected Siblings, and Parents

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Background: Although not a diagnostic criterion, individuals with ASD commonly experience cognitive difficulties. One possible mechanism is shortened telomeres. Telomeres are repetitive non-coding DNA nucleotides that protect genes by capping chromosome ends and progressively shorten with age. Recently, two reports associated shortened telomere length (TL) with ASD or familial relation. Further, shortened telomeres have been associated with age-related cognitive decline. While previous studies found no relationship between TL and ASD core symptoms, the relationship between TL and cognitive function or sensory symptoms in individuals with ASD and family members is unknown.
Objectives: We aimed to replicate the finding of shortened TL in children with ASD compared to neurotypical (NT) controls, and add new findings concerning TL in unaffected siblings. We investigated relationships between TL, cognition, and ASD-related behaviors in affected individuals, unaffected siblings, and parents.

Methods: Our participants (n=380) included 69 male NT controls (7.1±2.3 years), 108 individuals with ASD (11 female; 8.3±8.4 years), 136 unaffected siblings (66 female; 10.3±7.3 years), and 67 parents (43 female; 38.7±8.4 years). TL of DNA derived from blood leukocytes was determined using an established quantitative polymerase chain reaction method. Cognitive function was measured via Stanford-Binet Intelligence Scale-5, core symptoms via Autism Diagnostic Observation Schedule-2, sensory symptoms via Sensory Profile, and ASD-related behaviors in parents via Broader Autism Phenotype Questionnaire (BAPq).

Results: Among male NT, ASD, and unaffected siblings, there was a significant ANCOVA [$F(2, 232)=6.12$, $p=0.003$], with NT males having longer TL than males with ASD ($p=0.001$) and unaffected siblings ($p=0.05$), controlling for age (Fig. 1a). In a mixed-model, males with ASD were not different from male unaffected siblings [$F(1, 160)=2.48$, $p=0.12$; Fig. 1b], controlling for age. However, when including both sexes (with sex covariate), unaffected sibling's TL were longer than individuals with ASD [$F(1, 232)=5.39$, $p=0.02$], driven by females [$F(1, 70)=4.77$, $p=0.03$]. In individuals with ASD, TL was not related to core symptoms, but negatively related to sensory symptoms [vestibular: $r(86)=-0.27$; $p=0.001$ (Fig. 2a); visual: $r(84)=-0.25$; $p=0.02$; touch: $r(80)=-0.23$; $p=0.03$]. TL was positively related to cognition in parents only [knowledge: $r(44)=0.40$; $p=0.006$ (Fig. 2b); working memory: $r(44)=0.29$; $p=0.05$]. Parent's TL was also positively related to the BAPq aloof domain [$r(41)=0.43$ $p=0.004$].

Conclusions: We replicated shortened TL in individuals with ASD compared to NT controls. This is the first study to demonstrate unaffected siblings' TL is also reduced, but to a lesser degree than their affected siblings, which may be driven by females with ASD. We replicated findings of no relationship between TL and core ASD symptoms, but add new findings of relationships with sensory symptoms. Further, we demonstrate TL is more tightly coupled with cognition in parents, which is concerning for cognitive aging outcomes in affected individuals with reduced TL at young ages. We observed a surprising correlation between longer TL and greater aloof traits in parents, which may reflect a protective mechanism to social stress. Further research is warranted to determine if TL is both a biological mechanism of symptoms in individuals with ASD and a potential treatment target.

272 **214.272** The Autism Speaks Mssng Whole Genome Sequencing Precision Medicine Resource

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Background:
Autism Spectrum Disorder (ASD) is a highly heterogeneous disorder, both in clinical presentation and genetic architecture. There are hundreds of loci associated with ASD with multiple types of rare and common genome-wide variation contributing risk.

Objectives:

We are performing whole-genome sequencing (WGS) of families with ASD to build a resource, named MSSNG, to enable the sub-categorization of phenotypes and underlying genetic factors involved.

Methods:

We have created a cloud database containing WGS data and clinical information which is accessible through an internet portal with controlled access. We are soon releasing data to bring the total number of genomes to over 10,000, including new subjects who are part of the Ontario POND-network, The Quebec Transforming Care Consortium (TACC), the British Columbia iTARGET project, the Autism Phenome Project, the Baby Siblings Research Consortium and Autism Speaks AGRE samples (including The Autism Simplex Collection (TASC)). Data are available for single nucleotide variants (SNVs), small insertion/deletions (indels) and copy number variants, with structural variants (SV; including short repeats), and mitochondrial variants also coming.

Results:

From our first analysis, 61 genes and ~35 copy number variation (CNV) loci were implicated as contributing to ASD risk based on *de novo* or X chromosome single nucleotide variants (SNVs) and small indels, with 18 of these genes identified for the first time. Subsequently, we have focused on the identification and characterisation of smaller CNVs and SVs in 7,231 genomes. We have detected CNVs >1 kb in size using our established pipeline combining ERDS and CNVnator, or from Complete Genomics data, and we are now adding SVs detected using algorithms Manta, LUMPY and DELLY. Of the first 3,427 affected subjects analyzed, 6.6% carry an ASD-risk rare CNV, falling into one of four categories: chromosome abnormalities (0.8%), large CNVs >3Mb (0.9%), CNVs corresponding to known genomic disorders (3%) and deletions at known ASD-susceptibility genes or loci (1.9%). A further 1.7% of subjects have rare duplications impacting ASD-risk genes. All other public exome and WGS data is being incorporated into our MSSNG framework genome-wide data through comparative meta-analysis. To enable functional analysis studies of candidate variants, we have generated 63 iPS derived neuronal lines from individuals with ASD, and their familial controls, and another 25 lines using CRISPR modelling in an isogenic line. We have also consented 308 families (more coming) for connection of participants into local health medical record databases, with the aim of searching for environmental influences, and potential medical trends in the data.

Conclusions:

The Autism Speaks MSSNG project combines high quality WGS data with phenotype information to facilitate researchers of all backgrounds in studies of the genetic architecture of ASD. Further updates expected for the MSSNG resource include improved portal functionalities, phenotype querying capabilities, re-analysis of data with hg38, and inclusion of epigenetic data. Additionally, a subset of the genomes will be included in worldwide data sharing via the Beacon Network.

273 **214.273** Utilizing Extended Families to Prioritize Autism Risk and Protective Variants from Whole Exome Sequencing

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Background: Massively parallel sequencing in autism (AUT) has focused primarily on trio cohorts for identification of de novo loss of function protein coding variants. Extended, multiplex families, with at least one cousin pair with AUT, offer a unique and powerful tool to identify potential new AUT genetic risk loci using identical by descent (IBD) filtering. These pedigrees are likely to carry AUT susceptibility loci of moderate to high effect that may not be identified through de novo identification strategies. Furthermore, using typically developing siblings from these same families we can refine these risk candidate genes to only those with strong effects and identify potentially protective genes segregating in the families.

Objectives: Our study applies WES to extended, multiplex families likely to carry rare, partially penetrant inherited alterations. We hypothesize that separate IBD analysis among AUT individuals and typically developing individuals in these pedigrees will define genomic regions of shared AUT risk or protection and allowing identification of shared risk or protective variants.

Methods: We performed WES on at least two ASD individuals and two typically developing siblings across 14 extended families. Sequencing was performed on the Illumina HiSeq2000 and analyzed through current best practice pipelines including BWA-MEM alignment, quality recalibration by GATK, and variant calling with the GATK HaplotypeCaller. Annotations were applied with ANNOVAR. We determined IBD regions using existing whole genome genotyping data and the MERLIN package first using shared regions in ASD individuals in each family to identify shared risk variants, and then again with non-ASD individuals to identify protective regions. Variants were selected by heterozygous IBD sharing in all ASD (risk) or non-ASD (protective) individuals per family, protein coding effect (non-synonymous), and population frequency (< 5% in the ExAC database). Priority was further determined by removing variants shared with either non-ASD siblings (risk) or ASD siblings (protective).

Results: Filtering for shared risk variants in IBD regions identified 4-123 variants per family and for protective variants yielded 0-96 per family, depending on pedigree structure and resulting IBD region size. After filtering potential risk variants shared by non-AUT individuals there were 0-59 risk variants per family. Similarly, filtering out potential protective variants shared by AUT individuals revealed 0-30 protective variants per family. For risk gene identification, only one gene, *FAAP100* (*C17orf70*), passed all filtering criteria in more than one family. It is highly expressed in the cerebellum though its neuronal function is unknown. Individual families carried risk variants in several high evidence AUT candidate genes (defined by SFARI Gene database) including *ANK2, CIC, NF1, SCN7A,* and *WDFY3*. For protective gene identification, again only a single gene, *SCN9A*, was shared between non-AUT individuals only in more than one family. It is expressed primarily in the hypothalamus and testes and interestingly has been associated with protection against pain and neurodegeneration.

Conclusions: By studying these unique pedigrees, we have identified novel DNA variations related to AUT and demonstrated that exome sequencing in extended families is a powerful tool for ASD risk and protective gene discovery.

Poster Session
215 - Neurological findings
5:30 PM - 7:00 PM - Room: 710

274 **215.274** Simple Reaction Time Performance in Autism Spectrum Disorder and Neurotypical Subjects

M. Mazzucchelli[1], *V. Gariboldi*[1], ***G. Valagussa***[1,2], *C. Perin*[1], *C. Cerri*[1] *and E. Grossi*[2], *(1)School of Medicine and Surgery, University of Milan-Bicocca, Milano, Italy, (2)Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy*

Background: The speed with which an individual is able to make a simple motor response to a perceived stimulus may fairly be regarded as a significant index to his basic level of perceptual-motor integration. Developmental studies on reaction time in subjects with a neurotypical (NT) development report a decrease in simple reaction time (SRT) with increasing age and a strong correlation between upper and lower limb simple reaction time tasks. No studies are available in this regard in Autism Spectrum Disorder (ASD) subjects.

Objectives: The aims of this study are: 1) to assess developmental changes in the speed of a simple reaction at the lower and upper limb in ASD children as they age; 2) to assess the correlation between upper and lower limbs SRT in ASD children; 3) to assess the correlation between lower limb SRT and ankle dorsiflexors muscles strength in ASD children; 4) to compare the results with the same data obtained in a sample of 243 NT

subjects.

Methods: The study sample included 12 ASD subjects (10 males; age range 5 -18 years). The ASD subjects were diagnosed with autism according to the DSM V criteria, confirmed through ADOS-2 and under observation at our Institute. SRT was measured in milliseconds using a hand-held electronic timer and a light as the stimulus and finger or foot lever to trigger responses. The testing of ankle dorsiflexion force was done using a footplate attached to a spring gauge. All the tests employed have been validated for the study of sensorimotor components of balance into the Fall Screen Assessment System.

Results: At variance with NT group we found no significant correlation between both upper and lower SRT and age in ASD study group (upper limb: R Pearson=-0.056, p=0.863; lower limb: R Pearson=-0.065, p=0.841) and no correlation between lower limb SRT and ankle dorsiflexors muscles strength. Instead, similarly to NT group a significant positive correlation between upper and lower limb reaction time tasks was found (ASD: R Pearson=0.819, p=0.001; NT: R Pearson=0.666; p=0.000).

Conclusions: This is the first study that analyses upper and lower limbs SRT developmental variability and its correlation with ankle strength performance in ASD subjects. The absence of a developmental improvement in SRT and the impairment in lower limb SRT tasks found in ASD subjects point out a disorder of sensorimotor integration in ASD subjects potentially responsible for postural control imbalance.

275 **215.275** Simple Reaction Time and Postural Control in Autism Spectrum Disorder Subjects

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Background:
Reaction Time (RT) has been used as biomarker of cognitive performance and of trans-diagnostic phenotype in Autism Spectrum Disorders (ASD). It is also well known that RT is an important component of effective postural control and balance. In this regard few studies have examined the relationship between static and dynamic balance and Simple Reaction Time (SRT) in neurotypical (NT) children and adolescents. No studies are available in this regard in ASD subjects.

Objectives: The three aims of this study are: 1) to assess SRT in a ASD sample 2) then measure the correlation between lower limb SRT and sway tests (ST), maximal balance range test (MBRT) and coordinated stability test (CST) in ASD children; 3) to compare the results with the same data obtained in a sample of 243 NT subjects.

Methods:

The study sample included 12 ASD subjects (10 males). The ASD subjects were diagnosed with autism according to the DSM V criteria, confirmed through ADOS-2 and under observation at our Institute. SRT was measured in milliseconds using a hand-held electronic timer and a light as the stimulus and the activation of a foot lever for responses. We conducted all the postural control tests using a sway meter that measures displacements of the body at waist level. ST is the evaluation of anterioposterior and mediolateral sway as the subject attempts to stand as still as possible for 30 seconds; ST was performed in four different conditions: on the floor with open- eyes, on floor with their eyes closed, on a foam rubber mat with open-eyes and on a foam rubber mat with their eyes closed. MBRT measures the maximum distance traveled from the total forward and backward excursion. CST is the evaluation of errors made by the subject in moving the pen of the sway meter on a predefined track. All the tests employed have been validated for the study of sensorimotor components of balance into the Fall Screen Assessment System.

Results:

The mean age of ASD subjects was 11.67y (SD 4.08y; range 5-18y). Seven out of 12 ASD subjects (58,3%) showed SRT values above the Reference Intervals age related of NT children; four ASD subjects (33,3%) were in and those of 1 subject (8,3%) was lower. We found no significant correlations between SRT and ST values in all the four conditions and between SRT and both MBRT and CST values, while in the NT reference group there was a significant correlation between SRT and ST in 3 of 4 conditions. In the same group SRT performance significantly correlated also with MBRT (R Pearson=-0.245; p=0.000) and with CST (R Pearson=0.644; p=0.000).

Conclusions: This is the first study that analyses correlation between lower limb SRT and postural control performance in ASD subjects. In contrast with results obtained in NT subjects, lower limb SRT are not correlated with sway tests, MBRT and CST values. These findings confirm the presence of deficits of sensorimotor integration and therefore impairment in postural control in ASD children.

276 **215.276** Understanding Early Relationship between Autism Spectrum Disorder, Cognitive Impairment and Epilepsy in Infants with Tuberous Sclerosis Complex: Preliminary Results from the Epistop Project

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Background: Tuberous sclerosis complex (TSC) is a rare genetic multisystem disorder that confers a high risk of early neuropsychiatric conditions. Epilepsy is one of the major issues in TSC and is considered a potential risk factor for autism spectrum disorders (ASD) and developmental delay (DD), but the relationship between autistic traits, epilepsy, and cognitive functioning remains poorly understood. The EPISTOP project is a multi-center prospective European study focused on discovering correlation between epileptogenesis and neurodevelopmental disorders in TSC.
Objectives: The aim of EPISTOP was to compare neurodevelopmental outcome of the infants according to epilepsy variables and timing of antiepileptic treatment; we compared preventive group, in which antiepileptic treatment was started immediately after the first appearance of EEG abnormalities, versus conservative group, in which antiepileptic treatment was administered after the appearance of (sub)clinical seizures.

Methods: 97 TSC subjects were prospectively followed from 6 to 24 months of age with neuropsychological assessment (Bayley Scales of Infant Development and Autism Diagnostic Observation Schedule), in order to evaluate early interplay between developmental level and ASD risk. We

correlated neuropsychological outcome at 24 months with epilepsy variables including history and type of seizures, age at seizure onset/first abnormal EEG, and finally according to type (conservative versus preventive) and response to treatment. Comparisons between groups were performed with two-sample t test, ANOVA models, and Spearman's correlations. An alpha level of 0.05 was used for all statistical analyses, which were performed using SPSS v.23.0 (IBM Corp., Armonk, NY, USA).

Results: Data for the final analysis were available for 82 patients. A cognitive developmental quotient higher than 80 at 6 months of age was able to predict a positive developmental trajectory towards normal developmental level and no ASD symptoms at 2 years of age (p =0.025). ASD rate was significantly higher in patients with a history of epilepsy (p=0.017; risk rate or RR: 6.0), particularly if the onset of seizures was in the first 12 months of age (p=0.025, RR: 2.7). An onset of seizures in the first year of life was also associated with a high risk for DD/cognitive impairment (p=0.001, RR: 4.6). According to type of treatment, in the preventive group 65% of children had normal development at age 24 months, compared to 47% in the conservative group. ASD rate (with or without associated DD) was similar in the two groups (conservative 33%, preventive 30%), but DD without ASD was significantly lower in preventive group compared to conservative group (4% versus 21%; RR 0.6).

Conclusions: ASD presence in TSC was inextricably linked with cognitive level and severe, early onset epilepsy, but these correlations are not sufficient to explain the complex underlying mechanisms of ASD in TSC model. A rigorous, prospective follow-up with EEG and formal developmental assessment is mandatory to identify those infants and children at risk for developmental delay and/or ASD, in order to ensure early referral for parent-mediated implementation and training of cognitive skills and to potentially minimize the impact of these risk factors on ASD outcome.

Poster Session
216 - Novel therapeutic approaches (gene, protein or RNA targeted therapies)
5:30 PM - 7:00 PM - Room: 710

277 **216.277** Pancreatic Replacement Therapy with CM-at Is Associated with Reduction in Maladaptive Behaviors in Preschoolers with Autism.

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Background:
Many children with autism exhibit self-restrictive dietary patterns, particularly avoidance of protein. Previous studies by our group suggest that this behavior may reflect digestive impairment associated with abnormally low levels of the enzyme chymotrypsin in some children with autism (e.g., Heil et al, 2014). Chymotrysin is needed to digest protein, and a lower endogenous level of it results in a reduced ability to break down protein into its component amino acids. As a result of this deficiency, there might be lower levels of amino acids available to synthesize new proteins such as neurotransmitters--which in turn might ultimately affect behavioral status. This deficiency would be particularly problematic in rapidly growing preschoolers. If this digestive insufficiency could be normalized with dietary enzymatic replacement therapy, it may result in improved behavioral function in children with autism.

Objectives:

The objective of this study was to ascertain whether or not behavior (e.g., symptoms of irritability, hyperactivity) in preschoolers with autism could be improved with CM-AT, a pancreatic enzyme preparation.

Methods:

Preschoolers (n=190) ages 3-5 years old, meeting DSM-IV-TR criteria for Autistic Disorder, participated in this randomized, placebo-controlled, 12-week clinical trial of CM-AT. Children entering the trial were required to have a score of ≥11 on the Aberrant Behavior Checklist-Irritability scale (ABC-I). Following a 2-week placebo run-in, children were randomized to either CM-AT (n=92, 71 boys), which was delivered as granules sprinkled on food, or to placebo (n=98, 79 boys), which consisted of visually identical inert sprinkles. The primary outcome measure for this trial was ABC-Irritability (ABC-I). Here we report all the ABC data in this 12-week trial.

Results:

Mixed model repeated measures (MMRM) procedures revealed that children receiving CM-AT (relative to those receiving placebo) demonstrated significant reductions in Irritability (ABC-I: *p*=.038); Hyperactivity (ABC-HA: *p*=.049; Inappropriate Speech (ABC-IS: *p*=.015) over the 12 weeks of the trial. Additional MMRM analyses were performed examining treatment response in a subset of preschoolers (n=69) with higher levels of irritability (ABC-I ≥18+) and greater overall clinical severity (CGI-S≥4) at baseline. In this more severely affected subgroup, the 29 preschoolers who received CM-AT (relative to the 40 who received placebo), the significance of the treatment effects for Irritability and Hyperactivity were even greater than those found in the overall sample (ABC-I: *p*= .022; ABC-HA: *p*=.027). Although reductions in Lethargy/Social Withdrawal (ABC-L/SW) and Stereotypic Behavior (ABC-S) were also noted during the course of this 12-week trial for both the overall sample and for the more severe subsample, no statistically significant treatment effects emerged for these symptoms in this 12-week treatment trial.

Conclusions:

These results suggest that even within the short timeframe of 12 weeks, children with autism who received pancreatic enzymatic replacement therapy with CM-AT demonstrated reductions in maladaptive behaviors commonly associated with autism (e.g., irritability, hyperactivity, inappropriate speech). These effects were even more pronounced in a subset of preschoolers with autism who had higher levels of initial irritability and global clinical ratings of maladaptive behavior. Long-term effects of CM-AT are continuing to be studied in an open label follow-up study.

Poster Session
217 - Pediatrics
5:30 PM - 7:00 PM - Room: 710

278 **217.278** A Systematic Review of Play Based Intervention Effectivity for Children with Autism.

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Background: Autismspectrumdisorders (ASD) are an urgent global mental health problem with a worldwide estimated prevalence of one in 132 individuals. Studies show that up to 64% of the people with ASD have comorbid problems. Parents of children with autism display more mental distress. Children with ASD with co-morbid problems in combination with parental distress influences the parent-child relationship and may significantly interfere with the overall life outcome of people with ASD. Play therapy has been proven effective for children who experience mental health problems. The development of play within children with ASD differs from other children. There are few evidence based play treatments for children with ASD.

Objectives: To determine which forms of play therapy and/or play based interventions are effective on behavioural problems in children with an ASD and their parents.

Methods: A systematic literature search following the PRISMA guidelines. Studies were included if they reported quantitative data on any type of 'play therapy' or 'play based intervention' used within a population of 'children' with 'ASD'.

Results: We identified 69 studies fulfilling our search criteria constituting of 13 RCTs, 54 quasi experimental studies and 2 case studies. Positive outcomes regarding diminished behavioural problems and increased social skills in children with ASD were substantiated by randomized controlled trials (RCT) in seven play based interventions: 1) PLAY project, 2) Developmental, Individual-differences & Relationship-based model(DIR)/Floortime, 3) Lego® therapy, 4) Joint Attention Symbolic Play Engagement Regulation (JASPER), 5) Early Start Denver Model (ESDM), 6) 1-2-3 project and 7) Pivotal Response Treatment (PRT). Another three play based interventions showed positive results through quasi experimental research: 1) Theraplay, 2) Child Centered Play Therapy (CCPT) and 3) Parent-Child Interaction Therapy (PCIT). A large variation in treatment goals as well as in outcome measurements was found within all ten play based interventions. The main outcome measurements constituted of reduced withdrawn social behaviour or tantrums, increased social skills such as joint attention and eye contact and improved language skills.

Conclusions: Although a vast amount of studies regarding play based interventions for children with ASD are available, only a minority comprise RCT's. Future research should focus on evaluating the effectiveness of play based interventions for children with ASD through RCT's, in which parental distress and the parent-child relationship are included to improve the over all life outcome for people with ASD and their parents.

279 **217.279** Are Rates of Autism and Autism Symptoms Raised Among Children with Neurofibromatosis Type-1?

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Background:

NF1 is associated with several developmental and behavioral challenges including ADHD, and intellectual/learning disabilities. It was recently reported that up to 50% of NF1 subjects also meet diagnostic criteria for autism spectrum disorder. However, it is unclear if the increase in autism diagnosis and symptomatology is accounted for by confounding psychiatric features, especially ADHD symptoms.

Objectives:

This study reexamined the association between ASD diagnosis, ASD symptomatology, and NF1.

Methods:

We selected participants aged 5-13 with NF1 (mean age = 9.2; 50% male). Control subjects were matched on age and sex on each participant in a 4:1 ratio to create two control groups of 180 ASD subjects and 180 typically developing (TD) siblings. Participants were evaluated with the CBCL, NICHQ Vanderbilt, Vineland-II, SRS-2, RBS-R, and SCQ. We performed an EPIC search on ICD-10 diagnoses of NF1 and PDD; additionally, medical records of NF1 subjects were abstracted. Comparisons were also performed with data published by the International NF1-ASD Consortium.

Results:

In the OHSU EPIC database, there were 968 patients with an NF1 diagnosis, of whom 20 (2.07%) had a PDD diagnosis and 85 (8.8%) had an ADHD diagnosis.

On measures of autistic symptomatology, the NF1 group scored significantly lower than the ASD group, on both SRS-2 total score (55.8 vs 81.1; p = .001), SCQ total score (6.1 vs 20.6; p = .001) and RBS-R total score (10.4 vs 27.6; p = .001). On the two available measures of autism symptoms in the TD group, TD subjects scored lower than NF1 participants (SRS-2: 44.6 vs 55.8; p = .001; SCQ: 6.1 vs 1.9; p = .001), though the magnitude of the differences were small in comparison to the NF1/ASD contrast. Both groups' means fell under the published thresholds on these two instruments. Moreover, differences were attenuated on all measures when 11 NF1 participants with a comorbid ADHD diagnosis were removed from analysis.

The same pattern emerged with the total externalizing and internalizing scores of the CBCL, with the NF1 group falling between the ASD and TD groups. NF1 participants did not differ from TD siblings for adaptive behavior on the Vineland ABC (99.7 vs 102.3; NS), Daily Living Skills (102.7 vs 100.4; NS), and Socialization (104.8 vs 101.4; NS). However, NF1 subjects had significantly lower scores than TDs on the Vineland Communication score (97.0 vs 106.7; p = .001) although their mean scores were very close to the population mean and were significantly higher than in the ASD group (97.0 vs 75.3; p = .001).

Compared to published consortium data, the mean SRS scores for NF1 were slightly lower (55.8 vs 58.2); remarkably, both means fell well within the normal range of SRS norms.

Conclusions:

This study does not support an association of ASD diagnosis with NF1. There was no evidence of an increased rate of clinically diagnosed ASD in our sample or hospital electronic medical records. Our NF1 sample showed mild elevation of autistic symptomatology on standardized measures, but average scores remained below published cutoffs on these measures.

280 **217.280** Early Identification in Autism: Subtypes Based on Child, Family, and Community Characteristics

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Background: The American Academy of Pediatrics (AAP) screening guidelines highlight the importance of listening closely to parent concerns as an effective strategy to identify children earlier (Johnson & Meyers, 2007). While the AAP guidelines have led to increased rates of developmental screenings and earlier identification of ASD (e.g., Radecki, Sand-Loud, O'Connor, Sharp, & Olson, 2011), many children, especially those considered underserved (i.e., low-income, rural, or racial/ethnic minorities), still receive later diagnoses. Given the immense heterogeneity across autism spectrum disorders (ASD), we investigated subtypes of children with ASD based on parent concerns and socio-demographics.
Objectives: Research questions included: 1) among children with ASD, how do early parent concerns, child (i.e., age and gender), family (i.e., race/ethnicity, socioeconomic status [SES]), and community (i.e., provider access) characteristics group by subtypes, and 2) to what extent do subtypes of children with ASD differ by chronological age at the diagnostic evaluation?

Methods: We performed a secondary analysis with data drawn from a medical university child diagnostic center. The sample included children (n=712) 12 months- 12 years (M=66.68 months; SD= 34.28) who eventually received a diagnosis of ASD. We examined intake information completed by parents prior to the diagnostic evaluation including: 1) parent concerns, 2) child's age, 3) child gender, 4) family SES, 5) race/ethnicity, and 6) access to service providers. For parent concerns, we coded these statements into six categories (adapted from Ozonoff et al., 2009), including: 1) behavior/temperament, 2) cognitive development, 3) speech/communication, 4) social interactions, 5) stereotyped behaviors, and 6) medical. Coders examined percent agreement with 20% of the dataset and achieved 89%. For the first research question, we used latent class analysis (LCA). For research question two, we performed a Kruskal-Wallis H-Test.

Results: After comparing the LCA fit statistics (i.e., Akaike Information Criterion, Bayesian Information Criterion, Adjusted Bayesian Information Criterion, Vuong-Lo-Mendell Rubin, Lo-Mendell-Rubin, entropy) of a two to seven class solution, results revealed a five-class solution fit best. Two subtypes were identified younger (i.e., approximately 3.5 years of age) and were differentiated by communication and medical concerns. One of these younger subtypes included non-white, Hispanic children utilizing Medicaid. Another subtype was identified around 5.5 years and was differentiated by stereotyped and by developmental parent concerns. Lastly, two subtypes were identified at an older age (i.e., approximately 9 years of age) with either cognitive concerns, or social and behavior concerns. One of the oldest subtypes was characterized by females with ASD.

Conclusions: By understanding ASD subtypes based on parent concerns from diverse socio-demographics, we may inform universal screening procedures. Our study suggests that children with speech/communication parent concerns are most likely identified earlier regardless of race, ethnicity, or SES. Whereas, children with social and behavior parent concerns, as well as females were diagnosed later. Future research should examine the distinct subtypes of females with ASD. While certain social and behavior concerns are acceptable during early years of childhood, more research is needed to determine methods to distinguish these types of parent concerns earlier.

281 **217.281** Daily Dental Care, Dental Office Experiences, and Oral Health in Underserved Children with ASD

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Background: Dental care represents one of the most commonly reported unmet healthcare needs for children with ASD, a group vulnerable to excessive plaque, caries, and oral infections. Low socioeconomic and racial/ethnic minority status may further compound this risk, but limited research has focused on oral health in underserved families of children with ASD

Objectives: The present report is drawn from an ongoing clinical trial focused on enhancing daily dental hygiene and oral health outcomes in underserved children with ASD whose parents reported difficulty with dental care. Baseline data are presented to characterize in-home dental care, dental office visit experiences, and oral health status in this unique population, and to examine preliminary associations between health behaviors and oral health outcomes.

Methods: Participants included 112 families of children with ASD (*M* = 7.5, *SD* = 2.7, range = 3.1-13.3yrs) who reported difficulty with dental care. Families exhibited racial and ethnic diversity (45% Non-Caucasian, 39% Hispanic/Latino), and all were underserved (Medicaid-eligible). Children presented with a range of developmental and behavioral functioning (16% with ID; 61% clinical CBCL Total), and ASD symptom severity (ADOS-2 *M* = 7.3, *SD* = 1.8). Parents reported on dental history and in-home dental hygiene. A dental visit yielded standardized oral health measures and dentist ratings of child behavior.

Results: Fifty percent of children had participated in a dental visit within the past year; 20% had never been to a dentist. For the latter group, parental concern about child behavior was the most commonly reported barrier. Of children with a previous dental visit, 56% experienced prior use of physical restraint and 43% received pharmacological intervention. Only 44% of parents described their child's last dental visit as complete. Regarding in-home dental hygiene, parents reported completing child tooth brushing at least once daily an average of 5.1 (2.4) days/week and twice daily an average of 3.1 (2.8) days/week. Fewer families reported attempting (40%) and completing (25%) flossing. Most families reported problems engaging their children in tooth brushing (75%) and flossing (73%). Thirty-one percent of children presented with untreated dental caries (decayed teeth *M* = .92, *SD* = 1.8), which exceeds general population averages, and 52% were rated by study dentists as displaying negative responses to the exam. Interestingly, higher frequency of at least once-daily tooth brushing was associated with poorer quality oral health as measured by the decayed, missing, and filled teeth index, $r = 0.21$, $p < .05$.

Conclusions: Findings reveal heightened risk for unmet dental needs and poorer quality oral health in our sample of underserved children with ASD. The inverse association between dental hygiene and oral health suggests that parents may be attempting to respond to children's increased needs through at-home care. However, parents also reported significant difficulty engaging children in daily dental hygiene, which may result in compromised quality. Follow-up analyses will focus on identifying child and family factors predictive of children's participation in dental care and oral health status. Enhanced understanding of health behaviors and dental experiences is critical to advancing service models and care for this population.

282 **217.282** Do Fetal Biometrics Predict Toddler Measures of Autistic Traits or Language Development?

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Background: The prenatal period is a critical time for development. To date, research has not examined differences in fetal development beyond using the standard measures taken during the ultrasound scan. This is largely due to research being conducted retrospectively, using measures taken at the time of birth or using growth measures from medical ultrasounds. In the Cambridge Ultrasound Project (CUSP) we prospectively measured not just standard fetal markers of fetal growth but also a novel fetal biomarker, anogenital distance (AGD) since this is correlated with prenatal androgen exposure, and androgens are elevated in pregnancies where the fetus is diagnosed with autism postnatally.

Objectives: To test whether markers for fetal growth and novel biomarkers, including AGD, predict autistic traits and language development between 18-20 months of age.

Methods: The sample comprised 150 singleton pregnancies. At the time of abstract submission, 50 of these had completed data (28 males, 22 females). Prenatal ultrasounds were conducted from a research ultrasound between 26-30 weeks pregnancy using a GE 8 Expert Ultrasound system. Fetal head circumference (HC), cerebellum width, and ventricular atrium (VA) measures were taken. HC and cerebellum width were standardised according to UK fetal biometry reference charts. Additionally, anogenital distance (AGD) was measured from the centre of the anus to the base of the scrotum in males, and to the posterior convergence of the fourchette in females. For AGD no biometry reference charts exist, therefore a composite score was created controlling for estimated fetal weight (EFW) for AGD to standardise this measure. Parents were asked to complete the Quantitative Checklist for Autism in Toddlers (Q-CHAT) online when their infant was between 18- and 20-months old, along with the Communication Development Inventory (CDI) as a measure of vocabulary development. Standardised fetal biometry scores were examined against Q-CHAT and CDI scores at 18-20 months. Analysis was carried out separately for each growth parameter and sex. By the Spring, all 150 participants' complete data will be available.

Results: There was currently no significant effect of fetal biomarkers measured between 26-30 weeks gestation, including AGD on Q-CHAT or CDI at 18-20 months.

Conclusions: These preliminary findings suggest there is no association between fetal physical developmental and toddler measures of autistic traits or language development. This may be because the sample is currently underpowered, but the current data is only about one third of the final sample. Complete data will be reported in the poster as the infants turn 18 months. This study will continue to follow these infants' development until they are 24-months old to observe subsequent physical and behavioural development and re-administer the Q-CHAT at this time.

283 **217.283** Dreams in Children with Autism Vs ADHD: Content Recall and Frequency of Emotions

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Background:
The Autism Spectrum disorder (ASD) and the Attention Deficit/Hyperactivity (ADHD) disorder are two highly comorbid neurodevelopmental disorders. Individuals with any of these diagnoses show atypical cognitive functioning, including emotional processing when compared with typically developing (TD) counterparts. Despite a lack of systematic studies, dreams in ASD and ADHD children are thought to differ from those of TD children in various ways. Indeed, children with ASD often struggle to distinguish between mental states of dreaming and thoughts. Moreover, their dreams are more likely to be based on real-life events and thus may be perceived as concrete or realistic. On the other hand, dreams of children with ADHD contain more negative content such as physical aggression. However, their dreams frequency recall is similar to non-ADHD children. The study of dreams in these two groups of children could constitute an opportunity to better understand the physiopathology of neurodevelopmental disorders.

Objectives: The aims of the present study were to characterize the aspects of the manifest dream content in ASD and ADHD children. We also wanted to explore whether or not ASD and ADHD children differed on (1) the easiness to recall their dreams, (2) the cloudiness of dream recall, and (3) the frequency of four basic dream emotions which are sadness, joy, fear, and anger.

Methods: A total of 18 children diagnosed with ASD (11.7 ± 3.7 years, 14 boys) and 18 children diagnosed with ADHD (11.8 ± 3.3 years, 11 boys) filled a dream content self-report. Groups were compared on easiness to recall content (1 = never or impossible to recall, 5 = easy), cloudiness of recall (1 = really vivid, 5 = very cloudy) and the frequency of each of the four abovementioned emotions in their dreams (1 = never, 5 = always present). Results were compared with t-tests. We expected that recall, clarity and emotions would be decreased in the ASD group, while the negative emotions (sadness, fear and anger) would be more present in ADHD group.

Results: The children of the ASD group recalled less their dreams than the ones in the ADHD group (means ± s.d.: 2.0±1.0 vs 2.7±0.9; $t(29)=2.04$, $p<.05$). The content was more cloudy (3.9±1.1 vs 3.0±1.4; $t(29)=2.02$, $p<.05$) in the ASD group. There were no differences on the frequency of emotional items, both groups reporting rarely or seldom sadness, joy, fear, and anger.

Conclusions: Dream recall was less easy and less clear in children with an ASD when compared to ADHD. Comparable results on recall were published in ASD adults compared to a group of neurotypical individuals. The two groups of children did not differ on the frequency of emotional items, both displaying low scores. The samples were biased with more boys than girls, reflecting the clinical environment. The results possibly reflect an altered processing of emotional load in dreams of children with various neurodevelopmental disorders.

284 **217.284** Clinical Characteristics of Patients with Autism Spectrum Disorder Referred to a Pedopsychiatric Sleep Clinic

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Background: Sleep disorders are frequent in children with an Autism Spectrum Disorder (ASD), with prevalence estimates as high as 80%. Even though sleep disorders increase diurnal symptoms and constitute a significant burden for the entire family, little is known about the clinical characteristics of these children.
Objectives: To describe the clinical characteristics of 250 ASD children referred to a specialized pedopsychiatric sleep clinic.

Methods: We reviewed the medical charts of 250 children with ASD referred to the sleep clinic of a child psychiatry hospital (mean age = 10.8±2.9 years, 76.8% boys). Specialty of the referring physician, diagnoses, medication and scores on the Children Sleep Habits Questionnaire (CSHQ) upon arrival, as well as sleep disorders after assessment at the clinic were extracted for analyses.

Results: The majority of patients were either referred by a pediatrician (42.8%) or a psychiatrist (38.4%). Half of patients (52.0%) had another diagnosis, the most frequent being Attention Deficit Hyperactivity Disorder (20.0%) and Intellectual Disability (12.0%). Upon arrival to the sleep clinic, 112 patients (44.8%) were taking prescribed medications, the most frequent being psychostimulants (18.8%), antipsychotics (12.4%), and antidepressants (10.4%); more specifically at bedtime, antipsychotics were the most frequent prescribed medication while 119 patients (47.6%) were taking melatonin. Among the 145 patients who filled the CSHQ, 138 (95.2%) reached or exceeded the clinical cut-off score of 41; the total observed scores ranged from 33 to 74. The most frequent confirmed sleep disorder was insomnia (21.6%), followed by parasomnias (9.6%): somniloquy (6.8%), bruxism (6.0%), restless legs syndrome or periodic limb movements during sleep (5.2% and 7.2%, respectively), obstructive and central sleep apnea (2.0% and 1.6%, respectively), somnambulism (2.0%) and confusional arousals (2.0%). Atypical EEG during sleep was found in 2.8%. There were no confirmed cases of hypersomnia or narcolepsy, circadian disorders or nocturnal eating disorders.

Conclusions: These data point towards salient features of ASD children presenting at a sleep clinic: most referring MDs are specialists, half the ASD patients have at least one additional psychiatric diagnosis, and the most frequent sleep disorder is insomnia. The proportion of patients with insomnia clearly exceeds the prevalence published for neurotypical children, while the prevalence of sleep apnea is similar to published prevalence in the general pediatric population. Antipsychotics being the most prescribed medication at bedtime is worrisome.

285 **217.285** Heightened Emotional Eating Behaviors in Children with Autism Are Modulated By Gender.

***E. Richard**, M. Nadeau, A. J. Wolff and G. L. Wallace, The George Washington University, Washington, DC*

Background: There is substantial risk for obesity among children and adults with autism spectrum disorder (ASD). There is emerging evidence that overeating behaviors are more common in ASD and might contribute to this obesity risk in ASD. To date, study of food approach behaviors in ASD has not included emotionally mediated eating. Furthermore, although phenotypic sex differences in ASD are gaining recognition, they have yet to focus on eating behaviors.
Objectives: Examine the roles of emotional valence and gender on eating in a sample of children with ASD and typically-developing (TD) children.

Methods: Parents of 231 (145 male) 4- to 17-year-old (mean=8.46, SD=3.31) children (153 with ASD and 78 TD) completed questionnaires about their children's eating habits. Parent ratings of emotional eating behaviors were obtained using the Eating in the Absence of Hunger questionnaire

(EAH) and Child Eating Behavior Questionnaire (CEBQ). Body mass index (BMI) was calculated using parent report of age, height, and weight using CDC norms. Specific subscales of the EAH included Negative Affect, and Fatigue/Boredom. Subscales of interest in the CEBQ were Emotional Over-Eating and Emotional Under-Eating.

Results: The ASD group had a significantly greater male:female ratio than the TD group (chi square=13.91, p<.001). Children with ASD were much more likely than TD children to exhibit over-eating behaviors linked to Negative Affect (t=5.33, p<.001) and Fatigue/Boredom (t=2.42, p=.01), and more likely to exhibit both emotional over-eating (t=7.19, p<.001) and emotional under-eating (t=5.65, p<.001). There were significant interactions between diagnosis and sex (Fs>4.23, ps<.05) for the over-eating related variables. While the neurotypical sample presented no gender differences on any of these measures (*ns*), females with ASD were significantly more likely than males with ASD to exhibit Negative Affect related over-eating (t=2.76, p=.006), Fatigue/Boredom related over-eating (t=2.86, p=.006), and general emotional over-eating (t=3.03, p=.003). Interestingly, there were no significant correlations (*ns*) between any of these eating-related ratings and BMI in the ASD group, but in the TD group BMI was significantly correlated with emotional over-eating (r=.28, p=.02).

Conclusions:

To our knowledge, this is the first study to examine emotional eating behaviors (overall and their potential gender differences) in children with ASD. Parents rated emotional eating behaviors as much more common in children with ASD than in TD children. Furthermore, emotionally mediated food approach behaviors were more common in girls than boys with ASD, while no gender differences in these behaviors emerged in the TD children. None of these eating-related metrics was significantly correlated with BMI in the ASD group. This suggests that the reason for eating, but not necessarily the quantity of eating, is more strongly linked to emotions in children with ASD than in TD children, and most strongly in girls with ASD. One possible interpretation is that the act of eating serves as a socially-acceptable "stimming" (self-comfort through self-produced sensory input) behavior. Because females with ASD are more likely to "camouflage," or to mimic neurotypical behavior (Rynkiewicz et al., 2016), albeit at considerable mental "cost," eating may be an especially desirable stimming outlet for females.

286 **217.286** Identifying Correlates of Adaptive Functioning in Children and Adolescents with Neurodevelopmental Disorders: A Pond Network Investigation

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Background: Children and adolescents with neurodevelopmental disorders (NDDs), such as autism spectrum disorder (ASD) and intellectual disability (ID), have deficits in adaptive functioning that impair their ability to meet every day needs. Evidence consistently demonstrates IQ alone does not predict adaptive functioning in individuals with ASD and very few studies have examined correlates of adaptive functioning across NDDs. Given that NDDs may share underlying neurobiological mechanisms, better understanding of adaptive functioning and its correlates across NDDs can aid treatment planning and outcome monitoring.

Objectives: To examine the association of both NDD categorical diagnoses and dimensional NDD traits cutting across diagnoses on adaptive functioning.

Methods: Study data were obtained from the Province of Ontario Neurodevelopmental Disorders (POND) Network. Sample consisted of 2258 participants aged 3-18 years who are typically developing (n=364) or have clinical categorical diagnoses of ASD, ADHD, OCD, or ID. Behavioural variables-of-interest were obtained from psychometrically validated subscales of Social Communication Questionnaire (SCQ), Repetitive Behaviors Scale–Revised (RBS-R), Toronto Obsessive-Compulsive Rating Scale (TOCS), Strengths and Weaknesses of ADHD Symptoms and Normal Behavior Rating Scales (SWAN), and Child Behavior Checklist (CBCL). Adaptive functioning in conceptual, practical, and social domains was measured by the Adaptive Behavior Assessment System, 2nd Edition (ABAS-II). Elasticnet regularized regression was performed in R. False discovery rate correction was performed on approximate t-statistics to identify significant correlates across all regression outcomes.

Results: Having an ASD diagnosis and exhibiting higher levels of inattention were significant correlates of poorer adaptive functioning across all three domains. Severity of restricted interests in behaviour (measured by RBS-R) and repetitiveness (measured by SCQ) both had significant negative effects in conceptual and social domains.

Conclusions: An ASD diagnosis and dimensional traits of inattentiveness and repetitiveness are most associated with poorer adaptive functioning in children and youth. Increased understanding of adaptive functioning and specific correlates across NDDs can lead to better clinical assessment, tailored interventions, and improved transition to adulthood for children and adolescents with NDDs.

287 **217.287** Is Using Food As Reward in Children with Autism Associated with Increased Food Responsiveness?

A. J. Wolff, *E. Richard, M. Nadeau and G. L. Wallace, The George Washington University, Washington, DC*

Background:

Children with Autism Spectrum Disorder (ASD) are at elevated risk of being overweight and obese (Curtin et al., 2014). Parents use food commonly as a reward for their children's behavior; however, this is particularly common practice among children with ASD, through approaches such as applied behavior analysis. Research has found a correlation between parents who use food as a reward for their typically developing (TD) children and responsiveness to food and emotional eating (Farrow, 2016). This study seeks to be the first to examine this relationship in children with ASD and whether this relationship is modulated by picky eating status.

Objectives: Determine if parents of children with ASD use food as reward more often than parents of TD children and if food reward usage is correlated with food approach behaviors.

Methods:

Parents of children with ASD (n=153; M age = 8.9; 109 males) and TD children (n=78; M age = 8.3; 36 males) filled out online questionnaires about their children's eating habits and health. Parent utilization of foods as rewards was assessed using the Child Feeding Questionnaire (Birch et al., 2001) while food approach behavior was assessed using the Child Eating Behavior Questionnaire (CEBQ; Wardle et al., 2001). The CEBQ provides

measures of three relevant appetitive traits: food responsiveness, emotional overeating, and enjoyment of food. Picky eating was assessed using an item from the Eating Habits Survey (Wilde et al., 2012).

Results:

Parents of children with ASD reported greater usage of foods as rewards than parents of TD children (t=2.15, p<.05). Food reward utilization was positively correlated with two of the three food approach appetitive traits among all children with ASD: food responsiveness (r=.26, p=.001) and emotional overeating (r=.36, p<.001). However, when splitting the ASD group into picky eaters vs. non-picky eaters, the association with using food as reward and food responsiveness was accentuated in non-picky eaters (n=65; r=.37, p=.003) and disappears among picky eaters (r=.07, p=.54).

Conclusions:

Parents of children with ASD rated themselves as more likely to use food as a reward than parents of TD children, and the frequency of this food reward utilization was positively associated with food approach appetitive traits (i.e., food responsiveness and emotional overeating). Importantly, the link between using food as reward and food responsiveness was not found among picky eaters with ASD suggesting modulatory effects. Given the risks for overweight and obesity in ASD and its health consequences (e.g., cardiovascular health, diabetes, etc.), it is critically important to strive to use non-food-related methods of rewarding children with ASD, so as to try to lower the risk for developing appetitive traits that place children at risk for becoming overweight/obese.

288 **217.288** Medical Resident Needs for Training in Autism Spectrum Disorder: Comfort Level and Scope of Practice in Primary Care

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Background: The increased prevalence of autism spectrum disorder (ASD) and documented benefits of early intensive intervention have created a need for flexible systems for determining eligibility for autism-specific services. Given that most concerns for ASD initially present in primary care, pediatricians play an important role from first concerns to follow-up care. Unfortunately, many practicing pediatricians feel ill-equipped and uncertain assessing diagnostic risk and management of children with ASD.

Objectives: During development of a service system intervention introducing enhanced learning opportunities for residents in our pediatric residency program, we conducted the current study to assess the confidence of residents with regard to ASD screening, diagnosis, and follow-up care for ASD, in relation to other common concerns seen in primary care. This in turn helped identify potential training targets for our DBP rotation.

Methods: We designed an 18-item survey based on review of existing literature on physician and resident comfort level with a range of presenting concerns. Specific to ASD, residents were asked to rate the importance of education about ASD to their career, how strongly they felt that ASD concerns should fall within their scope of practice, their confidence in their ability to distinguish between ASD and other delays, their proficiency at using ASD screening tools, and their ability to connect families to specific services. Residents also completed rating scales assessing their confidence in providing care for patients presenting with ASD versus other common medical and developmental/behavioral concerns that present in primary care. Specifically, they rated their confidence in their ability to a) screen for and identify symptoms, b) communicate effectively about concerns, c) definitively diagnose, d) treat/manage symptoms, and e) facilitate follow-up care.

Results: Fifty-one residents completed REDCap surveys. Residents were significantly more confident in their skills with respect to caring for patients with other common concerns than for patients with ASD including significant differences in their perceived ability to diagnose, communicate with families about, treat/manage, and facilitate follow-up care. Of the 80% of residents that reported proficiency using screening tools for ASD, 68% answered that they had no/low confidence in distinguishing ASD from other delays, and 56% reported no/low confidence in formally diagnosing ASD. Of those residents who reported career plans in primary care, 92% indicated that further training and education about ASD is important/very important to their careers with 93% indicating that they moderately/very strongly feel that ASD concerns should fall within their scope of practice. For the residents in their last year of residency, 80% believed ASD concerns should fall within their scope of practice (regardless of career plans), but only 25% reported moderate/high levels of confidence in distinguishing ASD from other delays, and only 45% reported moderate/high levels of confidence in diagnosing ASD.

Conclusions: Pediatricians are the central figures within the medical home, which is increasingly functioning as the entry point for developmental and behavioral health intervention. In this capacity, enriching pediatric resident education through expanded training and experience in ASD detection and management will likely yield enhanced perceptions of care for providers and families alike.

289 **217.289** Predictors of Improved Adaptive Skills in Children with Autism Spectrum Disorder

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Background:

Although different modalities and intensity of early intervention services for Autism Spectrum Disorder (ASD) have been well studied, research on other modifiable variables prior to early intervention is limited. In Singapore, regular, long-term early intervention is provided for children with suspected ASD and other developmental disabilities from ages 0 to 7.

Objectives:

The aim of this study was to identify specific modifiable factors prior to early intervention and socioeconomic (SES) factors that are predictors of better outcome in children with ASD.

Methods:

Consecutive patients with ASD aged 5-year, 0-month to 7-year, 11-month were recruited from a tertiary developmental program in Singapore from August 2016 to July 2018. ASD diagnosis required a psychologist administered Autism Diagnostic Observation Schedule (ADOS) and an Autism Diagnostic Interview- Revised (ADI-R) with consistent clinical history and behavioural observations. The consent rate was 86.3% (N=199). Exclusion criteria were 1. Vision or hearing loss; 2. Significant neurological co-morbidity (cerebral palsy, epilepsy); and 3. Children with genetic syndromes. Parents of these children provided information on demographics, SES indicators and early intervention details (such as wait time and intensity).

The primary outcome was the Vineland Adaptive Behaviour Scales (VABS) Adaptive Behaviour Composite (ABC) score completed by a psychologist. Descriptive statistics were used to analyse family SES and early intervention factors. Using adaptive skills as the outcome, linear regression models were applied to determine significant correlates; specifically on variables prior to early intervention.

Results:

The sample consisted of 84.0% males, with a racial distribution similar to that of Singapore's general population (Chinese 67.7%, Malay 18.7% and Indians 4.5%). Mean age of the subjects was 6 years and 3 months (74.4 months, SD 13.1). Mean age at ASD diagnosis was 3 years and 5 months (41.4 months, SD 9.3). Mean VABS ABC standard score (mean 100, SD 15) was 77.8 (SD 15.9). Mean wait time for regular early intervention was 6.3 months (SD 3.0) and mean intensity of early intervention was 8.1 hours/week (SD 4.1). Linear regression showed that wait time for early intervention services was a strong predictor of the VABS ABC score after controlling for other child and parent variables (β=-1.14, p=0.03). Significant covariates also included maternal education (β= 5.39, p=0.04) and total score on the ADOS (β=-1.93, p=0.01).

Conclusions:

Wait time for early intervention services is a modifiable risk factor that can predict outcomes in children with ASD. When planning for early intervention services for these children, factors that reduce wait time should be a priority. Children from families with lower maternal education are at risk for poorer outcomes; hence ensuring an appropriate intervention plan for these children is of crucial importance.

290 **217.290** Revisiting a "WAIT and SEE" Mindset to Improve Early Intervention Referrals

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Background:

Advances in early screening and diagnosis make it feasible for experienced clinicians trained on validated tools to diagnose ASD by 18-24 months of age (Guthrie, Swineford, Nottke, & Wetherby, 2013). In spite of this, the median age for Autism Spectrum Disorder (ASD) diagnosis in the US is 4-5 years (Baio et al 2018), far beyond the window of opportunity for early intervention (EI).

There is often a delay between suspecting concerns and receiving services (Harrison & Roush, 1996). Many believe children will outgrow concerns (Wall et al., 2005). Building on the literature, a quasi-experimental design is used for an IRB-approved study of Primary Care Providers' (PCP) and parents' views on a ***'wait and see'*** mindset.

Objectives:

To determine whether and why some families and PCPs decide to wait before referring children with signs of delay for EI services and to gather suggestions for how to increase the willingness of PCPs and families to refer early.

Methods:

Parents of children with autism, some receiving EI, were sent an online survey and asked to participate in a phone interview. PCPs affiliated with a pediatric organization in a metro area were sent an online survey to complete.

Questions focused on: extent to which PCPs and families are using a 'wait and see' approach for developmental concerns; knowledge of and attitude towards EI/Part C

Results:

Family survey

- Completed by 13 of 50 families (26% response rate); additional surveys will be collected until April 2019
- 6 families consenting to a phone interview will complete a standardized qualitative interview by April 2019
- 10 of 13 had concerns about delay prior to age 2
- 11 of 13 relied on their PCP to make the referral
- Most believed their child would outgrow the problem

Primary Care Provider survey

Completed by 72 of 210 providers (34.30% response rate)

PCPs' views on '***Wait and See***':

- Families more likely to have this mindset (n = 40; 55.60%)
- Both tend to equally have this mindset (n = 18; 25.00%)
- PCPs more likely to have this mindset (n = 7; 9.70%)
- Neither have this mindset (n = 7; 9.70%)

PCPs admitting to personally taking this view:

- I have used 'wait and evaluate further' (n = 41; 56.90%)
- I have taken a 'wait and see' approach (n = 19; 26.40%)
- I have not been in this situation (n = 8; 11.10%)
- 1 BLANK; 3 who marked both 'wait and see' and 'wait and evaluate further'

Conclusions:

Family responses indicated that they might have sought a referral earlier if they had a better understanding of the signs of autism or developmental delay and that early intervention could help their child gain important skills. Families stated that they wished they had been aware of services that were available for their child/family.

PCP responses indicated a need for more training during residency and practice in early recognition of signs of autism, along with more time for

developmental screening.

291 **217.291** The Child Can't Chew: Another Reason for Selective Eating

***S. Asquith**, Carolina Speech & Language Center, Inc., Summerville, SC*

Background: Sally Asquith, MS, CCC-SLP, is the owner/executive director of Carolina Speech & Language Center near Charleston, SC. She has extensive experience with Pediatric Feeding Disorders, has been accepted for Board Certification in Swallowing/Swallowing Disorders, and is on the Executive Council of the International Association of Pediatric Feeding and Swallowing Disorders. In the course of treating children with ASD who were highly selective eaters, avoidant, and neophobic, the role of arrested oral-motor skills became a clear aspect of the feeding disorder. Reliance on soft, non-resistant foods is a typical hallmark upon intake. Children remain fixed on these foods due to a number of factors such as habit, neophobia, "sticky attention" with packaging, AND failure to advance the necessary mechanics to lateralize and crush age-appropriate foods. This poster aims to raise awareness of this issue, commonly overlooked by physicians, other professionals, and parents.
Objectives:

- Review current literature pertinent to the role of oral-motor development to the diagnosis and treatment of PFD in autism, as seminal textbooks (J Arvedson & L Brodsky; SE Morris; J Sheppard) advise.
- Complete a 5-year retrospective chart review of ASD patients with PFD in an outpatient clinic.
- Assess the incidence of poor oral-motor skills as an “unsung villain” and key variable in dx and tx of PFD in ASD.

Methods:

- Literature review
- Review all intake evaluations in a 5-year period
    - Code for oral-motor/chewing skills age-equivalent
    - Code for absence or presence/type of aversive reaction

Results:

- While there is an abundance of studies exploring behavior management of PFD and selective eating in autism, and there are also numerous studies on poor chewing/poor oral-motor in the neurotypical adult population, studies are minimal at best in examining the role of mechanics and ability to manage age-appropriate foods safely in pediatrics.
- 80% of pts with autism and PFD in chart review had significant oral-motor deficits, regardless of age.
- 60% of cases were also positive for aversive reactions

Conclusions:

Functional mechanical deficits are a key aspect of PFD in autism, across ages, and should be a basic consideration when diagnosing and treating selective eating.

292 **217.292** The Impacts of Sensory Processing Function and Emotional and Behavioral Problems on Self-Care Performance in Children with Autistic Spectrum Disorder

***C. T. Lin**, S. Y. Shen and C. Y. Huang, I-Shou University, Kaohsiung, Taiwan*

Background:
Self-care performance is increasing important to preschool children with autistic spectrum disorder (ASD) as they grow up. Participating in self-care activities facilitates children's cognitive and motor developments. Moreover, being independent in self-care performance archives children’s sense of accomplishment and self-confidence, and decreases caregiver’s caring burden and lowers parenting stress. Children with ASD often have sensory processing dysfunction and emotional and behavioral problems which might affect children’s performance in self-care. However, a lack of studies has investigated the impacts of these two critical child factors on self-care performance.

Objectives:

This study aimed to investigate the impacts of sensory processing function and emotional and behavioral problems on self-care performance in 3-6 year-old preschool children with ASD.

Methods:

The Item bank of computerized adaptive test (CAT) for measuring self-care performance (the CAT-SC) was used to assess self-care performance. Social Responsiveness Scale™ (SRS™-2) was used to identify ASD severity levels. The short form of Sensory Profile (SSP) was used to assess sensory processing function. The Child Behavior Checklist (CBCL) was used to assess emotional and behavioral problems. The multiple regression model was used to investigate the effects of sensory processing function as well as emotional and behavioral problems on self-care performance. The dependent variable was the total score of the item bank of the CAT-SC, and the independent variables included children’s age, sex, the total score of the SRS™-2, the total score of the SSP and the total score of the CBCL.

Results:

A sample of 33 preschool children with ASD was recruited in the study (mean age= 4.84, SD= 1.14), with 28 boys (84.8%) and 5 girls(15.2%). Most of the children had severe ASD (n=16, 48.5%). The stepwise multiple regression model revealed that children’s age (standardized β=0.71) and emotional and behavioral problems (standardized β=-0.44) were significantly related to children’s self-care performance (p<.01). That is, the older children had better self-care performance. On the other hand, children with more emotional and behavioral problems had poorer self-care performance.

Conclusions:

Among five critical child factors, only children's age and emotional and behavioral problems significantly related to self-care performance, which could serve as intervention guide for clinicians. Moreover, ASD severity levels and sensory processing function had no significant associations with self-care performance. This may be because of insufficient sample size of our study, which my need further research to investigate the associations between sensory processing function and self-care performance.

Poster Session
218 - Service Delivery/Systems of Care
5:30 PM - 7:00 PM - Room: 710

Health Care Utilization Patterns of Adults with Autism Spectrum Disorder in a Safety-Net Hospital

ABSTRACT WITHDRAWN

Background: Autism Spectrum Disorder (ASD) has become increasingly prevalent with the most recent CDC data stating that 1 in 59 children aged 8 years have been diagnosed with ASD (Baio, 2018). Despite the increasing prevalence of autism, there are few published studies analyzing healthcare utilization patterns in adults with autism. Based on data from Kaiser Permanente, Zerbo et al. compared healthcare utilization and costs among adults with ASD, adults with ADHD, and adults with neither condition (Zerbo et al 2018), and found that the utilization and costs of healthcare services among adults with ASD are higher than adults with ADHD or adults with neither ADHD nor ASD (Zerbo et al 2018). We aimed to better understand the utilization patterns for adults with autism in a safety-net hospital.
Objectives:

This study aims to identify the utilization patterns of different healthcare services among adults with ASD at Boston Medical Center (BMC).

Methods: The study population was retrieved from the clinical data warehouse of Boston Medical Center (BMC), which contained BMC patient data only. Adults 23 years of age and up at the time of any medical encounter were eligible for inclusion. Patients flagged with autism codes ICD-9 ([ICD-9 299.0] Autistic disorder; [ICD-9 299.1] Childhood disintegrative disorder; [ICD-9 299.8] Asperger's disorder; [ICD-9 299.9] Pervasive developmental disorder) and ICD-10 codes ([ICD-10 F84] Pervasive developmental disorder; [ICD-10 F84.0] Autistic disorder; [ICD-10 F84.2] Rett's syndrome; [ICD-10 F84.3] Other childhood disintegrative disorder; [ICD-10 F84.5] Asperger's disorder; [ICD-10 F84.8] Other pervasive developmental disorders; [ICD-10 F84.9] Unspecified pervasive developmental disorder) in the past ten years on either the problem list or the encounter were extracted from the database, and their encounters at BMC during 2017 were further retrieved as the sample data. The study included 304 adult patients, who made a total of 1,953 visits to BMC in 2017.

Results:

Of the 304 adult patients, 73 patients visited BMC once, and 64 patients visited twice in 2017. 62 adult patients had 10 or more encounters at BMC, and 2 had over 60 encounters. The total 1,953 encounters were broken down into four different visit types: outpatient (86%), inpatient (2%), emergency (10%) and other (2%). "Other" includes: observation, pre-admit, pre-clinic, recurring, and same day care visits. In addition, we identified the top 5 most frequently visited departments by number of encounters as follows: Psychiatric Clinic (227), Adult Emergency Department (180), Primary Care (152), Social Service Office (118), and Family Medicine (110).

Conclusions:

The average number of encounters per patient is 6.4, and 20% of the adult patients had 10 or more encounters in 2017. The most frequently visited departments were Psychiatry Clinic, Adult Emergency Department, and Primary Care. This information is helpful in informing efforts aimed at better supporting adults with ASD.

293 **218.293** Exploration of a Community-Based Early Intervention for Diverse Children with Autism

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Background: Despite the efficacy of early intensive behavioral intervention (EIBI) for children with autism spectrum disorders (ASD), little is known about the feasibility of implementing EIBI services for a broad and diverse community. The present paper describes and explores a model of EIBI that was designed with community dissemination as a primary objective. The Michigan State University Early Learning Institute (ELI) is a community-based EIBI model that provides comprehensive programming for low-income children with ASD and their families. Although affiliated with a university, the ELI is a stand-alone collective of EIBI centers that serves children with ASD within existing early childhood centers (e.g., preschools) near their home communities. The ELI started with a single center serving eight children within an inclusive learning environment, where children with ASD could interact with typically developing peers at a very young age. The ELI quickly expanded services in a manner that maintained the intensive and inclusive qualities of the original program. There are currently three MSU ELI sites in mid-Michigan with XX children served over 3.5 years. The ELI is a unique EIBI program in that it emphasizes services for low-income children and families, is built into communities, maintains consistent services, and emphasizes inclusive therapeutic services in preparation for public school.
Objectives: This exploratory study describes the feasibility of implementing an inclusive EIBI program within community settings, primarily for low-income children with ASD. The specific objectives were to assess the likelihood of low-income families to enroll children in the program, evaluate adherence to treatment by calculating utilization over one year, and compare preliminary outcomes to those observed in prior EIBI literature.

Methods: Observational methods were used to assess the utilization of the ELI program among low-income families. A single group pre-test post-test design was used to assess for changes among children with ASD enrolled in the ELI following one year across several outcome measures including: the *Mullen Scales of Early Learning*, the *Vineland Adaptive Behavior Scales*, the *Social Responsiveness Scale – 2nd Edition*, and language samples.

Results: There were 31 spaces available for families to enroll their children at the ELI during the study period. Low income children were enrolled into 22 of the 31 spaces. Total utilization among low income children was a mean of 85% (range, 80% to 94%). A dependent samples t-test will be

used to test for change on outcome measures.

Conclusions: Preliminary data suggest the ELI has potential as a model for delivering EIBI to low-income children with ASD in community settings. Utilization among low-income families was substantially higher than levels observed in prior research, suggesting the ELI model may be accessible to diverse families. Children demonstrated gains on standardized measures, though these gains were less than those observed in highly controlled research studies. Implications of utilization and outcomes will be presented.

294 **218.294** Improving Access for Autism Diagnosis in Toddlers from a Multi-Cultural and Underserved Community

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Background: Toddlers from families in underserved and low socioeconomic areas have difficulties accessing Autism Spectrum Disorders (ASD) diagnostic evaluations and treatment services in a timely manner. This can lead to sub-optimal outcomes. Furthermore, language and cultural barriers add to further delays.

Objectives: To improve access to autism diagnostic and treatment services in an underserved and multicultural community in Massachusetts (Worcester), while integrating a new level two screening test, the Rapid Interactive Screening Test for Autism in Toddlers (RITA-T) was introduced in an Early Intervention (EI) program. Current wait time for an autism evaluation in those below the age of three years old is 3-5 months.

Methods:

The RITA-T consists of nine interactive activities that evaluate developmental constructs delayed in toddlers with risk of autism. The RITA-T takes approximately ten minutes to administer. The language and commands integrated in the test are simple and do not require an advanced knowledge of the English language for comprehension. Four Early Intervention (EI) providers from the largest EI program in Worcester, THOM EI, were trained on the RITA-T. They administered the test to those who either had a positive Modified Checklist for Autism in Toddlers, Revised (MCHAT-R) or behavior concerns for ASD. Following screening, the toddler and his/her family were referred for further comprehensive testing by a diagnostic team in a tertiary care center. Those provided with an ASD diagnosis were referred to Applied Behavioral Analysis (ABA) services. Opportunities for follow up were offered for all.

Results: A total of 81 toddlers (78% male) were evaluated. Of the 81 toddlers evaluated, 58% were white, 20% were Hispanic, 15% were African-American, and 7.4% were Asian. The average age at screening was 27.4 months and the average time elapsed between RITA-T and final diagnosis was 42 days for children diagnosed with ASD, down from 3-5 months wait time. Referrals doubled to the local ABA provider, and age at referral decreased from 30 to 28 months.

Conclusions: The RITA-T is a useful Level 2 autism screening test that improves access for diagnosis and treatment for those in multicultural and underserved communities. Decreased wait times and expedited referrals to services improves outcome. Generalization of this model to other EI programs is underway in MA.

295 **218.295** Improving Access to Rural Mental Health Services Specific to Autism Spectrum Disorder

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Background: Autism Spectrum Disorder (ASD) is a developmental disorder comprised of deficits in social communication and the presence of restricted interests and repetitive behaviors (APA, 2013). It is estimated to impact 1 in 59 children in the U.S. (Baio et al., 2018), affecting the individual's developmental trajectory in communication, social competence, and adaptive behavior. Early identification and intervention can improve outcomes for children with ASD (National Research Council, 2001), but access to such services is not equal across all demographic groups. Rural communities face significant challenges regarding the availability and adequacy of services for children with ASD due to various barriers. Specifically, the Appalachian Region is highly underserved as seen through numerous indicators such as higher mortality rates, higher number of unhealthy days, higher rates of obesity, and higher poverty rates.

Objectives: The current study aimed to identify barriers and strengths of rural communities in Southwest Virginia through mixed-methods analysis.

Methods: Quantitative and qualitative data were collected from questionnaires and focus groups, respectively, completed by caregivers and service providers. Six focus groups were conducted (3 with caregivers and 3 with providers) from the Mount Rogers Community Services Board catchment area, in Galax city, Smyth county, and Wythe county of Virginia. Caregivers included parents and grandparents of children with ASD aged 5-21 years. Providers included professionals who provided treatment/supports for children with ASD.

Total participants consisted of 15 caregivers and 33 providers. Caregivers reported on barriers related to accessing ASD services, as well as types of services that they perceived were important but lacked. Providers reported on their barriers with providing services, difficulties of their clients accessing ASD services, and the types of services that they perceived were important but lacked availability.

Results: Quantitative findings indicated that caregivers had difficulties accessing ASD services due to *few providers available* (66.7%), *few providers with ASD knowledge or training available* (66.7%), *geographic isolation* (40%), and *affordability* (40%). Additionally, providers reported that they had difficulty providing ASD services due to *lack of resources* (48.5%) and *lack of ASD knowledge* (39.4%). Qualitative findings indicated that this region lacks 1) sufficient resources for ASD diagnosis and treatment, and therefore more providers are needed, especially with specific training in ASD, 2) sufficient information, educational, and training resources, and therefore caregivers need additional education related to autism and what it entails, 3) sufficient personal support resources for caregivers, and therefore caregivers struggle with child behavior and mental health (social skills, communication, aggression, anxiety, trauma), and 4) coordination among medical providers, providers in public schools, and other community providers.

Conclusions: Overall, the region's needs related to the diagnostic services and treatments of ASD are multi-faceted, and the needs of availability, access, and affordability must be addressed.

296 **218.296** Improving Initial Age of ASD Diagnosis for Children from Culturally and Linguistically Diverse Communities: Asking the

Parents

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Background:
The average age of a diagnosis of autism spectrum disorder (ASD) for children in the U.S is still after four, despite ability to reliably diagnose at two (Baio et al., 2018). For children from underserved, culturally and linguistically diverse (CLD) communities, this delay to diagnosis can be substantially greater (e.g., Shattuck et al., 2009; CDC, 2018). One CLD community in the U.S. with limited representation in ASD research is the Hmong community, a growing and underserved Southeast-Asian refugee group with a population size of approximately 300,000. As access to early and intensive intervention covered through insurance often requires a clinical diagnosis of ASD, delayed diagnosis can also mean delayed intervention.

Objectives:

The importance of early intervention warrants efforts to identify potential strategies for supporting CLD parents in obtaining an earlier diagnosis of ASD for their child. To identify potential strategies, we conducted a survey study examining Caucasian and Hmong caregiver experiences with the diagnostic process.

Methods:

Our survey examined (a) parent-reported barriers and facilitators to obtaining a diagnosis of ASD, (b) parent perceptions/knowledge of ASD identification, and (c) sources parents access for information on ASD (e.g., scientific article, blog, Facebook). The survey was previously conducted with a sample of predominantly Caucasian parents of individuals with ASD from a university research registry (n = 121; 91% Caucasain). A second sample is being conducted with Hmong parents of individuals with ASD.

Results:

Results from our first sample indicate that dismissal of parent concerns from healthcare professionals, long waitlists for evaluations, and dismissal of parent concerns from friends/family were the most frequently parent-reported barriers to obtaining a diagnosis of ASD for their child. Conversely, doing research, having knowledge of appropriate development, and recognizing the importance of an identification were the most frequently parent-reported facilitators. Additionally, parents reported turning most frequently to the internet, other parents of children with ASD, healthcare professionals, and books for information on ASD. We predict group differences between Caucasian and Hmong caregivers will exist across all outcome variables. Findings from a previously conducted systematic literature review, examining what parents report were barriers and facilitators to obtaining a diagnosis of ASD for their child, will supplement survey results and also be discussed.

Conclusions:

The results from this study will inform key strategies for supporting CLD parents, particularly Hmong parents, in obtaining a diagnosis of ASD for their child earlier. Specifically, identifying barriers and facilitators identifies problem areas that can be targeted, as well as supportive factors that can be enhanced to support parents in obtaining a diagnosis of ASD. Additionally, an understanding of parent perceptions of identification and the sources parents access for information on ASD indicates the messages regarding identification that need to be reinforced as well as the effective methods for delivering those messages. This work also contributes to the limited literature base on ASD in CLD communities.

297 **218.297** Increasing Universal ASD Screening in Primary Care: A Pragmatic Trial with a Six-Month Follow-up

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Background:
Although the American Academy of Pediatrics recommends universal use of ASD-specific screening at 18 and 24 months, compliance by primary care providers (PCPs) is limited by time constraints and lack of confidence regarding ASD care. The Modified Checklist for Autism in Toddlers–Revised with Follow-up (M-CHAT-R/F, Robins, 2014), is a well-validated screener comprising a 20-item parent checklist and a follow-up interview for positive initial screens, designed to reduce false positives. However, limited time allotments for well-child visits often result in the omission of the follow-up interview, leading to potential over-diagnosis.

Objectives:

To examine the effectiveness of an intervention for community-based PCPs designed to: (1) increase the use of the M-CHAT-R/F at 18 month well-child visits, and (2) increase PCP self-efficacy regarding clinical care for toddlers with possible ASD.

Methods:

Sample. 61 PCPs from 10 practices in 4 counties across Washington State were enrolled. PCPs had a mean age of 45.2 years and mean of 13.7 years in practice. The majority were MDs (72.9%) and female (75.0%).

Procedures. A stepped wedge design was used to randomly assign each county to the timing of intervention. Survey data were collected at baseline (T1) and 6-months post-intervention (T2). The intervention comprised a 2-hour, interactive training workshop conducted in each PCP practice. Workshops focused on the introduction of a novel online version of the M-CHAT-R/F, along with information about the importance of universal ASD screening at 18 months, early behavioral features of ASD, strategies for talking to families about ASD concerns, and local ASD resources.

Online M-CHAT-R/F. An online version of the M-CHAT-R/F was developed using REDCap (Research Electronic Data Capture; Harris et al., 2009) and is accessed via tablets. This version triggers the follow-up questions when appropriate, and provides automated scoring. Medical staff access the results via the final screen, which is color-coded to indicate pass/fail status, and can log-in directly to REDCap to review the specific items failed.

Measures. Self-report measures of screening practices and self-efficacy regarding ASD care were collected at T1 and T2. At T2 only, feasibility and acceptability of the online M-CHAT-R/F were measured with items adapted from the User Rating Profile (URP; Chafouleas et al., 2011), and objective data on 18-month screening rates were obtained from the REDCap database.

Results:

The percent of PCPs using the M-CHAT-R/F follow-up interview increased from 37% to 91%. Significant increases in PCPs' self-efficacy in caring for

young children with ASD were found (see Table 1). Provider ratings indicated high levels of feasibility and acceptability for the online M-CHAT-R/F (Table 2). At T2, 7 of the 10 practices were using the online M-CHAT-R/F routinely at 18-month visits.

Conclusions:

This brief community-based intervention was effective for increasing PCPs' use of universal ASD screening at a 6-month follow-up period. PCPs rated the online M-CHAT-R/F as feasible and acceptable. While automation of the M-CHAT-R/F scoring removed a common barrier to screening (i.e., lack of time), improvements in provider self-efficacy regarding ASD care may have also contributed to increased rates of universal screening.

298 **218.298** Living without Adequate Community Mental Health Support: The Experiences of Parents of Post-Secondary Students with Autism and Co-Occuring Mental Health Challenges

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Background: Young adulthood marks an especially demanding transitional period for young adults with Autism Spectrum Disorder (ASD) pursuing post-secondary education, and their families. Young adults with ASD experience higher rates of co-occuring mental health challenges compared to others with or without developmental disorders. In addition, policies typically mandate individuals with ASD to make the transition from child to adult health services at age 18, involving a disruption of daily routines and contact with familiar health care providers. Studies show that adult-based community mental health agencies are not typically inclusive of individuals with ASD. It is imperative to gain a better understanding of the experiences of young adults with ASD and co-occuring mental health challenges that may or may not be mental health service users to delineate the characteristics and effectiveness of mental health care delivery systems versus other kinds of informal mental health supports.
Objectives: To conduct a qualitative inquiry of parental perspectives on the experiences of post-secondary students with ASD and co-occuring mental health challenges while accessing or trying to access mental health services and/or informal mental health supports in one Canadian province.

Methods: The experimental methodology involves conducting semi-structured interviews with parents or legal guardians of young adults (age 18 to 30 years, currently enrolled in post-secondary education) with ASD and co-occuring mental health challenges. Data collected through interviews include feedback on formal or informal diagnoses of ASD and mental health challenges, including psychiatric disorders, and experiences during assessments and while accessing or trying to access support for mental health needs in relation to perceived attainment of post-secondary academic success.

Results: Results show that young adults with ASD and co-occuring mental health challenges experienced barriers while accessing or trying to access support for mental health needs. The majority of parents/legal guardians identified unsuccessful attempts to access mental health supports for their children. The most common barrier to accessing mental health supports was found to be restrictive intake criteria. The most common barrier to receiving effective mental health supports was found to be lack of perceived clinicial confidence to care for the population of young adults with ASD and co-occuring mental health challenges.

Conclusions: Knowledge disseminated from this study contributes a qualitative inquiry on the characteristics and effectiveness of mental health care delivery systems versus other kinds of informal mental health supports. The study findings support the view that young adults with ASD and co-occuring mental health challenges are a population for whom optimal supports may not currently be accessible, and they highlight the need for a broader environmental scan of supports that can further inform critical gaps in funding and policies.

299 **218.299** Long-Term Follow-up of Primary Care Workforce Training in ASD Identification in Young Children: Does Advanced Training Facilitate Sustainable Practice Change?

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Background:
The increased prevalence of autism spectrum disorder (ASD) and documented benefits of early intensive intervention have created a need for flexible systems for determining eligibility for autism-specific services.

Objectives:

This study evaluated the long-term effectiveness of a training program designed to enhance autism spectrum disorder identification and diagnosis within community pediatrics and related early intervention system settings across several state systems of care over a 10-year training period.

Methods:

An electronic survey was distributed to 493 participants who completed STAT-MD training designed to teach early identification of ASD for pediatric health care providers and facilitate within practice diagnosis and management of young children with ASD. Participants were asked to detail aspects of practice both prior to and after receiving STAT-MD training, including barriers associated with practice changes.

Results:

At the time of submission, results came from:

- 120 practitioners
- Variety of settings (private practice, academic medicine, military instillations)
- 11 US states, plus Japan, Trinidad and Tobago, and Puerto Rico
- Following training, practitioners reported an increase in comfort level for discussing potential ASD diagnosis with families of children below 36 months of age ($p<0.01$) and reported an increase in their ratings of appropriateness to provide ASD diagnosis prior to or without referral to tertiary centers ($p<0.01$). Surveys will continued to be collected until early 2019 to account for practitioners in 2018 training workshops, to include a new program in rural areas of Alaska.

Conclusions:

A percentage of pediatric providers participating in the advanced training reported significant changes in screening and consultation practices following training, with some demonstrating long-term practice change. Such collaborative training methods that allow ASD identification within broader community pediatric settings may help translate enhanced screening initiatives into more effective and efficient diagnosis and treatment. At the same time, potent barriers towards completion of such training and long-term practice change are evident:

- Low response rate to survey itself
- Varied post training practice settings
- Administrative and billing barriers to assessment

These barriers may require novel engagement strategies for sustainable long-term practice change.

300 **218.300** Mixed Methods Study of Early Learning Institute (ELI) Program Implementation across Three Early Intervention Sites

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Background:

Autism spectrum disorder (ASD)—affecting 1.5% of the population—is a pervasive, lifelong neuro-developmental disorder characterized by impaired social communication and repetitive behavior and/or restricted interests. Early behavioral intervention (EBI) is an effective treatment for reducing ASD symptoms and improving development for young children at-risk or diagnosed with ASD. EBI is typically delivered through community-based agencies; yet, little is known about the quality of these services. One method for ensuring quality community-based EBI is to translate efficacious curriculum into community settings that provide services to young children with ASD. The Early Learning Institute (ELI), based on the work of Maurice, Green, & Luce (1996) and Lovaas (2003), provides evidence-based curriculum to children with ASD between the ages of 2-5 years. This study aimed to better understand the implementation process of ELI delivered at three community agencies in the mid-Michigan region in order to facilitate its dissemination and implementation into broader community-based early intervention settings.

Objectives:

- Assess implementation processes and implementation outcomes (appropriateness, feasibility, acceptability, and utility) related to ELI utilization.
- Explore staff perspectives on use of implementation strategies and processes.
- Collect data on facilitators and barriers of the ELI program curriculum, training, and implementation process to facilitate further dissemination to community-based organizations.

Methods:

A sequential explanatory (QUAN --> qual) mixed methods design was utilized to evaluate facilitators and barriers to ELI implementation within and between three sites.

QUAN Phase: Twenty-five providers (4 directors/administrators, 2 BCBA and 19 behavioral technicians (BT)), completed a web-based quantitative survey, including the Acceptability of Intervention Measure, Intervention Appropriateness Measure, Feasibility of Intervention Measure, Implementation and Sustainment Strategies Survey and the Leadership Culture, Staff Culture, Leadership Behavior and Measurement Subscales of the Organization Readiness to Change Assessment (ORCA) to gather data on the organizational characteristics, provider characteristics, implementation strategy use, and implementation factors hypothesized to influence initial and sustained use of ELI.

Qual Phase: A sub-sample of 13 providers (1 administrator, 1 BCBA, 11 BT's) participated in a semi-structured interview that was developed based on QUAN findings. The interview focused specifically on facilitators and barriers to delivering ELI in community-based settings. Qualitative coding, utilizing grounded theory, has been completed using an iterative coding, comparison and consensus methodology.

Results:

ANOVAs indicated no significant differences in ratings of acceptability, appropriateness, or feasibility by site or provider role. However, significant differences in ORCA ratings were found between provider roles in leadership culture, [$F(2, 24)=6.36$, $p=0.007$], with lower ratings from BT's ($M=3.08$, $SD=0.89$) as compared with directors/administrators ($M=4.19$, $SD=0.55$) and BCBA's ($M=4.88$, $SD=0.18$). No other significant differences on the ORCA were found between sites or provider roles.

Quantitative and qualitative data are being integrated through the use of joint display, and will be presented at the conference.

Conclusions:

Findings will highlight key facilitators and barriers to successful implementation of ELI that may be able to generalize to other community-based early intervention settings for children with ASD, helping to inform the process of adoption, implementation and sustainment within these contexts and facilitate broader uptake of ELI into community-based settings.

301 **218.301** National and State-Level Trends in Adult Supplemental Security Income (SSI) Awardees with ASD: 2005-2017

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Background: The Supplemental Security Income (SSI) program, a nationwide cash assistance program, is an important yet understudied source of financial support for adults with Autism Spectrum Disorder (ASD). Prior research found a 327% national increase in the number of working-age SSI recipients with ASD between 2005 and 2015. However, the possibility of changes in the characteristics of this population has not yet been explored.

Objectives: Specific research questions included: 1) How has the number and proportion of SSI awardees with ASD changed over time and how do these changes vary by age?; 2) How has the demographic composition of awardees with ASD changed, and how do these changes compare to awardees other disabilities?; and 3) How did the number of SSI awardees with ASD vary across states and over time?

Methods: We used Social Security Administration (SSA) program data from 2005 to 2017 to examine national- and state-level changes in the composition of new SSI awardees (ages 18-64) with respect to gender, age, SSI history and the relative size of the ASD group. We also present data on the population of awardees with intellectual disability (ID) and other mental disorders (OMD) to help contextualize our findings.

Results: The number of awards for ASD increased dramatically, rising from 3,384 in 2005 to 12,096 in 2017 (a total increase of 257.4%). In contrast, the number of ID awards declined by 54.9% and OMD awards declined by 48.9% decrease. Nine out of every 10 ASD awards were given to young adults, ages 18 to 25 years. This figure has been relatively stable across the years, suggesting that growth in transition age young adults is not driving overall increases in the population of ASD awardees. The composition of awardees with ASD did not significantly change between 2005 and 2017 with respect to age, gender and SSI history. However, there were significant between-group differences in awardee characteristics. Overall, awardees with ASD were younger (mean age 20.9 years) and had a higher percentage of males (81.0%) compared to awardees with ID and OMD. All states reported increases in both the number and proportion of ASD awards between 2005 and 2017. However, the degree of growth varied considerably across states (ranging from a low of 2.1% in New Mexico to a high of 12.7% in New Jersey—a difference of 10.6%). By comparison, the number of ID and OMD awards declined in every state. Our findings also indicate a general increase in state heterogeneity in the prevalence of ASD awards. Across all 50 states and Washington D.C., the average proportion of ASD awards increased by 8.0 percentage points between 2005 and 2017, and the standard deviation increased by 251.1%. In contrast, state-level variability declined in the ID and OMD groups between 2005 and 2017.

Conclusions:

Findings from this study underscore the need to consider geographic and age differences in SSI participation among individuals with ASD and identify how these differences relate to variation in economic outcomes across states and disability groups.

302 **218.302** Scholars of Human Expression: The Experiences of Autistic Performing Arts Professionals and Attitudes of Performing Arts Employers in the UK

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Background: Researchers and clinicians have long held that imagination is limited in autism. Yet it is increasingly recognised that creativity is an area of strength in many autistic people. Although creative practice such as the performing arts has not traditionally been thought of as an occupation in which autistic people would engage, our initial work in this area has revealed that there are people diagnosed as autistic and those with high levels of autistic traits working in this field. Further, autistic people and those with high levels of autistic traits reported wanting more employment support than non-autistic colleagues. We still need to establish, however, the nature of these support needs and the experiences of autistic adults in the performing arts.

Objectives: This research examined in-depth the employment experiences of autistic performing arts professionals and the attitudes and adjustments of performing arts employers who work with autistic people. We sought to better understand the challenges that autistic adults face in performing arts employment and the nature and extent of the support they require.

Methods: Semi-structured interviews were carried out with 18 UK-based autistic performing arts professionals (7 female, 9 male, 2 non-binary/other; mean age 33) and 19 UK-based performing arts employers (10 female, 9 male; mean age 44). Interviews with autistic professionals focused on their likes and dislikes concerning their workplaces, and if they had ever needed or would like support for their work. Employers were asked about their current knowledge of autism, whether they had any experience working with autistic people, and if they knew how or where to find support for either an autistic employee or themselves if needed.

Results: Interviews were recorded, transcribed verbatim, and analysed using thematic analysis. Autistic performing arts professionals described facing challenges in the workplace. These centred on anxiety, colleagues' misconceptions, and feeling obliged to network despite finding high levels of socialisation stressful. Professionals also spoke about how autistic traits benefitted their work: being able to focus on tasks for a long time and work in precise detail, and how being autistic enabled them to approach their work from a unique perspective. A few autistic professionals had access to support, but the majority felt that there was not enough, if any, support available and highlighted many ways in which they could be better supported. Performing arts employers varied in their experiences of working with autistic people, but they consistently identified that every autistic person has different needs and requires individualised support. Many employers had limited knowledge about autism-specific support or relied on other professionals to provide it. They indicated a willingness to learn more, but were concerned that there was little time for training.

Conclusions: The results paint a picture of meaningful contributions of autistic people within the performing arts yet a number of challenges with which to contend. Crucially, these findings allow us to understand the current unmet support needs of autistic performing arts professionals, and make best-practice recommendations in this area. Future research should develop and evaluate employment-based support for these professionals.

303 **218.303** Practices Surrounding Autism over-Diagnosis and Under-Diagnosis: Results from a National Healthcare Provider Survey

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Background: The prevalence of autism spectrum disorder (ASD) increased tenfold in the last 40 years, prompting concern about autism misdiagnosis and over-diagnosis. Few studies have assessed ASD over- or under-diagnosis, or the practice of assigning ASD diagnoses for children not meeting Diagnostic Statistical Manual (DSM) criteria.

Objectives: To measure rates of healthcare provider-reported over- and under-diagnosis of ASD in a national sample of U.S. ASD providers. To assess providers' reasons for over- and/or under-diagnosis of ASD.

Methods: A mixed-mode (email/mail) survey was sent to all members of the Society of Developmental and Behavioral Pediatrics (SDBP) who indicated a clinical interest in ASD, performed at least 5 ASD evaluations in the prior year, and who were currently practicing in the US. Each respondent used a Likert-type scale to indicate: (1) whether he/she thought autism was over-diagnosed, under-diagnosed, or diagnosed at the appropriate rate; (2) whether he/she had personally diagnosed a child with ASD when the child did not meet DSM criteria ("over-diagnosis"); (3) whether other providers in his/her area over-diagnose children with ASD; (4) whether he/she had personally not diagnosed a child with ASD when the child did meet DSM criteria ("under-diagnosis"). Reasons for under- and over-diagnosis of ASD were assessed. Descriptive statistics were used to assess rates of self-reported over- and under- diagnosis, and multivariable logistic regression was used to assess variability in responses according to respondent gender, years in practice, and US region

Results: 217/347 (63%) of eligible providers completed the survey. Overall, 48% of providers thought that autism was diagnosed at an appropriate rate. More providers thought ASD was over diagnosed (32%) than underdiagnosed (19%; p = 0.008). 8.8% of providers self-reported over-diagnosing ASD at least sometimes; however, 58% reported that other providers over-diagnosed ASD at least sometimes. Commonly-cited reasons for ASD over-diagnosis included: assisting in access to school services (46.1%) and assisting in access to medical services through health insurance (47.6%). Male providers were significantly more likely to self-report over-diagnosing ASD compared to female providers (16.7% versus 5.7%; Adjusted Odds Ratio 3.24 [95% Confidence Interval 1.17-9.02]). 7.8% of providers self-reported under-diagnosing ASD. There were no significant provider demographic associations with under-diagnosis. Commonly-cited reasons for under-diagnosis included: parents really did not desire the diagnosis (35.4%) and parents weren't ready to hear the diagnosis (43.4%).

Conclusions: Relatively few U.S. providers self-report over-diagnosis of ASD; however, they report that this practice pattern is widespread among local colleagues. Under-diagnosis was less common. Study results suggest that ASD over- and under-diagnosis may be occurring in a meaningful portion of reported ASD cases in the US. Over-diagnosis may present an effort on behalf of ASD providers to facilitate access to limited services.

304 **218.304** Predictors of Changes in Daily Activity in Transition-Aged Youth with Autism

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Background: Transitioning into adulthood is fraught with challenges for young adults on the autism spectrum. The fragmented nature of social and community services does not promote a seamless transition from youth to the adult service sectors. At the same time, community involvement of these transition-age youth (TAY), whether it be continued schooling, employment, or vocational training, plays a crucial role for meaningful outcomes later in adult life. Therefore, a greater understanding of the facilitators of continued community involvement during this period is warranted.

Objectives: In this study, we aim to identify the association between clinical need and service receipt with the stability of community involvement in young adults with autism that are transitioning into the adult service sector.

Methods: Caregiver survey data was taken from the baseline Canadian Autism Spectrum Disorders Alliance (CASDA) National Autism Needs Assessment Survey in 2014. Caregivers (n=330) that elected to be contacted again were sent the same set of questions in 2017 about sociodemographic factors, clinical need, service receipt and their typical weekday activity in the last four months. Three cohorts based on age were defined: (1) youth who were between 14-17 years of age at time 2; n=227) and thus not transitioning in the 3 year period, (2) transition-age youth (TAY), who were under 18 years of age at time 1 but aged into the adulthood at time 2, ending up between 18-21 years of age at time 2; n=48) and (3) adults who were past transition age at both time periods (25-29 y.o. at time 2, n=55). We compared patterns and predictors of having a typical structured daily activity during the week (either school, employment or volunteer activity) of the TAY group with both the younger and older cohorts who had not experienced this transition during the same time period. We then identified the service use and clinical need predictors of losing a typical structured daily activity over this transition period.

Results: Aside from age, the three groups did not differ with respect to rurality, gender, caregiver education level or income. Those in the adult group were less likely to live with family (67%) compared to the TAY (85%) and youth groups (97%). At time 2, only 1.3% of youth had no structured activity, compared to 17% of the TAY group, and 45% of the adult group. Of those that had a structured daily activity at time 1, a significantly larger portion of the TAY group lost a daily activity at time 2 (29.2%), compared to youth (6.2%) and adults (14.5%). We will present further data on what predicted losing services in the TAY group.

Conclusions: This research highlights that those transitioning to adulthood are a greatest risk of losing structured daily activities, and that once in adulthood (at least for individuals 25-29 years of age), many continue to struggle to obtain meaningful postsecondary engagement. These results can help guide the design of youth and transition age programs that will impact adult outcomes.

305 **218.305** Prevalence and Correlates of Significant Spoken Language Delay in Preschool-Aged Children Seen at an Autism Clinic

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Background: Understanding profiles of preschool-aged children with significant spoken language delay at time of autism evaluation is important to identify service delivery needs. Currently, little is known about the prevalence of spoken language delay in this population, and which factors may distinguish children with and without phrase speech.

Objectives: Data from children (ages 36 – 59 months) seen for evaluation at an interdisciplinary, urban autism clinic were examined to: (a) ascertain the prevalence of spoken language delay, defined as parent-reported lack of phrase speech by age 36 months, and (b) examine demographic, educational, and diagnostic differences among children with and without phrase speech.

Methods: Data were collected from a pre-appointment background and history questionnaire completed by caregivers. Parent-reported phrase-speech was validated by clinician-administration of ADOS Module1. Chi-square and *t*-tests were calculated to compare bivariate differences

between groups.

Results: *Demographic & Speech Profiles.* Children (*N*=691) were mean age 47.41 months (*SD*=7.15); 80.46% were male; 62.37% were using phrase speech; 37.63% were not. Children without phrase speech were younger (*M*=45.12, *SD*=7.30 months) than children with phrase speech (*M*=48.80, *SD*=6.70 months), $t_{(689)}$=-6.76, *p*<0.001. No sex differences were found between groups (*p*=.66). Clinicians administered an ADOS Module1 for 90.85% of children whose parents reported no phrase speech (ADOS data available for *n*=468 children). A lower proportion of phrase speech was observed among children who were Other/Multi-Racial (57.81%) or Black/African American (46.26%), when compared to Caucasians (71.94%), $X^2_{(2, N=674)}$=31.01, p<0.001. Families with private insurance had a greater proportion of children with phrase speech (66.88%) compared to families with Medicaid (50.98%), $X^2_{(2, N=691)}$=17.05, *p*<0.001.

Early Intervention Status. The proportion of parents with concerns about their children's language development was higher in children without (91.89%) versus with (61.88%) phrase speech, $X^2_{(1, N=292)}$=31.66, *p*<0.001.The proportion of children who received early intervention services was greater in children without (45.10%) than those with (32.08%) phrase speech, $X^2_{(1, N=679)}$=11.59, *p*=.001. Among children without phrase speech for whom data were available (*N*=257), 24.12% were not receiving speech therapy and, among a smaller subset with available data (*N*=111), only 9.01% had access to a speech generating device.

Diagnostic Status. The proportion of children identified as having autism based on clinical impression was higher in children without phrase speech (85.24%) compared to those with phrase speech (67.18%), $X^2_{(2, N=427)}$=16.55, *p*<0.001. Mean ADOS Comparison Score among children without phrase speech (*n*=160) was higher (*M*=6.44, *SD*=2.70) than the mean Comparison Score (*M*=5.47, *SD*=2.77) among children with phrase speech (*n*=302), $t_{(460)}$=3.59, *p*<.001.

Conclusions: More than one-third of children seen for autism evaluation were not using phrase speech by age three years, and, despite parent concerns, more than half had not received early intervention. Children most at risk for spoken language delay were Non-White and those who received medical assistance. Results suggest the need for pediatrician and clinician training on the importance of early speech-language intervention for young children with autism and significant spoken language delay. Such training should include education on the value and efficacy of augmentative and alternative communication for this population with autism.

306 **218.306** Primary Care Medical Home Designed for Young Adults with Autism Reduces Emergency Department Utilization

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Background: Young adults with autism spectrum disorder (ASD) are at elevated risk for frequent utilization of the emergency department (ED) due to psychiatric conditions, medical comorbidities, and poor continuity of primary care. The Center for Autism Services and Transition (CAST) at The Ohio State University Wexner Medical Center (OSUWMC) was co-designed with adults with ASD, caregivers, and providers to reduce barriers to primary care access and develop strategies for improving patient self-management of healthcare conditions. Figure 1 provides a schematic representation of the CAST program. The overall goal of this program is to help adults with ASD build the skills they need to ultimately be able to obtain medical care anywhere from providers beyond CAST.

Objectives: The objective of this study was to examine the association between number of years in the CAST program and ED utilization.

Methods: A retrospective longitudinal design was used to analyze administrative records from CAST patients with at least one ED visit that occurred between the years 2015-2018 (n=61 patients). A majority of patients were male (79%), white (80%), and had a co-occurring intellectual disability (66%). The median age of patients in 2015 was 21 years (interquartile range [IQR]: 17, 25). During the study period, these CAST patients visited any OSUWMC ED a total of 311 times with a median number of 3 visits per patient (IQR: 2, 7). Repeated measures negative binomial regression was used to examine the association between number of years in the CAST program and number of ED visits per year for: 1) any reason, and 2) non-emergent conditions. Covariates included sex, race, age, co-occurring intellectual disability, and the number of OSUWMC ED visits in the year prior to CAST program enrollment.

Results: Enrollment in the CAST program for two (IRR=0.7 95% CI=0.5-0.9), three (IRR=0.6, 95% CI=0.4-0.9), or four years (IRR=0.4, 95% CI=0.2-0.8) was associated with a significantly lower rate of ED visits, relative to the first year of enrollment. Additionally, enrollment in the CAST program for two (IRR=0.5, 95% CI=0.3-0.9) or three (IRR=0.3, 95% CI=0.1-0.7) years was significantly associated with fewer ED visits for non-emergent conditions, relative to the first year of enrollment. Four years of enrollment was also associated with a decrease in non-emergent ED visits (IRR=0.2), although this finding did not reach statistical significance (95% CI=0.1-1.0). Figure 2 provides a graphical demonstration of how the risk for any ED visit and non-emergent ED visits decreases as years in the CAST program increases.

Conclusions: Two years of enrollment in the CAST program was associated with 30% reduction in the number of annual ED visits and a 50% reduction in risk of visits for non-emergent conditions. Additionally, program participation continued to reduce ED utilization after three and four years of enrollment. These findings suggest that the CAST program is effective at improving access to quality primary care, thereby reducing over-reliance on ED services. Further work is needed to examine the impact of this program on other aspects of healthcare utilization.

307 **218.307** Provider Perspectives on Parent-Provider Communication about ASD Detection: Implications for Applying Shared-Decision Making

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Background: Challenges in parent-provider communications about early ASD concerns may contribute to delays for detecting ASD and accessing specialized treatment. During the detection process, parents have indicated that providers did not offer sufficient support and advice about the nature of ASD (Osborne & Reed, 2008). Community early intervention (EI) providers have reported a lack of comfort and uncertainty about their role in discussing concerns with parents, including what specific information should be conveyed (Cameron & Muskett, 2014). Both parents and providers seem to agree that greater sharing of information is needed to support the families during the diagnostic process (Keenan et al., 2010). Further research on EI providers' perspectives about discussing early ASD concerns and referrals may yield key insights on ways to improve parent-provider communication and apply shared-decision making, which promotes a balanced partnership that capitalizes on both parents' and providers' unique expertise, values, and beliefs.

Objectives: Identify the common issues/facilitators that arise when providers communicate with families in their caseload about ASD concerns and make decisions about appropriate next steps/referrals.

Methods: Three 90-minute focus groups were conducted by a facilitator using a semi-structured guide and audio recorded for transcription and coding. Participants included 25 EI providers from 3 EI agencies in a large urban setting. Grounded Theory (Corbin & Strauss, 2014) was used to identify the themes in reviewing the transcripts. All transcripts were coded by two independent coders and inter-coder reliability was met for all themes.

Results: A total of 5 major themes emerged**.** As part of their unique role in working with children with ASD/ASD concerns, providers indicated that they felt responsible for introducing/discussing concerns about ASD and providing parents education on the topic. When bringing up ASD concerns to parents, providers indicated that they attempted to introduce the concerns gradually over time/sessions in order to gently assess parent readiness and avoid parents rejecting their concerns and discontinuing EI services. With regards to parents' acceptance and follow through for referrals, providers indicated that influential factors included parent awareness and motivation and child symptomatology (and its severity). When working with families from different cultural backgrounds, providers indicated that they confronted additional barriers including parents' perceptions of stigma and ASD and miscommunication due to language differences. When making recommendations for ways to improve parent-provider communication, providers indicated the need to use strategies that: (1) lead to a better understanding of parents' perspectives; (2) provide parents clarity about the next steps (i.e., waitlists and types of services); and (3) include simple, visual materials that can be used with all parents, including those from different cultural backgrounds and/or with possible literacy issues.

Conclusions: Findings re-affirmed that providers face various challenges when communicating with parents about ASD concerns and referrals. Given the challenges and recommendations that emerged, using shared-decision making may lead to considerable improvements in parent-provider communication because its primary components/strategies involve: (1) seeking and supporting parent participation, (2) exploring/explaining the next steps clearly, (3) assessing parents' beliefs and values, and (4) reaching and monitoring a decision.

308 **218.308** Provider Use of Evidence-Based Practices for Students with Autism in School-Age Transition Periods

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Background: Several treatment methods found to be effective for teaching children with autism have been identified as evidence-based practices (EBP) (Odom et al., 2010; Wong et al., 2014), and training teachers on EBPs is best way for schools to provide effective education students with ASD. Teachers may struggle with implementation of EBPs as interventions are time intensive, costly, and require significant training to implement with high fidelity (Lopata et al. 2012). Teachers face additional barriers including decreased financial resources, lack of curriculum materials, high staff turnover, poor training, and resource challenges for children whose families live at or below the poverty line (Mandell et al., 2013; Pellechia et al., 2015). Educators often use practices with limited evidence-base for individuals with ASD (Stahmer, Collings & Palinkas, 2005). Teachers may particularly disengage in EBP use during stressful times, such as times of transition. Research highlights the importance of successful transitions as well as the difficulties for children considered at risk (Pears et al., 2015). Given the associated difficulties of transition, teachers report a lack of training opportunities, knowledge and attention to students' individual needs as well as school coordination gaps during transition (Nuske et al. 2018).

Objectives: To identify reported use of evidence-based strategies and interventions for under-resourced individuals with ASD in public school classrooms during times of transition.

Methods: Under-resourced students with ASD attending public schools enrolled in the study prior to transition to primary or secondary school. School personnel providing interventions were interviewed before and after transition and asked to report strategies used in pre and post transition classrooms to meet student goals. Authors first coded reported intervention data using codes that identified general types of interventions (n=10 intervention types), derived from a list of common practice intervention types, then authors coded the reported intervention data using EBP codes, derived from Wong et al. (2014) (n=15 EBP). For both coding rounds, coders reached IRR at 0.8 and 20% of data were double coded. For double coded data, discrepant codes were coded using consensus. SPSS was used to report descriptive statistics for the coded data.

Results: Pre and post-transition school personnel (n=30) reported implementing 198 total strategies for students (n=7). Overall, 35% of strategies were identified as not EBP. The most frequently used EBPs reported were prompting (13%) and visual supports (13%). The least frequently reported EBPs were technology aided instruction and intervention (1%), discrete trial training (1%) and PECS (1%) (Table 1). Of the strategies identified as not EBP (n=70), instructional interventions (14), self-regulation (11) and consequence-based interventions (10) were most frequent. The percent frequency of reported EBP interventions was similar pre-transition (64%) and post-transition (65%).

Conclusions: Educators reported implementing various strategies for students with ASD during transitions. Although many strategies were reported, there is variability in the evidence-base of the strategies being used. Understanding these patterns highlights current gaps in EBP and may inform needed adjustments to implementation and dissemination efforts in real-world settings.

309 **218.309** Risk Factors for Emergency Department Utilization Among Adolescents with Autism Spectrum Disorder

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Background: During recent years children and adolescents with autism spectrum disorder (ASD) have be increasing their ED utilization at a higher rate compared to those without ASD. Investigation is needed into the risk factors for elevated ED utilization among adolescents diagnosed with ASD who are more vulnerable for psychiatric emergencies.

Objectives: This study mined a large, national healthcare claims database to examine healthcare utilization history of adolescents with ASD to

identify risk factors for elevated ED utilization.

Methods: Using MarketScan® between 2005 and 2014, we designed a retrospective, longitudinal study to determine the risk factors associated with the ED utilization among adolescents (aged 12-21) with ASD. We identified ASD subjects as those with at least two separate diagnoses of ASD (ICD-9 codes 299.0x and 299.8x) through the entire study period. The ED utilization was summarized at the individual level on a yearly basis, with an index date of the first ED visit during that year. For a calendar year without ED visit, the index date is set to be July 1st. Risk factors include mental health comorbidity; psychotropic medications; prior visit(s) to a psychiatrist, prior ED visit and demographic characteristics (age, sex, etc.).

Results: Our study cohort consists of 63,886 ASD patients with 181,686 person-year observations. Multivariable logistic regression analysis examining the independent effect of each factor on ED utilization found a statistically significant sex-by-age interaction effect on ED utilization (p=0.03). While female adolescents with ASD generally were more likely to visit ED than males, sex effect was significant in early and late adolescence (age 12-14: adjusted Odd Ratio 1.24; 95% confidence Interval [1.13-1.37]); 18-21: 1.26 [1.14-1.39]), but not in middle adolescence (15-17: 1.08 [0.98-1.19]). Meanwhile, the longitudinal effect of age depends on sex. For females, the odds of ED visit significantly increased when patients entered late stage adolescence (age bracket 12-21 vs. 12-14: 1.24 [1.08, 1.42], age bracket 15-17 vs. 12-14: 0.99 [0.88-1.11]). In contrast, the odds of ED visits among males increased monotonically over time. In addition, having internalizing (e.g. digression) type of mental health comorbidity alone or concurrently having externalizing comorbidity (e.g. adhd) increased the odds of ED visits significantly (concurrent: 1.27 [1.19-1.37]; internalizing only: 1.17 [1.08-1.28]; Reference: neither); but not with the externalizing comorbidity alone (1.02 [0.94, 1.10]). Clearly prescriptions of more categories of psychotropic drugs were associated with higher ED risk. Even prescriptions of just two categories of these medications significantly elevated the odds of ED visit (1.20 [1.12-1.30]). Finally, a prior ED visits was strongly associated with recurrent ED visits (9.55; [8.93-10.23]).

Conclusions: This study has reaffirmed previous work documenting higher ED utilization by adolescent females than males among adolescents with ASD. Concurrent externalizing and internalizing psychiatric comorbidities as well as internalizing conditions alone correlate to higher ED utilization. Illness severity as demonstrated by psychiatric referral and use of two or more classes of psychotropic medications also appear to mark vulnerability for ED utilization. Previous ED visits appear to correlate most strongly for future ED utilization.

310 **218.310** Polypharmacy of Psychotropic Medications May Increase the Risk of Emergency Department Visits Among Adolescents with Autism Spectrum Disorder

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Background: Studies have documented high prevalence rates of using psychotropic medications to manage comorbid mental health concerns in children and adolescents with ASD, particularly older children and adolescents with ASD. It is not uncommon for physicians to prescribe multiple psychotropic medications both within and across drug classes. However, little is known about the effectiveness of polypharmacy to minimize high level service, utilization such as the Emergency Department (ED) for behavior and/or mental health crises.
Objectives: This study used a large, national healthcare claims database of a privately insured population in the US to investigate the association between prescription patterns of psychotropic medications and the incidence of ED visits for adolescents with ASD.

Methods: Using the MarketScan® database between 2005 and 2014, we designed a retrospective, longitudinal study to describe the prescription patterns of psychotropic medications (MEDs) among adolescents (aged 12-21) with ASD and potential ED visits. We identified ASD subjects as those with at least two separate diagnoses of ASD (ICD 9 codes 299.0x and 299.8x) through the entire study period. ED utilization was summarized at the individual level on a yearly basis, with the index date defined as the first ED visit date in a calendar year, or set to be July 1st for a year without ED visits. Prescribed psychotropic MEDs within 3 months prior to the index date were documented. Other potential risk factors/confounders considered include mental health comorbidity and demographic characteristics (age, sex, etc.). Descriptive analyses and multivariable regressions were performed to estimate the effect of psychotropic MED prescriptions on ED utilization.

Results: Our study cohort consists of 63,886 ASD patients with 181,686 person-year observations (Table 1). Annually, 57.7% had ≥1 psychotropic MEDs prescribed within 3 months prior to the index date and 17.6% concurrently had ≥3 different psychotropic medications concurrently prescribed. More older adolescents were prescribed ≥ 3 MEDs (age 18-21: 19.0% ; age 15-17: 18.8%; age 12-14: 15.7%). 35% of adolescents with ASD having both internalizing and externalizing mental health comorbidities were prescribed ≥3 psychotropic MEDs, followed by those with internalizing comorbidities only (27.8%), those with externalizing comorbidities only (20.3%), and those with neither (8.9%). Multivariable logistic regression analysis showed that (Table 2), while there was essentially no increase in ED risk with prescribing 1 or 2 psychotropic MEDs, prescription of ≥3 MEDs was associated with a significantly increased risk of ED visits (adjusted Odds Ratio [95% Confidence Interval]=1.26 [1.14, 1.38] vs. 2 MEDs).

Conclusions: In this privately insured population, nearly 60% of adolescents with ASD had at least one prescribed psychotropic medication annually and 17.6% had 3 or more concurrent psychotropic MEDs within 3 months of ED utilization. Our study has provided evidence that psychotropic polypharmacy is associated with elevated risk of ED visits among adolescents with ASD. Further studies are warranted to examine whether this is reflective of greater symptom severity, more complex presentations, suboptimal medication management, under-utilization of other treatments, or some other factor(s).

311 **218.311** Service Experiences of Autistic Women with Anorexia Nervosa

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Background:
Anorexia Nervosa (AN) is a severe, restrictive eating disorder (ED). 20-30% of women in treatment for AN are on the autism spectrum (Huke et al., 2013). Moreover, autistic women receiving treatment for AN have poorer outcomes compared to non-autistic women receiving the same treatment (Stewart et al., 2017; Wentz et al., 2009). There has been limited research investigating autistic women's experiences of ED services. This project is

part of the Study of Eating Disorders in Autistic Females (SEDAF).

Objectives:

To explore experiences of ED services from the perspectives of autistic women with experience of AN, the parents of autistic women, and professionals working in relevant services.

Methods:

Interviews covering ED service experiences were conducted with 15 autistic women with experience of AN (mean age 32 years, range 25-38), 15 parents, and 15 professionals working in ED and/or autism services. A collaborative approach to thematic analysis (Braun & Clarke, 2006) was used to identify themes for each of the three groups. Autistic women with experience of AN acted as advisors to the study. They helped develop the interview schedule and contributed to the data analysis and interpretation.

Results:

Preliminary analysis has focused on the interviews provided by the autistic women.

Service Engagement: Services were reported to lack understanding of autism. Autism-related social and sensory difficulties were often seen as a failure to engage with treatment and sometimes led to discharge. Not yet having a diagnosis of autism invariably led to autistic behaviours being misinterpreted.

Treatment Approaches: Common therapeutic approaches included cognitive behavioural therapy (CBT) and dialectic behaviour therapy (DBT). CBT was helpful for some autistic women, but many suggested the approach was too abstract and their difficulties in thinking flexibly held them back. DBT was seen as more helpful due to its focus on emotion regulation and practical skills. Participants generally favoured individual therapy, as they disliked speaking in front of others or had difficulty following and engaging in group conversation.

Service Improvements: Providing information before an inpatient admission was valued. Moreover, meetings with staff and a tour of the inpatient ward allowed autistic women to feel more prepared before being admitted. Individualised approaches and staff with an understanding of autism improved autistic women's engagement and their trust in services' ability to treat them.

Conclusions:

Autistic women reported being unable to fully benefit from the services they were offered, which is likely to impact on their well-being and treatment outcomes. This difficulty with engagement was primarily attributed to a lack of understanding of and adjustment for autism within services. However, the women provided insight into service and treatment approaches that could best meet their needs. This research may inform service adaptations to meet the needs of autistic individuals as well as the development of autism-specific interventions to treat AN.

312 **218.312** Service Use Classes Among School-Aged Children from the Autism Treatment Network Registry

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Background: Use of specific services may help to optimize health for children with autism spectrum disorder (ASD); yet, little is known about their service utilization patterns.

Objectives: We, therefore, aimed to (1) define service use groups and (2) determine associations of sociodemographic, developmental, behavioral, and health characteristics with service use groups among school-aged children with ASD.

Methods: We analyzed cross-sectional data on 1,378 children aged 6-18 years with an ASD diagnosis who were enrolled in the Autism Speaks Autism Treatment Network Registry, from years 2008-2015 across 18 sites in North America. We used data from the first follow-up visit (9-15 months post baseline) on 13 service use indicators spanning behavioral and medical therapies (e.g., behavioral interventions, psychotropic medications, special diets). Latent class analysis was used to identify groups of children with similar service use patterns. Bivariate and multivariable analysis was then used to determine associations of sociodemographic, developmental, behavioral, and health factors with services use groups.

Results: Latent class analysis placed school-aged children with ASD into 4 services use classes: limited services [LS] [12%], multimodal services [MS] [36%], predominantly educational and/or behavioral services [EBS] [43%], and predominantly special diets and/or natural products [SDNP] [9%] (Figure 1). Multivariable analysis results showed children in the LS class were significantly older and had significantly less severe ASD than those in the EBS class. Children in the MS class had significantly more externalizing behavior problems than those in the EBS class, and children in the SDNP class had significantly higher income and significantly poorer quality of life compared to those in the EBS class (Table 1).

Conclusions: Results suggest distinct service use groups exist among school-aged children with ASD following diagnosis and may be related to certain sociodemographic, developmental, behavioral, and health characteristics. Together, these findings may be used by health professionals to better support families in decision-making about service use for their child with ASD following diagnosis.

313 **218.313** Social Services Referrals and Child Protection Plans Involving Autistic Children and Children with Intellectual Disability in the United Kingdom

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Background:

Autistic individuals are at increased risk of victimisation by peers throughout the lifespan. It is less clear whether autistic children are also at increased risk of maltreatment by adults as children. There is good evidence that intellectual disability increases the risk for maltreatment. Additionally, some studies have found that autism increases a child's risk of ending up in the child protection system in some states in the USA, but this has not been investigated in the United Kingdom at a population level.

Objectives:

The current study aims to determine whether autism diagnosis and/or intellectual disability (ID) increase children's risk of being referred to social services and/or becoming the subject of a child protection plan (which are put in place if there is evidence of maltreatment) in the UK using population data.

Methods:

Data from the National Pupil Database (NPD), which includes information about all children in the state funded school system in the UK, was obtained from the Department of Education for the 2015-16 school year (N= 7,973,400). Unique Pupil Identification numbers were used to link school records and social service records that contain information on whether a child has been referred to social services, and whether they have received a child protection plan. Information on demographic factors (age, gender, ethnicity, home language and socioeconomic status) were also extracted from the NPD. Special educational needs diagnosis information was used to identify whether or not each child had autism and/or and ID. Logistic regression was used to determine the odds of being referred to social services and receiving a child protection plan depending on autism diagnosis and ID.

Results:

After adjustment for demographic variables and ID, autism significantly increased the odds of being referred to social services (odds ratio =2.83, 95% CI 2.78-2.89). Having ID also independently increased the odds of referral to social services (odds ratio =2.54, 95% CI 2.51-2.56). After adjustment for demographic variables and ID, there was no evidence that autism increased the odds of receiving a child protection plan (odds ratio = .919, 95% CI .859-.983). Conversely, ID significantly increased the odds of receiving child protection plans (odds ratio = 1.75, 95% CI 1.71-1.80).

Conclusions:

After adjusting for the effect of ID, autism does not increase the risk of receiving a child protection plan in the UK, indicating autism does not independently increase the risk of maltreatment by adults. However, children with ID (including a significant proportion of autistic children) are at a significantly increased risk of maltreatment. A limitation of this study is that it only includes cases of maltreatment that are identified by social services. Further work is needed to identify the impact maltreatment on autistic and non-autistic children with ID.

314 **218.314** The Autism Spectrum Ambassador Program: Enhancing a Novel Medical Student Run Program

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Background: Recent studies have identified that children with Autism Spectrum Disorder (ASD) often face negative experiences when accessing healthcare. Triggers for these patients can include changes in routine and anxiety from interactions with new people and environments. The Autism Spectrum Ambassador Program (ASAP) aims to improve the healthcare experience for pediatric patients diagnosed with ASD and their families by providing the child and family with a medical student Ambassador to accompany them and facilitate accommodations on their behalf during a medical or surgical procedure at the Penn State Hershey Children's Hospital.

Objectives: This study aims to use a common quality improvement methodology (PDSA cycles) to improve recruitment and enrollment for our novel medical student run Ambassador program.

Methods: Program materials were created by study personnel to teach medical students about autism and the Ambassador Program. This program pairs ASAP-trained medical students with a family whose child is scheduled for an outpatient procedure and who may benefit from accommodations to improve cooperation and procedure tolerance. We realized over the first full year of implementation that the protocol to identify and recruit participants was not as effective as we had hoped. To identify potential barriers we used structured, open ended interviews with every member of the study team. A flowchart detailing the protocol steps was created and changes to the study protocol were made based on the feedback learned from interviews to maximize the program's success.

Results: In the 2 years after the program's inception, 23 patients were identified for enrollment. Ten participants were enrolled as controls. While 13 were enrolled into the intervention group, only 4 were assigned student Ambassadors. The remaining 9 did not complete the accomodation survey despite several reminders to do so. Figure 1 details the themes identified and potential solutions for each barrier as a result of the interviews conducted. Figure 2 depicts a flow chart which links each barrier (colored letter) with the step in the protocol that is affected. We decided to focus changes that would 1) increase the number of available Ambassadors, 2) better identify potential study participants, and 3) enhance the flexibility of the consenting process. Changes included 1) allowing student Ambassadors to create and distribute accommodation plans even if they themselves were not available to be at the child's procedure in person, 2) distributing study flyers to all clinic sites and re-educating the surgical sub-specialities about the program and 3) adding an option to consent potential recruits over the phone rather than only when they were in the hospital for a planned visit. While plans for protocol changes have been made, no data have yet to be collected.

Conclusions: While the ASAP program aims to improve the healthcare experience for pediatric patients diagnosed with ASD and their families, barriers exist that prevent the positive impact of this program to be fully realized. We hope that recent changes to the protocol informed by detailed interviews with study personnel will lead to improved outcomes for our patients with autism and their families.

315 **218.315** The Implementation of Reciprocal Imitation Training (RIT) with Toddlers in a Community-Based Setting

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Background: Numerous studies have indicated that early, ASD-specialized treatment leads to significant improvements in social, language, cognitive, and behavioral functioning for children with ASD. However, very few treatments have been adapted for use in community-based settings, where they may reach a broader segment of the population and remedy limited access. This study examines the implementation of Reciprocal Imitation Training (RIT)--an evidence-based, ASD-specialized treatment–by community Early Intervention (EI; IDEA Part C) providers serving toddlers from birth to 3 years.

Objectives: To examine: (1) the effectiveness of a system-level intervention (i.e., training workshop) for EI providers for increasing their self-efficacy when providing intervention to toddlers with possible ASD; (2) key implementation factors related to providers' use of RIT (i.e., adoption, acceptability, feasibility); and (3) providers' perceptions of RIT effectiveness for improving key outcomes.

Methods:

Sample.62 EI providers from 9 agencies in 4 counties across Washington State were enrolled. Providers had a mean age of 42.3 years and mean of

15.2 years in practice. The majority were speech-language pathologists (46.5%) or occupational therapists (23.3%) and female (93.8%).

Procedures. A stepped-wedge design was used to randomly assign counties to the timing of the system-level intervention. Survey data were collected at baseline (T1) and 6-months post-intervention (T2). The system-level intervention comprised a 1-day training workshop conducted for each agency, which focused on imitation impairments in ASD, the RIT cycle steps, parent coaching, and live demonstrations and practice.

RIT. RIT (Ingersoll, 2008) is a manualized ASD-specialized treatment that uses a naturalistic developmental behavioral approach (NDBI; Schreibman et al., 2015) to teach object and gesture imitation within a play-based context. RIT was chosen because of its strong evidence base (Ingersoll, 2010; 2012), ease of administration, flexibility, and focus on a core deficit area for ASD. Given its low intensity and playful nature, RIT is suitable for toddlers with delays in imitation and unlikely to have any negative consequences if used with toddlers who do not have ASD.

Measures. Self-report measures of practices and self-efficacy regarding ASD care were collected at T1 and T2. At T2, providers rated items about RIT feasibility and acceptability from the User Rating Profile (URP; Chafouleas et al., 2011) and about perceived RIT effectiveness.

Results: There were significant increases in providers' self-efficacy in identifying and discussing treatment goals with families of children with ASD, $p<.01$. At T2, provider ratings indicated high levels of feasibility and acceptability for RIT (Table 1). 48 providers (81%) reported using RIT with 349 children and coaching 277 parents. The majority of these providers indicated that they perceived RIT to improve key parent-child outcomes (Table 2).

Conclusions: These findings suggest that a relatively brief training workshop can increase EI providers' use of an evidence-based ASD treatment with their caseload and feel more efficacious in working with families of children with possible ASD. While additional research is needed to directly assess its effectiveness at improving parent-child outcomes, RIT may help families get an early start on accessing specialized treatment within an established infrastructure available across the U.S.

316 **218.316** The Penn State Hershey Children's Hospital Autism Spectrum Ambassador Program: A Novel Medical Student Run Advocacy Program

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Background: Autism Spectrum Disorder (ASD) is one of the most common pediatric neurodevelopmental disorders in the U.S with prevalence of 1 in 45 children. The number of patients with ASD presenting for therapeutic or diagnostic procedures under sedation/anesthesia is increasing. These children face significant barriers interacting with the healthcare team and often have negative experiences. Recent literature shows that Autism care plans are effective in improving patient experience and outcomes; however, no study has evaluated the implementation of custom care plans with use of an adjunct medical student ambassador (MSA) model.
Objectives:

1. Describe a novel, student-run advocacy program for children with ASD undergoing medical procedures
2. Assess patient satisfaction with a customized Accommodation Plan (AP) implemented by the healthcare team and with having a MSA during the procedure
3. Analyze changes in career interests and ease of interaction with children with ASD for participating medical students

Methods: The Autism Spectrum Ambassador Program (ASAP) is a Penn State Children's Hospital initiative for training medical students to advocate for patients with ASD during a medical procedure under anesthesia. Following IRB approval and parental consent, a convenience sample of children with ASD were enrolled in the pilot project. Subjects were assigned to either the intervention or control arm based on availability of a MSA. Each child's guardian completed an Accommodation Survey prior to his/her procedure to identify unique accommodations to be implemented during the hospitalization. Then, an individualized AP was made based on Accommodation Survey responses and distributed to the child's healthcare team, regardless of whether a MSA would be present that day or not. Both parents and MSAs were requested to complete a Satisfaction Survey shortly after the procedure.

Results: A total of 23 children (13 intervention and 10 controls), ages 5-17 years and 78% male, were enrolled in this pilot program. Of those in the intervention group, 4 were paired with a MSA. 50% of controls completed the satisfaction survey compared to 31% of those in the intervention group. 75-80% of the participants felt that ASAP enhanced their patient experience when compared to a prior hospitalization. Importantly, MSAs did not have a negative effect on patient experience by patient report. MSAs appeared to enhance the staff's implementation of the APs (from 60% to 100% in our sample). There was a small shift in reported MSA career interest to Developmental Pediatrics after program completion. 100% of students reported both feeling more comfortable with this patient population and high satisfaction with the overall experience.

Conclusions: ASAP aims to improve the patient experience for pediatric patients diagnosed with ASD and for their families. Experiences with the program were overall positive, and the MSAs were well received. For MSAs, there was a small shift in career interest and an increased comfort level while interacting with special-needs children. The researchers anticipate that changes in the recruitment process is warranted to enhance participant enrollment and acknowledge the full value of the program.

317 **218.317** The Service Provider Perspective: "What Services Do I Need and Want?" Vs. the Thoughts of Service Providers.

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Background:
Service providers aim to provide services that will benefit the service users. The service users often receive services they do not find useful, need, want or like. There are several reasons for the discrepancies ranging from not being heard, not finding the right professionals, to having bureaucratic reasons why the right kind of service is not funded for the individual. More importantly, and more often than not, the service provider may not know what is the best service they should provide.

Objectives:

The aim is to explore how service providers and services are found, what are the services that are found to be useful by the services users and which ones are not, why people drop out from services, and do professionals and individuals with ASC have the same answers to these questions.

Methods:

An online web survey and phone interview survey was conducted in Finland. Two entities were contacted: professionals who work with ASC and individuals with ASC. Individuals at the age 15 or above were targeted due to the national school curriculum after which services are provided by other organisations than schools.

Results:

The ongoing survey has reached by now 580 professionals and 152 individuals with ASC. In the poster we will present the survey participant demographics more thoroughly and the analyses of the survey data.

Conclusions:

The survey results will be discussed in relation to the way service providers should try to impact their service design to reach correct outcomes but also to have services that are found to be useful by the service user. We will also suggest that data should be used to alter the ways funding is placed on different services by municipalities and by the state in order to have the voices of the services users to be h

318 **218.318** Transition to Adult Healthcare for Teens and Young Adults with ASD

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Background: With increases in Autism Spectrum Disorder (ASD) prevalence, not only is the number of children diagnosed with ASD increasing, but the number of adolescents with ASD who are transitioning to adulthood is also rising. This results in a growing number of young adults with ASD transitioning from the pediatric to adult health care systems. Without a coordinated transition plan, pediatric providers often continue to provide care to young adults with ASD that is beyond the scope of their medical training. When adult providers are identified who are willing to assume the care of young adults with ASD, they often feel unprepared to address the unique needs of this population.
Objectives: Develop resources for pediatric and adult medical providers to facilitate transition to adult healthcare for teens and young adults with ASD.

Methods: A pediatric primary care practice that serves children with ASD and other special health needs as well as their typically developing siblings was identified. Staff, patients, and families were surveyed to determine baseline transition practices. Existing resources were identified. New resources for staff, patients, and families were created and implemented. Results from utilization of resources and technologies were accessed to identify improvements and barriers.

Results: Baseline data revealed much variability across staff and families regarding addressing transition. In addition to the need for improved consistency, topics needing greater attention were identified. These included financial and legal issues as well as vocational, educational and recreational options post high school. An evidence-based and replicable Patient Checklist, starting for patients at age 12 and continuing through ages 21+, was implemented to improve transition activities within the practice. The checklists included a formal transition policy, staff and family educational resources, a templated HEEADSSS -ASD assessment to aide providers in structuring a psychosocial interview with a young adult with ASD, a transition registry to create a working database of transitioning patients, and a comprehensive transition template imbedded into the practice EMR system to track completion of transition goals for individual patients. While designed for the transitioning patients of a pediatric practice, these same elements can guide an adult primary care practice in readying their practice to receive young adults with ASD.

Challenges in implementing the transition process included finding time within provider schedules to discuss transition-related issues with patients/families, changing existing practices and methodologies throughout the organization to help support the new transition model, and identifying adult providers with whom to collaborate regarding patients' ongoing care needs. Those families for whom the process was implemented reported better preparation for transition including greater access and knowledge of adult systems of care and more satisfaction with medical care from adult providers.

Conclusions: Transition from the pediatric to the adult healthcare systems presents unique challenges for people with ASD. To ensure a coordinated and seamless transition, the process must be clearly outlined and started early in adolescence, the adolescent and family must be an integral part of the transition process, and there must be collaboration and communication between the pediatric and adult care providers.

319 **218.319** Use of a Novel Care Model to Reduce Behavioral Crisis Emergency Room Visits and Inpatient Psychiatric Hospitalization Length of Stay

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Background: In patients with autism and other neurodevelopmental disorders, high patient acuity and limited outpatient care resources contribute to high emergency room (ER) visit rates while in crisis. This represents a significant burden to the healthcare system in terms of cost and potential for injury to the patient, family and medical staff.
Objectives: 1) To determine if enhanced outpatient care management was associated with reduced ER visit rates for behavioral reasons. 2) To determine if enhanced outpatient care management was associated with decreased length of stay.

Methods:

This chart review was approved by the Cincinnati Children's Hospital Medical Center IRB. High acuity patients within our neuropsychiatry continuum of care were enrolled in enhanced care management. All enrolled patients had a diagnosis of Autism Spectrum Disorder (ASD) or other neurodevelopmental disorder and a history of significant healthcare utilization for behavioral and/or medical reasons. All patients received 1) outpatient nurse care management including frequent phone calls to families and care coordination 2) mental health specialist support in the outpatient psychiatry clinic and 3) efforts to provide direct admission to inpatient psychiatry when possible in order to avoid an ER visit. Utilized chart review to gather data from the first 47 consecutive patients enrolled in our enhanced care management program. Data on ER visits for

behavioral health reasons and inpatient psychiatry hospitalizations was collected from patients for the year prior to enrollment in care management and at least one year post-enrollment.

Results:

Forty-seven patients with a mean age of 15.1 years (stdev 3.9) were included in this analysis. Enrollment in neuropsychiatry enhanced care management was associated with a statistically significant ($p<0.0001$) decrease in both the annual number of ER visits for behavioral reasons and the annual number of days admitted to the inpatient psychiatry unit. The average number of annual ER visits prior to enrolling in enhanced care management was 1.4 visits (range 1-8 visits, stdev 0.9). After enrollment in enhanced care management, the average number of annual ER visits was 0.5 visits (range 0-4 visits, stdev 0.6). Average annual length of inpatient stay pre-enrollment was 13.1 days (range 4-45 days, stdev 7.6), while the average annual length of inpatient stay post-enrollment was 5.6 days (range 0-22 days, stdev 4.9).

Conclusions:

Enrollment in the enhanced neuropsychiatry care management program was associated with a statistically significant decrease in annual ER visits, with an estimated annual cost savings of $103,400 ($2,200 per patient per year). The average annual length of inpatient stay was also significantly decreased with an estimated annual cost savings of $514,650 ($10,950 per patient per year). Future work will include assessing for changes in patient and family quality of life, and assessing injury reduction in the ER and the inpatient psychiatry unit.

320 **218.320** Usual Care Intervention Practices for Youth with Co-Occurring Autism Spectrum Disorder and Intellectual Disability

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Background: Approximately 31% of children with Autism Spectrum Disorder (ASD) have a comorbid intellectual disability (ID) (Baio et al., 2018). As co-occurring ID has been found to predict poor prognosis in ASD (Matson & Shoemaker, 2009), there is a need to better understand the usual care of core social and associated psychiatric symptoms in this population.

Objectives: Understanding usual care for youth (ages 7-22) with ASD and ID is important for advancing the dissemination of evidence-based practices (EBPs) and decreasing treatment disparities in this population. We collected usual care information from expert ASD providers in order to assess self-reported familiarity and use of common practices for treating youth with ASD and ID.

Methods: Expert ASD providers (*N*= 53) representing multiple disciplines across 5 sites were recruited via purposeful sampling. Experts reviewed and suggested revisions to 49 literature-derived practices through a two-round Delphi poll, then rated a revised list of 55 practices on familiarity and use across three domains: anxiety, externalizing behaviors, and social skills. Round 2 ratings of experts who endorsed frequently treating youth with comorbid ID (*n*= 26) were compared with those of experts who never or rarely treat youth with comorbid ID (*n*= 27).

Results: Chi-square analyses indicated that experts who frequently work with individuals with ASD and ID are significantly less familiar with *Psychoeducation* (c2= 4.337, p= .037). In treating anxiety, they are more likely to use *Functional Behavior Assessment* (c2= 4.48, p= .034) and *Suppression Approach* (c2= 4.971, p= .026) and less likely to use *Self-Management* (c2= 3.927, p= .048). In treating externalizing behaviors, experts who work with youth with ID are more likely to use *Didactic Teaching* (c2= 4.369, p= .037), *Shaping* (c2= 4.043, p= .044), *Stimulus Control* (c2= 7.619, p= .006), *Suppression Approach* (c2= 3.846, p= .050), and *Token Economy* (c2= 4.609, p= .032). In treating social skills, they are more likely to use *Providing Choices* (c2= 5.88, p= .015), *Noncontingent Reinforcement* (c2= 5.299, p = .021), *Response Cost* (c2= 4.886, p= .027), *Stimulus Control* (c2= 8.292, p= .004), *Suppression Approach* (c2= 7.127, p = .008), *Imitating the Child* (c2= 4.9, p= .027), and *Communicative Temptations* (c2= 3.886, p= .049), and less likely to use *Self-Management* (c2= 8.265, p= .004).

Conclusions: Findings suggest that expert community providers who commonly treat youth with ASD and ID are more likely to use specific discrete intervention strategies, particularly suppression and stimulus control, for treating anxiety, externalizing behaviors, and social skills than those who treat youth with ASD without comorbid ID. This information could inform research on the dissemination and implementation of EBPs for youth with ASD and ID.

321 **218.321** What Services Are Families of Children with Executive Function Challenges Getting? What Do Parents Say They Want?

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Background:

Parents of children with neurodevelopmental disorders commonly report unmet needs in regard to the treatment and management of their child's diagnosis (Brown et al., 2012; Hodgetts, Zwaigenbaum & Nicholas, 2015). While parent trainings are becoming integrated into the service array as an evidenced-based resource (e.g., Postorino et al., 2017; Loren et al., 2015), there are substantial barriers to these services that limit parent engagement and involvement (Martinez et al., 2018). Furthermore, an understanding of the services that parents truly want is lacking.

Objectives:

To investigate child-related services families are receiving, services and supports parents want, and parent availability to participate in school-based parent trainings.

Methods:

We administered online surveys nationwide to 125 parents of children in 3rd through 5th grades with executive function (EF) problems.

Results:

Results show that 5.6% of parents of a child with an ASD or ADHD diagnosis (N=107) reported they had attended a parent training on EF, and 16.3% reported they had attended a school-sponsored parent training of any kind. Parents of children with Individualized Education Plans (IEPs) (N=57) were more likely to have attended a school-sponsored parent training than those whose children did not have IEPs (χ^2=4.054). Parents of children who received services outside of school (N=42) were more likely to report greater child EF support than those who did not receive outside services

(χ^2=7.588). Parents of children with an ASD diagnosis (N=45) reported that their child was more likely to receive EF support compared to those whose child had an ADHD diagnosis (N=60), or those whose child had undiagnosed EF difficulties (N=18; χ^2=11.78). Eighty-six percent of parents reported that they would like more training opportunities. More specifically, parents reported that they want, and realistically think they can devote, between 0 to 1000 hours to training, with a median of 10.0 hours, per year. Only four parents (3.2%) said they want zero hours of school-based training per year and three (2.4%) said they realistically are able to devote zero hours to training.

Conclusions:

While rates of EF parent training attendance are relatively low, this is likely due to limited opportunities for training. In this study, parents reported that they would like to receive more training. This information should be used to support increased provision of services to families of children with EF problems.

322 **218.322** What Services Do Preschoolers with ASD Utilize? Comparing Services in Two US Cities

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Background:

Although 48 states in the United States have enacted laws requiring health plans cover autism-specific therapies, there is high variability in the legal requirements across states (Baller et al, 2015; Autism Speaks, 2018). Additionally, there are large disparities in access to services for children with ASD in minority groups (Mandell et al, 2002). Although the education system plays a critical role in providing services for preschoolers with ASD (Brookman-Frazee et al., 2009), increasingly, families are accessing additional services through insurance-funded programs. Recent research examining the effect of autism insurance mandates indicates an increase in insurance-based services, but also significant ongoing barriers to expanding access to services to meet need (Baller et al., 2015; Candon, 2018). More information is needed to understand how demographic factors and state and local policies affect children's service utilization. Due to ongoing challenges with service access (Thomas et al, 2007), it may be useful to examine and compare regional service utilization in a diverse sample in order to understand where to intervene to improve access for underserved youth.

Objectives:

Explore differences in service use based on sociodemographic and geographic factors by comparing parent report of non-school based ASD services from preschoolers in Pennsylvania and California.

Methods: Data from two longitudinal studies of preschool children (3 – 5 years old) with ASD receiving publicly funded educational services in Philadelphia, Pennsylvania (N = 71; 83% male; 55% Black/African American; 18% Hispanic/Latino) and San Diego, California (N = 144; 80% male; 36% Hispanic/Latino; 2.8% Black/African American) were analyzed. Parents reported their children's current non-school based services (e.g., speech therapy, occupational therapy) via interview (Philadelphia) or questionnaire (San Diego). Chi-square tests of independence were run to examine differences.

Results: Table 1 summarizes the percent of preschoolers with ASD whose parents reported receiving specific services outside of school programs in both locations. When compared to children in CA, children in PA received significantly less behavioral therapy, but significantly more mental health services (*p*s <.001). In addition, more children in CA received medication than in PA (*p* <.02). Further analyses will explore child and family characteristics (e.g. race/ethnicity, socioeconomic status) and state policy differences as predictors of service use.

Conclusions: Preliminary results suggest that there are differences in service utilization for preschoolers with ASD in CA and PA. These utilization differences may be related to sociodemographic characteristics of the families or differences in service availability due to state policies.

323 **218.323** "We Are Doing the Best We Can" - Service Provider and Government Stakeholder Perspectives on Autism Spectrum Disorder Services in the Western Cape Province of South Africa

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Background:

Meeting the educational needs of school aged children with autism spectrum disorder (ASD) is a major challenge in South Africa. In the Western Cape Province, for example, the rate of referrals to educational services significantly outweighs capacity in the system. An analysis of the Western Cape Education Department database performed by us in 2016 found 940 children with ASD in the system, and 744 children waiting for school placement. Alarmingly, numbers on the waiting list showed an increase of 276% over a five-year period. Existing services and structures are therefore under increasing pressure and scrutiny to identify solutions.

Objectives:

The objective of the study was to examine multi-stakeholder perspectives of the challenges and proposed solutions to meet the educational needs of children with ASD and their families. Here we focused on the perspectives of clinical service providers and government stakeholders.

Methods:

Semi-structured interviews were conducted with eight ASD service providers and six stakeholders from the Western Cape Departments of Education, Health and Social Development. Thematic analysis was used to identify emerging themes and related categories from each stakeholder group, before identifying critical domains of synergy and contestation in the two groups.

Results:

Service providers shared information about service related challenges in meeting the needs of individuals with ASD across the spectrum and across the lifespan. The theme '*We are failing the child*' described how decisions made were reactive rather than proactive, and not always in the best interest of the child with ASD and their families. The theme '*Everyone is working in silos*' captured the frustrations of providers about

perceived poor collaboration between government departments.

Government stakeholders from different departments displayed varying degrees of knowledge and accountability for the ASD situation in the province with some departments assuming more responsibility than others as demonstrated in the theme '*They are all not on the same page*'. In the absence of an integrated national or provincial strategy for ASD, some departments described the approach to service delivery as '*Putting out little fires everywhere'.* Government stakeholders concurred that collaboration was a problem and that all government departments should be working together to find solutions.

Two integrated, overarching themes emerged from both constituencies. '*Autism is an expensive diagnosis'* highlighted stakeholder perspectives that autism services demanded very significant physical and human resources. '*We are doing the best we can*' described how, despite having an overburdened system and over-stretched resources both stakeholder groups felt that the Western Cape Province was doing better than other provinces in the country in terms of ASD services by having a consolidated database, outreach teams and establishing new ASD units at some special schools.

Conclusions:

The study highlighted various challenges in meeting the educational needs of children with ASD in South Africa. Few, if any, tangible solutions were proposed by stakeholders. Findings suggest the urgent need for a multi-stakeholder process, crucially including the voices of families who live with ASD, to generate comprehensive, evidence-based, sustainable and scaleable policies and practices to meet the educational needs of all children with ASD.

324 **218.324** Echo Autism Transition: An Innovative Approach for Increasing Access to Healthcare for Adolescents and Young Adults with Autism Spectrum Disorder

B. A. Malow[1], *G. Stobbe*[2], *N. C. Cheak-Zamora*[3], *A. Curran*[4], *K. Davis*[5], *A. Hess*[6], *R. L. Loftin*[7], *M. O. Mazurek*[8], *M. Mirza-Agrawal*[9], *M. Tapia*[10] *and K. Sohl*[11], *(1)Sleep Disorders Division, Department of Neurology, Vanderbilt University Medical Center, Nashville, TN, (2)Psychiatry & Behavioral Medicine, Seattle Children's Autism Center, Seattle, WA, (3)Health Sciences, University of Missouri, Columbia, MO, (4)Thompson Center for Autism, Columbia, MO, (5)Seattle Children's Autism Center, Seattle, WA, (6)The Ohio State University/CAST, Hilliard, OH, (7)Department of Psychiatry and Behavioral Sciences, Feinberg School of Medicine, Northwestern University, Chicago, IL, (8)University of Virginia, Charlottesville, VA, (9)Florida International University, College of Medicine/EMBRACE, Miami, FL, (10)University of Texas at Austin, Austin, TX, (11)Thompson Center for Autism, University of Missouri - School of Medicine, Columbia, MO*

Background:

Dramatic increases in the prevalence of autism spectrum disorder (ASD) have been accompanied by a rising tide of adolescents with ASD who are entering adulthood. With well-documented shortages in the provider workforce, training of community healthcare providers to serve the unique needs of transition-age youth with ASD in geographic, racial, ethnic, and economically diverse communities requires novel approaches.

Objectives:

Project Extension for Community Healthcare Outcomes (Project ECHO) framework is an approach that has proven successful in increasing the role and expertise of the practicing community-based primary care provider (PCP). Project ECHO uses secure multi-point videoconferencing technology to create a learning community, connecting PCPs in local communities ("spokes") to an interdisciplinary team of experts ("hub") through regular recurring sessions. During these sessions, learning is facilitated through brief evidence-based didactics, case-based learning (during which PCPs present their own cases for discussion and co-management), collaborative mentorship, and guided practice.

In ECHO Autism (*Clinical Pediatrics, 56(3)*: 247-256, 2017), significant improvements were observed in self-efficacy, adherence to ASD screening guidelines, and use of ASD-specific resources, with high satisfaction reported by participants. We now describe the development and implementation of an innovative approach to increasing access to healthcare for adolescents with ASD, entitled ECHO Autism Transition.

Methods:

In Summer 2018, the planning team, including hub team members, developed a template for presentation along with didactic presentations and materials to measure outcomes. In Fall 2018, PCPs were recruited for the program through several routes including community-based referral sources, national provider organizations, and social media. A total of 12 weekly 1-hour sessions are being conducted, in which a series of didactic presentations are given by hub team members on topics related to transition-age years. Case presentations are delivered by spoke participants that allow for discussion between hub members and participants. Recommendations are discussed and formally given to the case presenter. Recommendations and resources are available online for participants to access at any time. Participants receive CME for participation, and outcome measures regarding participant satisfaction, confidence, and knowledge are being collected (to be completed in early 2019).

Results:

A total of 15 PCPs were recruited nationally and meet weekly for the ECHO sessions. Didactic sessions include topics such as medical and psychiatric co-occurring conditions, behavior management in primary care, supporting families through transition, life skills development, supporting the self-advocate, guardianship, education, housing, and sexuality. Case presentations highlight challenges facing adolescents and their families as they transition to adulthood. Data regarding participation rate, provider satisfaction, provider confidence and knowledge, and common themes of case presentations are being collected and will be presented.

Conclusions:

To our knowledge, ECHO Autism Transition is the first of its kind to focus on the transition to adulthood in ASD. We have successfully developed and launched a case presentation template, outcomes measures, and didactic presentations and have enrolled a cohort of participants. We will present additional outcomes data paralleling that published previously for ECHO Autism. ECHO Autism initiatives illustrate evidenced-based approaches in building workforce capacity and access to quality care in individuals with ASD.

Poster Session
219 - Social Neuroscience
5:30 PM - 7:00 PM - Room: 710

325 **219.325** ASD Symptoms Are Associated with Reduced LPP As Youth Learn about Inconsistent Peers during Social Interactions.

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Background: Social skills deficits are a primary autism spectrum disorder (ASD) symptom. Failure to learn about others in new or unpredictable social situations may contribute to this deficit. Prediction and reevaluation of others during iterative social interactions is essential for learning (Behrens, Hunt, Woolrich, & Rushworth, 2008) to appropriately engage in social interactions, but is less essential once learning has occurred (Davis & Levine, 2013). Quicker learning to predict another's behavior may improve social skills in individuals with ASD symptoms. The late positive potential (LPP), an event-related potential associated with evaluating and attending to emotional stimuli (Hajcak et al., 2009), is enhanced to unpleasant social stimuli and reduced after reevaluation (Foti & Hajcak, 2008). Individuals with ASD exhibit a blunted LPP to social stimuli (Benning et al., 2016). Yet, little is known about how ASD symptomology relates to the changes in the LPP as individuals *learn* about their peers during social interactions.

Objectives: Examine if learning moderates relations between ASD symptomology and changes in the LPP over iterative social interactions.

Methods: Electrophysiological responses were measured via EEG as neurotypical youth (N = 54, M_{age}=12.11, SD_{age}=2.91; 22 male) were evaluated by purported peers who provided consistent (100% positive *or* negative) or inconsistent (50% positive and negative) evaluation in a Virtual-School context. Participants randomized to the control condition were informed of each peer's reputation for being nice, mean, or unpredictable prior to entering the Virtual-School (N=29). Those in the learning condition learned each peer's reputation through their evaluation alone (N=25). In this group, learning was confirmed based on ratings participants provided about each peer after every two interactions (nice-vs-unsure-vs-mean). Change scores for the LPP after social evaluation (400-1000ms) were calculated by subtracting early (first 48) from late (last 48) interactions. Moderation analyses determined the extent to which changes in LPP (X) differentially related to ASD symptoms (Y; subscales of the SRS-2, Constantino & Gruber, 2005) in the learning and the control groups (W).

Results: The learning group had greater changes in peer rating between early and late interactions for all peers, demonstrating learning occurred (*p's*<0.05*)*. Group moderated the relation between change in LPP to inconsistent peer evaluation and ASD symptoms of social awareness, communication, and cognition (*B's*>0.49, *p's*<0.05). Specifically, in the learning group, reduced LPP to inconsistent social evaluation in late-vs-early interactions was associated with more severe ASD symptoms. This relation was not observed in the control group. No effects were observed for consistent social interactions (*B's*<0.34, *p's*>0.16).

Conclusions: More severe ASD symptoms are associated with reduced LPP responses to inconsistent social evaluation when individuals learn about their peers through first-hand experience. Reduced LPP responses may indicate social evaluation from inconsistent peers becomes less salient throughout learning for those with ASD symptoms. This may increase reevaluation and difficulties predicting inconsistent peers which could exacerbate problems generalizing social skills to novel social situations (Bellini, Peters, Benner, & Hopf, 2007). Thus, targeting learning in novel or inconsistent social interactions may enhance the generalization of social skills in those with ASD symptoms.

326 **219.326** Altered Functional Connectivity during Social Interaction in Children with Autism Spectrum Disorder

Y. Xiao[1,2], *D. Alkire*[1,2], *D. Moraczewski*[1,2] *and E. Redcay*[1,2], *(1)Department of Psychology, University of Maryland, College Park, MD, (2)Neuroscience and Cognitive Science Program, University of Maryland, College Park, MD*

Background: Individuals with autism spectrum disorder (ASD) have difficulties engaging in reciprocal social interaction, which might be due to both atypical reward processing and mental state reasoning, or mentalizing (Chevallier et al., 2012; Pelphrey et al., 2011). While previous explorations of social processing in ASD were mainly focused on activation and conducted in non-interactive contexts, recent studies have begun to address this question during real-time social interaction (Jasmin et al., 2018; Redcay et al., 2013). However, research has not examined the integration within and between mentalizing and reward brain networks during social interaction in children with ASD, especially in middle childhood, an important period for social and cognitive development.

Objectives: We aimed to investigate functional correlations within and between the mentalizing and reward networks during social interaction in children with ASD compared to neurotypical (NT) children.

Methods: Preliminary data from an ongoing study are reported from 12 children with ASD (10 males, 12.3 ± 0.91 years) and 12 NT children (11 males, 13.01 ± 1.44 years), matched on age, gender, and IQ. We used an interactive game in which children predicted responses of either a social partner or a story character based on either mental or non-mental state information (Alkire et al., 2018).

Data preprocessing was performed using AFNI (Cox, 1996), with functional images normalized to a child template (Fonov et al., 2011) and effects of head motion minimized (i.e., censor volumes exceeding 1 mm framewise displacement (FD); remove runs >10% censored volumes or mean FD > 0.5 mm). Controlling for head motion, functional connectivity was calculated by estimating trial-wise beta series (Mumford et al., 2012; Rissman et al., 2004) of regions in the mentalizing and reward networks (Neurosynth; Yarkoni et al., 2011) for each condition (Figure 1). We examined effects of group (ASD vs. NT), social context (social partner vs. story character), and their interaction on the mean connectivity within and between the mentalizing and reward networks. Further, we verified specificity of the effects within and between the mentalizing and reward networks through a supplemental analysis within the mirror neuron and salience networks, which are also involved in social interaction (Redcay and Warnell, 2018).

Results: We observed group*social context interactions on mean connectivity within the mentalizing network ($F(2,23) = 4$, $p = .0496$) and between the mentalizing and reward networks ($F(2,23) = 4.01$, $p = .0495$). These effects were driven by greater connectivity during social interaction in NT children (mentalizing network: $F(1,11) = 9.38$, $p = .004$; between networks: $F(1,11) = 6.41$, $p = .017$) but not in children with ASD. Our specificity analyses demonstrated no effects within the mirror neuron or salience networks.

Conclusions: We demonstrated that brain functional connectivity within and between the mentalizing and reward networks is modulated by social-interactive context in NT children but not in children with ASD. These preliminary results suggest reduced neural sensitivity to social interaction in children with ASD compared to NT children, which provides new insights into the brain basis underlying social difficulties in ASD during real-world social interaction.

327 **219.327** Analysis of Neural Dynamics during Social Interaction with a Virtual Avatar in Autism

A. Bánki[1], *A. Lefebvre*[2], *D. A. Engemann*[3], *A. Pedoux*[4], *F. Amsellem*[5], *R. Delorme*[6] *and* ***G. Dumas***[7], *(1)Faculty of Psychology, University of Vienna, Vienna,*

Austria, (2)Institut Pasteur, Paris, France, (3)Parietal Team, INRIA, Gif-sur-Yvette, France, (4)Institut de psychologie, Université Paris Descartes - Sorbonne Paris Cité, Paris, France, (5)Pasteur, Paris, France, (6)AP-HP, Robert-Debré Hospital, Child and adolescent Psychiatry unit, Paris, France, (7)Human Genetics and Cognitive Functions Unit, Institut Pasteur, Paris, France

Background:
Social interactional neuroscience aims to explore the neural mechanisms underlying our social interactions, in order to better understand human behaviour and to reveal processes that are responsible for social impairment, one of the primary characteristics of neurodevelopmental disorders such as Autism Spectrum Disorder (ASD).

Objectives:

The aim of this study is to provide a more precise understanding on impaired reciprocal social interactions in ASD with the perspective of developing electroencephalography (EEG) based diagnostic methods in current child and adolescent psychiatric practice.

Methods:

In this study, neural dynamics of 40 typical controls (CTR) and 40 participants with ASD (Table 1) were recorded with high-density EEG (HD-EEG) during resting state and a social interactive task, where subjects coordinated their finger movements with a virtual avatar designed to behave like a human (Human Dynamic Clamp [HDC]). Neurophysiological data was analysed in order to compare the neural dynamics between the two groups. We computed Power Spectral Density (PSD) for each participant and investigated anatomo-functional differences in the usual frequency bands (Hz): Delta (1-4), Theta (4-7), Alpha (Low: 7-10, High: 10-13), Beta (13-30) and Gamma (30-45) and 8 brain lobes (Left frontal, Right frontal, Left parietal, Right parietal, Left occipital, Right occipital, Left temporal and Right temporal). Motor behaviour performances and verbal reports about the avatar's behaviour were also assessed to compute sensorimotor and socio- cognitive metrics.

Results:

Social interaction with a virtual avatar revealed in both CTR and ASD groups a decrease in the Alpha band over the parietal lobes and an increase in the Beta and Gamma bands over the occipital lobe. However, we observed: 1) a greater High-Alpha suppression over the frontal lobe in ASDs, potentially reflecting inhibitory effects, and 2) higher increase in the Beta and Gamma bands over the occipital lobe in CTRs, potentially reflecting attentional effects; both observations are consistent with our previous findings. Behavioural analyses found small differences between groups, for sensorimotor scores ('Phase Coordination', 'Amplitude Coordination', 'Task Realisation') but more specially for socio-cognitive metrics ('Intentionality', 'Theory of Mind').

Conclusions:

These results support the development of social interactive tasks for the exploration of the neurophysiology of autism and its link to social cognition. The Human Dynamic Clamp allows to narrow the intra-individual variance while revealing inter-group differences. Our findings demonstrate that it can be used in clinical context and serves as a new instrument for the evaluation of on-line and off-line modes of social cognition. The HDC can also contribute to the improvement of existing therapeutic interventions for ASD that exploit virtual reality and social robotics.

328 **219.328** Associations between Changes in Social Visual Engagement and White Matter Microstructure during the First 6 Months of Life.

A. L. Ford[1], *L. Li*[2], *W. Jones*[3], *A. Klin*[3] *and S. Shultz*[3], *(1)Marcus Autism Center, Emory University School of Medicine, Atlanta, GA, (2)Marcus Autism Center, Children's Healthcare of Atlanta, Emory University, Atlanta, GA, (3)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA*

Background: Attention to eyes—a critical skill that guides typical socialization—is already in decline by the second month of life in infants later diagnosed with Autism Spectrum Disorder (ASD), with steeper decreases in eye fixation associated with more severe social disability (Jones & Klin, 2013, *Nature*). In contrast, typically developing (TD) children *increase* their attention to eyes throughout infancy, establishing a foundation for continued social visual engagement and brain specialization. The neural systems associated with this basic mechanism of social adaptive action are currently unknown, even in typical development. Identifying associations between trajectories of social visual engagement and trajectories of brain maturation in typical infancy is an important step towards understanding how deviations from these trajectories may lead to the emergence of social disability in ASD.

Objectives: To identify associations between trajectories of white matter microstructure and trajectories of social visual engagement in the first 6 months of life.

Methods: Diffusion MRI and eye-tracking data were collected prospectively and longitudinally in the same infants (n=32, 10 female) at 3 and 6 pseudorandom time points, respectively, between birth and 6 months. All participants were full-term, healthy infants with no family history of ASD or developmental delay and no known medical or genetic conditions. Diffusion data were collected with the following parameters: multiband factor of 2 with GRAPPA of 2; 2mm isotropic spatial resolution; b=0/700 s/mm^2, 61 diffusion directions. Atlas-based tractography was used to delineate major white matter tracts: arcuate fasciculus, corpus callosum – body, genu, and splenium, inferior fronto-occipital fasciculus, and inferior longitudinal fasciculus. Fractional anisotropy (FA) values were generated for each tract. Eye-tracking data were collected while infants viewed scenes of actress caregivers engaging in naturalistic interaction and percentage of fixation time for each of four regions-of-interest (eyes, mouth, body, background) was calculated. Growth curves were fit using functional principle component analysis (FPCA) and Functional Linear Regression using Principal Component Analysis tested associations between longitudinal trajectories (Yao, Müller, & Wang, 2005, *Ann. of Statistics*).

Results: Functional regression analyses revealed significant coefficients of determination (p<.05) between growth curves of eye-looking and FA in the genu of the corpus callosum (CCg) and inferior fronto-occipital fasciculus (IFOF). No other associations were found. Examination of the estimated regression functions (Figure 1C) revealed that percentage of fixation time on eyes at earlier developmental time points positively contributes to FA in the CCg and IFOF at later developmental time points (Figure 2).

Conclusions: This study provides the first demonstration of associations between trajectories of white matter development and social visual engagement in the first months of life. Early attention to eyes—a basic mechanism of social adaptive action that is disrupted in ASD—is positively associated with later development of the CCg and IFOF, tracts that form the structural foundation of pathways involved in voluntary goal-directed

attention. These findings indicate that developing visual networks may be particularly responsive to experiential input involving the eyes of social partners and suggest a process by which early divergence from normative experience may lead to atypical patterns of white matter development in ASD.

329 **219.329** Atypical Associations between Gesture Processing, Performance and Social Symptoms in Autism Spectrum Disorder

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Background: Individuals with autism spectrum disorder (ASD) demonstrate impairments in nonverbal communication, including diminished use of gestures, gesturing errors and difficulties with imitation. One potential explanation for these impairments is a deficit in perceiving biological motion (BM). Decreased visual sensitivity to BM may inhibit adequate processing of dynamic non-verbal social cues, like gestures. This perceptual dysfunction may impede learning and subsequent performance of these actions, resulting in nonverbal communication deficits and atypical social development in ASD.

Objectives: The goal of this study was to examine the brain-behavior relationships between neural activity during gesture processing, gesturing abilities and social symptoms to identify atypical mechanisms underlying perception-action coupling and how this abnormality may relate to compromised social development in ASD.

Methods: Participants included 15 children and adolescents with ASD and 16 typically-developing (TD) controls, ages 9 to 17. During the fMRI task, participants viewed animations (created by applying digitalized motion capture of actions performed by an actor to a 3D human model) of both functional (e.g. driving) and communicative (e.g. waving) gestures. Gesture performance was assessed outside the scanner using a charade-style paradigm, in which participants enacted a series of 15 familiar actions (e.g. brush teeth), which were double-coded by raters blind to diagnosis for quality of specific components (e.g. limb movement, hand posture). A parent-report measure of social functioning, the Social Responsiveness Scale (SRS-2), was also collected.

Results: In whole brain analyses, both groups showed activation of lateral occipital-temporal cortex (LOTC), a region sensitive to both body motion and form. Beta parameters were averaged from 6-mm radius spherical regions of interest (ROI) centered around individual peak coordinates in bilateral LOTC. This ROI analysis revealed that the ASD group had reduced activity in left LOTC compared to controls ($p < .001$). In order to explore this group difference in neural activity, we examined associations between activation, gesture performance and social symptomology. The TD group showed a negative correlation between left LOTC activity and SRS scores ($r = -.49$, $p < .05$), not present in the ASD group ($r = -.09$, $p = .76$). Gesture performance was also negatively correlated with SRS scores in both groups, significant only in the TD group ($r = -.60$, $p < .05$; ASD: $r = -.57$, $p = .05$). These associations demonstrate links between social impairment and both diminished processing and performance of gestures. In a subset of participants who completed both fMRI and behavioral components (8 ASD, 12 TD), activity in left LOTC was positively associated with gesture performance in the TD group ($r = .65$, $p < .05$) but not the ASD group ($r = .08$, $p = .86$).

Conclusions: These findings suggest that in typical development, increased neural processing of gestures is associated with better gesture performance and social functioning, supporting a link between perception of dynamic social cues, subsequent gesturing abilities and sociability. The absence of such relationships in the ASD group may reflect dysfunction in a perception-action coupling mechanism that leads to cascading effects on atypical social development.

330 **219.330** Decreased Ventral Striatum Activation during Receipt of Social Response in Children with ASD and Co-Occurring Social Anxiety Symptoms

H. A. Yarger[1], *L. A. Kirby*[2], *D. Moraczewski*[3], *K. R. Warnell*[4], *K. A. McNaughton*[5], *A. Cechaviciute*[1], *D. Alkire*[5] *and E. Redcay*[3], *(1)University of Maryland, College Park, MD, (2)Yale Child Study Center, New Haven, CT, (3)Department of Psychology, University of Maryland, College Park, MD, (4)Department of Psychology, Texas State University, San Marcos, TX, (5)Neuroscience and Cognitive Science Program, University of Maryland, College Park, MD*

Background: Children and adolescents with Autism Spectrum Disorder (ASD) are frequently diagnosed with co-occurring anxiety disorders, with meta-analytic results indicating social anxiety disorder (SAD) co-occurs in approximately 16.6% of children and adolescents with ASD (van Steensel, Bogels, & Perrin, 2011). Research focused on SAD in adults has pointed to reduced neural activity in the ventral striatum (VS) during social reward processing when being observed by others (Becker, Simon, Miltner, & Straube, 2017). In one study comparing activation during receipt of social versus monetary reward in adults with ASD or SAD, adults with SAD exhibited greater amygdala activation relative to ASD in response to social reward (Richey et al., 2014). Little work has explored the co-occurrence of social anxiety (SA) symptoms and ASD and its impact on neural activation, especially in children during a real-time social interaction.

Objectives: The current study investigated whether co-occurring SA symptoms in children with ASD were associated with amygdala and VS activation in response to social versus nonsocial engagement during a real-time social interaction.

Methods: Participants were 26 children with a confirmed diagnosis of ASD aged 7 to 15 years ($M = 12.3$, $SD = 1.9$). Symptoms related to SA were assessed using the social phobia scale of the Screen for Child Anxiety Related Emotional Disorders, parent version (SCARED; Birmaher et al., 1997). SA scores ranged from 1 to 18 ($M = 7.0$, $SD = 4.3$). Neural activity within the VS and amygdala in response to social reward was assessed using a socially interactive fMRI paradigm (Warnell, Sadikova, & Redcay, 2018). Participants chatted with either a peer or a computer (social interaction context) that contingently responded to their interest (engaged) or was away (non-engaged), creating a 2 (peer vs. computer) x 2 (engaged vs. non-engaged) design. We were interested in the comparison between social contingency (i.e., peer-engaged) and nonsocial contingency (i.e., computer-engaged). We hypothesized that there would be a positive association between SA symptoms and amygdala activation and a negative association between SA symptoms and VS activation during the peer-engaged relative to the computer-engaged context.

Results: Results supported a negative association between levels of SA symptoms and activation in the inferior ($r = -.54$, $p = .01$) and superior VS ($r = -.50$, $p = .01$) when receiving a socially contingent (i.e., engaged) response from a peer versus the computer. No significant association was observed between SA symptoms and amygdala activation during peer versus computer response ($r = -.13$, $p > .05$).

Conclusions: Results extend previous work in social anxiety by demonstrating a negative relation between social anxiety and social reward

activation in the striatum, but not the amygdala, in children with ASD. Further, unlike previous studies, these social reward effects were found within a naturalistic peer interaction which may have greater relevance to real-world social interaction.

331 **219.331** Distinct Neural Signatures in Social Brain Circuitry in Female Children with ASD

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Background: Autism spectrum disorder (ASD) affects 1 in 189 girls in the United States and is characterized by pervasive deficits in social communication. Due to the greater incidence of ASD in males, the vast majority of research into the behavioral and brain bases of autism have relied on data collected predominantly from male participants. Unfortunately, this has precluded a comprehensive understanding of autism in females, which is critical for developing autism treatment approaches for girls. Of particular interest is that, on average, females with ASD have greater social communication abilities compared to males. This result is consistent with the hypothesis that females with ASD are "protected" from more severe forms of social dysfunction.

Objectives: Here, the goal of our work is to provide important new information regarding the behavioral and neural profiles of girls with ASD with a focus on identifying brain circuitry which are intact relative to boys with ASD.

Methods: We examined the integrity of brain systems underlying a critical aspect of social function that is impaired in ASD: the processing of human voices. Specifically, we examined intrinsic functional connectivity of the voice-selective brain network, anchored in bilateral superior temporal sulcus, in a group of 13 girls with ASD (7-12 y/o) and a comparison group of 13 boys with ASD matched on age, IQ, motion, and ADOS Social Affect. We are also analyzing similar brain and behavioral data from the ABIDE-2 dataset and vocal task-based brain imaging data previously collected by our group.

Results: Preliminary data provide evidence for differential recruitment of voice processing, reward, and affective brain systems in females with ASD. Consistent with a previous study (Abrams et al, *PNAS*, 2013), boys with ASD showed hypo-connectivity of the extended voice-selective network, which includes reward and salience regions. Strikingly, girls with ASD show hyper-connectivity within this network: connectivity in females with ASD exceeded both males with ASD as well as TD boys and girls.

Conclusions: Results suggest that girls with ASD show a distinct neural signature characterized by hyper-connectivity of the extended voice-selected network, and provide preliminary evidence that increased connectivity of voice-reward circuitry may serve as a neuroprotective mechanism for females with ASD. Findings provide new and important information regarding social brain circuitry in girls with ASD, and may contribute to the development of new approaches for identifying and treating affected girls.

332 **219.332** Effects of Oxytocin on Biological Motion Perception in Youth with ASD: A MEG Study

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Background:

The ability to recognize and prefer biological motion is highly conserved and typically developed within the first year of life and is believed to be critical for developing social skills and social understanding. Few studies have shown that infants and adults with autism spectrum disorders (ASD) failed to recognized biological motion, preferred a non-biological stimuli and present atypical brain activity during these tasks. Intranasal administration of the neuropeptide Oxytocin (OT) in individuals with ASD, has been found to modulate the activation of the mirror-neuron system (MNS) and other social-related brain regions, as well as attention to social cues. Here we focused on the influence of OT on the oscillatory brain activity in people with ASD during biological motion perception tasks, especially on alpha-band (mu) activity which is involved in socially-related tasks.

Objectives:

This study aims to explore the impact of OT on oscillatory brain activity in ASD using magnetoencephalography (MEG) during a well-validated biological motion paradigm. We focused mainly on alpha frequency which is considered to represent the MNS activity and correlates with social perception. We hypothesize that OT administration will modulate alpha-band activity in response to biological motion stimuli to resemble that of an aged matched typically developed (TD) group.

Methods:

As a part of an ongoing study, we present initial data from twenty youth with ASD (aged 12-18), who received a single dose of intranasal OT (24IUs) in a double-blind placebo-controlled study. Forty five minutes following administration, participants were scanned in the MEG. During each scan participants were presented with twelve point-light video clips, each 28 s long, presenting figure-performed human action (clapping hands, jumping) or a random movement. An aged-matched TD group serves as a baseline for comparison. For ethical reasons, TD participants did not receive OT/placebo.

Results:

Preliminary results indicate that in ASD, OT indeed modulate the power of alpha band during video clip observation. Calculating the ratio of alpha power between the biological and the random conditions revealed time-dependent differences in the pattern of alpha in sessions with and without OT. Still, with or without OT, ASD individuals presented neural activation patterns different from those of TD.

Conclusions:

Our results indicate that in ASD, OT can influence primary and preserved developmental abilities such as the ability to differentiate biological from non-biological movement. In line with former studies our results imply that OT may attune attention to social stimuli and thus might help to improve social difficulties. To the best of our knowledge this is the first MEG experiment addressing the influences of OT on youth with ASD. Studies of this shade light not only on behavior but also on specific neural component correlates with social perception and thus allow us to learn more about the complex phenomenon of ASD.

333 **219.333** Embodied Emotions in Autism Spectrum Disorder: Somatosensory Evoked Potentials Reveal Atypical Patterns of Neural

Activity during Perception of Emotional Expressions in ASD

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Background: Previous research has shown the independent contribution of the right somatosensory cortex to emotion recognition in the neurotypical individuals (Adolphs & Damasio 2000, Pitcher et al. 2008, Sel et al. 2014), supporting the embodied emotion hypothesis (Niedenthal 2007). Atypical patterns of responses to emotions in Autism Spectrum Disorder (ASD) have been shown in visual cortical areas, but embodiment processes in the Somatosensory Cortex have not been studied in this group yet.
Objectives: The current study investigates embodied simulation in the somatosensory cortex during emotion perception in ASD and typically developed (TD) adults.

Methods: We tested two groups of 20 TD and 20 ASD participants, matched for age (mean TD= 40.3, mean ASD = 41.62), gender (1 female, 19 male) and IQ (mean IQV TD = 114, ASD = 108.08, mean IQP TD = 117, ASD = 112.62). We presented neutral, afraid and happy faces to participants while their brain activity was recorded with a 64 channels EEG. In separate blocks, participants were either discriminating the emotion expressions (emotion task) or the gender (gender task) of the faces shown answering either an emotion or gender question on 20% of trials per task. On 50% trials participant received mechanical tactile stimuli on their left index finger after 105'' from visual onset. We measured the visual evoked potentials (VEPs) over the occipital lobe and the somatosensory evoked potentials (SEPs) over the Somatosensory Cortex. To isolate the pure somatosensory responses related to emotional processing from visual carryover effects, we subtracted the neural activity recorded in the visual-only condition (i.e., when no tactile stimuli were delivered) from activity in the tactile condition (following Sel et al., 2014).

Results: VEPs: we found significant main effects of emotion at P120, N170, and P300, and significant interactions between emotion, task and group at N170 and P300 ($p<.05$) with significant emotion effects only for the emotion task in both groups suggesting different visual processing of emotional expressions in the two groups during later processing stages. SEPs: Both group showed main effects of emotion in the right hemisphere in 60-80'', and in 80-100''. In 80-100'' time window, the effect was significant only in emotion task. Most importantly, we found significant interaction between emotion and group across all time windows between 100 and 220 ms, suggesting group differences at later processing stages. Follow up analyses showed that the main effect of emotion was persistent after 100'' in the right somatosensory cortex of the TD but not in the ASD group, suggesting differential recruitment of somatosensory cortex for embodied processing between the two groups.

Conclusions: Our study provides novel evidence of the contribution of the somatosensory cortex in emotion processing in individuals with Autism Spectrum Disorder. In particular, our results show the presence of embodiment in TD and ASD in early Somatosensory Evoked Potentials, but this effect was prolonged only in the TD group.

334 **219.334** Engagement and Disengagement of Visual Attention in Children with Autism Spectrum Disorder

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Background: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder commonly characterized by abnormalities in social interaction, including decreased time spent looking at others, as well as abnormal reciprocal gaze and eye-contact. Previous studies using eyetracking technologies have identified general deficits in engagement and disengagement of visual attention in children with ASD. These findings suggest that abnormalities in social interaction may be, at least in part, the product of visual attention deficits. Such studies, however, have yet to investigate whether engagement of visual attention in children with ASD is differentially impacted by social and non-social stimuli.
Objectives: We sought to investigate whether visual attention in children with ASD is differentially engaged and disengaged by social and non-social stimuli.

Methods: Eyetracking data were recorded from 11 individuals with ASD and 10 typically-developing (TD) individuals, between the ages of 9 and 16. Participants fixated on a central stimulus for 1s, at which point a peripheral stimulus appeared to one side, either while the central stimulus remained on screen ("overlap" condition) or 250ms after the central stimulus disappeared ("gap" condition). Stimuli were presented in a randomized order, in grayscale, for both social (20 faces of children) and non-social (20 objects, including tennis ball, the Earth, cartwheel, etc.) conditions. Latency to saccade to the peripheral stimulus was recorded, and the gap effect (difference between average "overlap" and "gap" saccade latencies) for each participant was calculated. Reduced gap effect reflects deficits in engagement of visual attention; elevated gap effect indexes deficits in disengagement of visual attention.

Results: There was no significant difference in overall gap effect between ASD and TD participants ($p=.77$). For trials where both central and peripheral stimuli were of the same kind, there was no significant difference in gap effect between ASD and TD children (social:social $p=.34$; nonsocial:nonsocial $p=.73$). On the other hand, for trials with a social central stimulus and a nonsocial peripheral stimulus, there was a gap effect in TD children ($p<.01$) but none in children with ASD ($p=.39$). For trials with a nonsocial central stimulus and a social peripheral stimulus, there was a gap effect in children with ASD ($p<.01$), but none in TD children ($p=.30$).

Conclusions: An overall reduction in engagement of visual attention was not observed in ASD children compared to TD children, as there was no significant difference in gap effect between groups overall, or for trials in which both central and peripheral stimuli were of the same kind. However, ASD children displayed comparatively reduced engagement with social stimuli when presented with peripheral nonsocial stimuli, as well as increased engagement with nonsocial stimuli when presented with peripheral social stimuli. This finding suggests that children with ASD may have reduced engagement of visual attention that is specific to social stimuli, rather than a general deficit in visual engagement. It may provide a potential explanation for some of the abnormalities in social interaction observed in children with ASD.

335 **219.335** Frontal EEG and Thermal Asymmetries during the ADOS Predict ASD Severity

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Background: Thermoregulatory and other homeostatic abnormalities are often noted in ASD. Such reports have received limited attention. However, they do merit investigation given that temperature impacts nearly all aspects of neuronal functioning, including EEG activity. Although aberrant brain activity has been implicated in the manifestation of social symptoms in ASD, thermoregulatory deficits also have the potential to give rise to cognitive dysfunction, including social deficits. For example, human and rodent studies have demonstrated that body and brain temperature undergo systematic changes during social interaction. Moreover, recent studies employing infrared thermography of the face have found that changes in facial temperature correlate with social-cognitive abilities in non-ASD samples.

Objectives: The objective of this exploratory study is to examine how individual variability in physiological measures, such as thermal and EEG asymmetry, acquired during real-life, person-to-person interaction may potentially serve to index the severity of social deficits in ASD.

Methods: In this ongoing study, non-invasive measures of frontal brain alpha, beta, and theta band hemispheric activity and thermal homeostasis are employed during live administration of the Autism Diagnostic Observation Schedule 2nd Edition (ADOS-2) via wireless EEG and high-resolution infrared thermography of the face, respectively. Eleven individuals with ASD (3 females) and 10 typically developing individuals (4 females) with an age range of 5-17 years have been tested thus far. EEG is recorded as one continuous epoch spanning the duration of the ADOS-2 session and pre-processed offline to remove ocular and movement artifact via EEGLAB. A left-right hemispheric asymmetry index score for frontal lateral (F8-F7) and frontal medial (FC6-FC5) electrode pairs is then calculated. Infrared thermographic images are also taken at the beginning, middle, and end of the ADOS-2 session. Average temperatures for specific ROIs (i.e., cheeks, eyes, medial canthi, and nose) are then extracted using IRFlash (ICI) and temperature asymmetry (T_{L-R}) is calculated by subtracting average maximum values in left ROIs from average maximum values in right ROIs.

Results: In a GLM, ADOS scores were predicted by diagnosis (t = -10.2, $p < .0001$), T_{L-R} (t = -3.5, $p < .006$), and diagnosis x T_{L-R} interaction (t = 2.4, $p < .04$). ADOS scores and T_{L-R} were significantly related for ASD (r = -.82, $p < .02$) but not TD (r = .13, $p = .78$) participants. EEG alpha and beta asymmetry at F7-F8 electrodes was also found to predict ADOS scores ($ps < .003$) in interaction with diagnosis ($ps < .05$). This relationship was, again, uniquely present for ASD participants indicating that left frontal asymmetry is associated with lower comparison scores on the ADOS-2. Finally, significant relationships were found between T_{L-R} and EEG asymmetry (alpha and theta) for the medial FC5-FC6 ($ps < .05$) but not the lateral F7-F8 electrodes ($ps > .05$).

Conclusions: The results of this study reveal an intriguing link between ASD severity, facial temperature asymmetry, and EEG asymmetry. Although the relation between all three variables appears to be complex, our findings thus far highlight the potential utility of physiological indices of social symptom severity in ASD.

336 **219.336** Heterogeneity in Alpha Rhythm Modulation in School-Aged Children with and without Autism Spectrum Disorder (ASD): Results from the ABC-CT Interim Analysis

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Background: The alpha rhythm is oscillatory EEG activity in the 8-13 Hz frequency range originating from sensorimotor cortex. Alpha rhythm is suppressed when individuals execute motor action; such modulation in the absence of motor activity is inferred to represent mirror neuron system activity. There is mixed literature regarding atypical alpha rhythm in children with Autism Spectrum Disorder (ASD). The present study analyzed EEG response to point-light displays of biological motion to examine the relationship between alpha modulation and clinical presentation in ASD.

Objectives: To contrast alpha modulation in children with ASD versus typical development in response to point-light biological motion and to explore its relationship with clinical characteristics. The examination of alpha modulation may be instrumental in understanding neural atypicalities that affect how children with ASD process and understand the social world around them.

Methods: Participants were children with ASD (n=105) and typically developing (TD) controls (n=55) aged 6-11 (Table 1). ASD diagnoses were confirmed using the Autism Diagnostic Observation Schedule (ADOS-2) and the Autism Diagnostic Interview (ADI-R). Parents completed the Social Responsiveness Scale (SRS-2), a validated 65-item measure of social impairment in natural settings. Participants viewed a biological motion (biomotion) paradigm in which point-light displays (PLDs) of a human walking versus scrambled motion were presented randomly in four blocks of 26 trials (1025-1200 ms fixation crosshair followed by the 1000 ms stimulus). Alpha modulation was calculated as the difference in alpha power between the baseline fixation crosshair condition and the biomotion stimulus at central, frontal, and occipital electrode clusters over both hemispheres.

Results: Alpha modulation did not correlate with parent-reported social function (SRS-2) or ASD symptom severity (ADOS-2 Calibrated Severity Score; CSS) in TD males and males with ASD. However, in females with ASD (n=23), CSS correlated with alpha modulation over frontal (r=-0.469, p=0.024) and occipital (r=-0.443, p=0.034) regions, and SRS-2 scores correlated with alpha modulation over central (r=-0.444, p=0.039) and frontal (r=-0.496, p=0.019) regions. Correlations indicated that increased frontal, occipital, and central alpha modulation was associated with lower ASD symptomatology in females with ASD. In TD females (n=21), SRS-2 scores were positively correlated with alpha modulation over central (r=0.485, p=0.026) and frontal (r=0.439, p=0.047) regions, indicating that increased modulation was associated with greater social impairment. CSS correlates were not examined in TD females due to insufficient variation caused by floor effects.

Conclusions: Preliminary results suggest that alpha modulation during biological motion perception is distinct in males versus females with ASD and in females with and without ASD. However, females with and without ASD show opposing directionality and distinct scalp topography in the relationship between alpha modulation and social function. These results suggest that alpha modulation may offer a useful tool to understand phenotypic heterogeneity associated with sex differences in ASD.

337 **219.337** Initial Eye Gaze to Faces and Their Functional Consequence on Face Identification Abilities in Autism Spectrum Disorder

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Background: Two areas of active research in autism spectrum disorder (ASD) include visual social attention and face processing. The visual social attention literature demonstrates that individuals with ASD exhibit decreased attention to salient social stimuli. Research on face processing suggests deficits in this domain in ASD, but includes many mixed findings regarding the nature and extent of these differences. The existing literature in these areas points to the need for additional research that carefully characterizes visual social attention to faces, optimizing precision in both the spatial and temporal domains, and assessing its functional role in a specific task or context (e.g., face identification). One way to achieve this is to focus on the most important, or critical moments, for a given context. Highly complex contexts, such as typical social interactions, are comprised of a series of critical moments that contain brief, specific, and often unpredictable cues. A simpler context, such as face identification, is also comprised of critical moments of processing. Specifically, the first moment one looks at a face has been shown to be highly informative and sufficient to identify faces in neurotypical adults.
Objectives: The current study focused on comprehensively characterizing the first moment one looks to a face and its functional consequence on face identification abilities in adolescents with and without ASD.

Methods: 42 adolescents with and without ASD (n = 21 per group) completed an adapted version of an established eye-tracking and face identification paradigm. Specifically, a series of faces were presented briefly, and we observed where participants naturally look first, while simultaneously measuring their face identification abilities. Then, the location at which individuals look when presented a face was experimentally manipulated, and we observed how face identification performance varied as a function of that location. Participants also completed the Dartmouth Face Perception Test (DFPT), a more traditional measure of face identification.

Results: Adolescents with ASD showed strikingly similar patterns of behavior related to initial eye gaze to faces (average first look location: t(40)=.61, p=.54; variability (SD) of landing location of the first look across trials: t(40)=-.32, p=.75) and face identification performance (t(40)=.60, p=.55) for briefly presented faces when naturally viewing faces. Face identification accuracy varied as a function of experimentally manipulated first look location (F(4,124)=26.77, p<.001), but there were no differences between groups (F(1,31)=.10, p=.75). Although there were no group differences related to first look, adolescents with ASD performed significantly worse on the DFPT compared to TD controls (t(40)=2.56, p=.01).

Conclusions: Results suggest that the initial look to faces and face identification for briefly presented faces are intact in ASD, ruling out the possibility that deficits in face perception, at least in adolescents with ASD, begin at the initial look. However, individuals with ASD showed impairments on the more traditional measure of face identification, pointing to the possibility that atypicalities in face processing in ASD appear after the first look.

338 **219.338** Intranasal Oxytocin Enhances Perceptual Mechanisms for Voice-Identity Recognition.

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Background: Individuals with autism spectrum disorder (ASD) have difficulties recognizing other people by the voice – a deficit associated with reduced responses in the right posterior superior temporal sulcus/ gyrus (pSTS/STG) (Schelinski *et al.*, 2016, *SCAN*; Schelinski *et al.*, 2017, *Autism Res*). The right pSTS/STG has been implicated in the perceptual analysis of voice-identity information (Maguiness *et al.*, 2018, *Neuropsychologia*). Intranasal oxytocin can promote face recognition and modulate face-sensitive brain responses in ASD (Domes *et al.*, 2013, *Biol Psychiatry*; Guastella *et al.*, 2010, *Biol Psychiatry*).
Objectives: To investigate whether intranasal oxytocin can enhance the impaired voice-identity recognition and increase the right pSTS/STG responses in ASD.

Methods: Nineteen adults with ASD (ASD group) and nineteen typically developed (TD) controls (control group) participated in a randomized, double-blind, placebo-controlled, cross-over design study. The groups were pairwise matched on age, gender, handedness and intelligence quotient (IQ). All participants had normal hearing and were free of psychopharmacological medication. Participants with ASD had already received a formal clinical diagnosis of ASD (Asperger Syndrome/ childhood autism (1 male; verbal IQ = 109)) according to the diagnostic criteria of the International Classification of Diseases (ICD 10; World Health Organization, 2004). Within the study, they underwent additional clinical assessment using Autism Diagnostic Observation Schedule (ADOS, Lord *et al.*, 2000, *J Autism Dev Disord*) conducted by researches with formal training. Participants completed two sessions of a functional magnetic resonance imaging (fMRI) experiment on voice-identity recognition: after oxytocin and after placebo administration. The experiment included two conditions: voice-identity task and speech task. In both conditions, participants listened to blocks of neutral two-word sentences spoken by four male speakers. In the voice-identity task, participants matched the identity of each speaker to a target speaker. In the speech task, participants matched the content of each sentence to a target sentence. Targets were presented at the beginning of each block.
We calculated a three-way ANOVA: Substance (oxytocin, placebo) x Task (voice-identity, speech) x Group (ASD, control). Region of interest (ROI) was the right pSTS/STG, because it is known to show decreased BOLD response to voice-identity vs. speech recognition in ASD compared to TD controls (Schelinski *et al.*, 2016, *SCAN*).

Results: Oxytocin did not have any effect on the behavioral performance in the voice-identity recognition experiment. For the ROI, we found a significant three-way interaction Substance x Task x Group ($p < .05$ FWE corrected). Post hoc t-tests revealed that oxytocin increased right pSTS/STG responses to voice-identity vs. speech in the control group, but not in the ASD group.

Conclusions: Our results suggest that oxytocin can enhance perceptual analysis of voice-identity features in the right pSTS/STG in TD individuals. This was not the case in ASD, at least not to the same extent as in TD population, which supports previous evidence that perception of voice identity is atypical in ASD.

339 **219.339** Model-Based Approach Reveals Differences in Children's Cooperation during Social and Non-Social Exchange

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Background:
Cooperation is a complex and inherently social phenomenon, relying on our ability to learn about other humans and adapt to their strategies. In early childhood, humans become increasingly skilled collaborators as they develop more sophisticated models of other people's intentions and behaviors. In contrast, children with autism spectrum disorder (ASD) have core deficits in inferring others' mental states from subtle, implicit social cues that may significantly impair cooperation. Computational modelling, in particular Reinforcement learning (RL) algorithms, could reveal the mechanisms underlying cooperation in typically developing (TD) children and how these differ in children with ASD.

Objectives:

We use a computational modeling approach to characterize how TD children and children with ASD sustain cooperation with a peer (social) versus a computer partner (non-social). We hypothesize that cooperation strategies will differ between the social and non-social conditions in TD children; conversely, cooperative strategies will not differ between conditions in children with ASD.

Methods:

In two visits, children play child-friendly versions of the multi-round trust game (TG). In the TG, children have the option to either keep five coins or share any amount with their partner. Their partner receives four-times the amount of coins and can either keep everything or share half back. Children were unaware of the number of trials each game comprises.

In the initial visit, children (TD-group: N=37, age=13 years, SD=3.26) perform an IQ test and play a non-adaptive computer partner who shares 70% of the time (fixed non-social condition). In the second visit, children (TD-group: N=25, age=12 years, SD=2.6), are paired with a peer based on age, sex and IQ. Children do not know each other before the visit. They are told that they would sometimes play with the peer (social condition) and sometimes with a computer algorithm (adaptive non-social condition). In fact, they only play with their peer once.

Results:

During the fixed non-social condition, TD children share with the computer partner 61% of times on average. Children share similar amounts when knowing they play the adaptive non-social computer partner (59%). Compared to non-social conditions, children share more often when they think they play with the peer in the social condition (68%). Children are also more forgiving, re-initiating cooperation after the trustee defects, in the social condition compared to the computer conditions.

Bayesian model comparison shows that TD children's decisions to share in the non-social and social conditions rely on different strategies. In both non-social conditions, RL models best describe their behavior. Notably, in the social condition (that only differs in the information given to the child) a simpler tit-for-tat strategy describes children's behavior more accurately.

Conclusions:

Results indicate that a computational modeling approach can detect selective social strategies for establishing trust and cooperation in TD children. In a next step, we will test the how these strategies differ in children with ASD. Our approach could yield objective and quantifiable markers of cooperation in children with ASD that improve phenotypic classification of the disorder.

340 **219.340** Neural Correlates of Individual Facial Feature Processing in ASD

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental condition, characterized by difficulties in social communication alongside narrow interests, repetitive behaviors, and sensory sensitivities (American Psychiatric Association, 2013). Atypical neural responses to faces is thought to contribute to social deficits in ASD (Kang et al., 2018). Compared to typically developing (TD) controls, individuals with ASD exhibit delayed brain responses to upright faces at a face-sensitive event-related potential (ERP) known as the N170 (Bentin et al., 1996; McPartland et al., 2004). Yet, questions persist regarding how those with ASD respond to different classes of facial stimuli. Thus, investigating the physiology of the N170 to distinct facial percepts may provide additional insight on nature of atypical face perception in ASD and its relation to the clinical phenotype.
Objectives: To confirm previous findings that temporal processing of upright faces are delayed in individuals with ASD and examine differential response patterns for classes of facial stimuli across TD and ASD groups.

Methods: ERPs were recorded from 11 adolescents and adults with ASD (10 male and 1 female) and 21 TD controls (18 male and 3 female) using a 128-channel Geodesic Sensor Net. The sample was matched on age (ASD: M=22.44, SD=8.45; TD: M=25.57, SD=7.77) and IQ (ASD: M=101.82, SD=19.43; TD: M=112.81, SD=14.3051). Participants were presented with two stimulus blocks each composed of 240 gray-scale digital images on a computer monitor with a black background. The first block included eyes, upright faces, inverted faces, and distorted faces. The second block was composed of hands, noses, lips, and faces. The N170 was extracted from six electrodes over the right occipitotemporal scalp. Peak amplitude and latency were analyzed in response to eyes, upright faces, inverted faces, and distorted faces. Data analysis for N170 amplitude and latency in response to hand, nose, lips, and face stimuli is ongoing. ASD symptomology was measured using the Autism Diagnostic Interview-Revised (ADI-R) and DSM-IV clinical diagnosis was determined by the senior author.

Results: There was a significant main effect of condition on N170 latency ($F(3, 28)=9.135$, $p<0.001$) and N170 amplitude ($F(3, 28.00)=16.387$, $p<0.001$) across groups, with faster N170 components to eyes than upright faces, distorted faces, and inverted faces. Additionally, participants with ASD exhibited slower right N170 latency for upright faces than TD individuals (ASD: M=172.00, SD=24.27; TD: M=150.48, SD=26.09; $p=0.031$). However, no significant associations were found between groups in eyes, distorted face, and inverted face conditions.

Conclusions: Consistent with previous research, individuals with ASD exhibit longer N170 latencies to upright faces than TD individuals. Our findings also show that both groups display enhanced response to eye conditions, suggesting shared salience of eye stimuli. Comparable neural responses between groups for other stimuli suggests atypical neural responses to faces in ASD may depend on prototypic face configuration. Additional EEG research studying top-down face processing is needed to elucidate the relationship among holistic and configural face processing in ASD.

341 **219.341** Psychophysiological Processing of Emotions in Individuals Varying in Autistic Traits and Social Anxiety

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Background:
Individuals with autism spectrum disorder (ASD) exhibit differences in emotional processing compared to non-ASD individuals. Similarly, individuals with social anxiety disorder (SAD) also show differences in emotional processing than those without SAD. These processing differences are thought to be associated with differences in brain structures and in connectivity between brain regions related to face processing and social cognition. Because ASD and SAD are co-morbid conditions, examining how traits related to ASD and SAD uniquely predict the neural processing of emotional stimuli can help to disambiguate the shared and distinct contributions that traits related to these two conditions can have on emotion processing.

Objectives:

This study aimed to evaluate differences in emotional face processing based on varying degrees of self-reported autistic behaviors and social anxiety. Event-related potentials (ERPs) were used to assess early neural processing directed at emotional faces with the goal of examining the distinct relationships between traits related to autism and social anxiety and the neural processing of specific emotions.

Methods:

Fifty-three individuals (26 males; M_{age} = 19.88 years) completed an oddball task in which participants identified a face depicting an emotional expression amongst a series of faces displaying neutral expressions. Participants completed two blocks of 300 trials consisting of mostly neutral faces with 15% oddball pictures displaying emotions (i.e., happy, angry, surprise, and fear). Each face was presented for 1000ms with an intertrial interval between 1000-1500ms. Participants pressed a key as quickly as possible when they identified a face depicting an emotion. In addition, participants completed the Autism Quotient Scale (AQ) and the Social Phobia and Anxiety Inventory (SPAI-23). EEG activity was recorded and ERPs were quantified between 50 and 150ms at parietal electrodes (P1), between 150 and 250ms at parietal electrodes (P2), between 175 and 350ms at frontal electrodes (N2), and between 300 and 650ms at parietal electrodes (P3); see Figure 1.

Results:

The SPAI was correlated with P1 amplitude to happy faces, r = .58, p = .040, N2 amplitude to fearful faces, r = .54, p = .048, and P3 amplitude to angry faces, r = .48, p = .033. Scores on the SPAI (M = 20.90, SD = 9.87) and AQ (M = 16.89, SD = 8.66) were significantly correlated with one another, r = .42, p = .017. In order to assess the distinct contribution of SPAI controlling for AQ, regression analyses were performed. Results revealed that P3 amplitudes to angry faces were significantly predicted by the SPAI, β = .629, p = .040, when controlling for AQ, as demonstrated in Figure 2. For the other analyses, controlling for AQ reduced the effect of the SPAI on ERP amplitude.

Conclusions:

Together, these findings indicate that social anxiety traits distinctly predict the neural processing of certain emotions when controlling for autistic traits. These findings may contribute to our understanding of the social cognitive processes underlying the impaired identification and interpretation of emotional facial expressions in socially anxious and autistic individuals, which is crucial for developing successful interpersonal communication interventions.

342 **219.342** Reduced Neural Processing of Speech-in-Noise in the Left Inferior Frontal Gyrus in Autism Spectrum Disorder

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Background: Recognising what another person is saying under noisy conditions (i.e. speech-in-noise perception) is an everyday challenging experience. There is evidence that speech-in-noise recognition is restricted in people with an autism spectrum disorder (ASD) (Alcantara et al., 2004; Schelinski & von Kriegstein, in prep.). However, the underlying neuronal mechanisms of this speech perception difficulty are unclear. A recent meta-analysis showed that three cerebral cortex regions are particularly involved in speech-in-noise processing (Alain et al., 2018).
Objectives: Here we tested, whether atypical responses in these regions might explain speech-in-noise perception difficulties in ASD.

Methods: 17 adults with ASD (M_{age} = 30,53 years; 14 males) and 17 typically developing adults (matched pairwise on age, sex, handedness, and full-scale intelligence quotient (IQ)) performed an auditory-only speech recognition task during functional magnetic resonance imaging (fMRI). All participants had normal hearing (confirmed with pure tone audiometry) and did not take psychotropic medication. Participants in the ASD group had previously received a formal clinical diagnosis and underwent additional clinical assessment including the ADOS (Lord et al., 2000) and ADI-R (Lord et al., 1994). During the fMRI experiment, we presented blocks of sentences that were either presented with or without noise (noise / no noise condition). Sentences were semantically neutral and phonologically and syntactically homogenous. In the noise condition, sentences were presented together with pink noise (signal-to-noise ratio = -8). In both conditions, the first sentence of a block was the target sentence and participants decided whether the content of the following sentences matched the content of the target sentence. Both conditions included the same set of sentences. All sentences were spoken by six male speakers. Before the fMRI session, participants were familiarised with the voices of all speakers together with their face during an audio-visual training phase. For the fMRI analysis we used a general linear model implemented in SPM12.

Results: Both groups showed typical speech-sensitive blood-oxygenation-level-dependent (BOLD) responses for the no noise condition including bilateral superior temporal sulcus, precentral and inferior frontal brain regions (p < .05 family wise error (FWE) corrected for the whole brain). For recognising speech in the noise as compared to the no noise condition we found higher BOLD responses in the control as compared to the ASD group in the left inferior frontal gyrus (left IFG), whereas both groups showed similar responses for the two other regions that are particularly involved in speech-in-noise processing (i.e. right insula and left inferior parietal lobule; p < .05 FWE corrected for the three regions of interest). An ANOVA revealed that there were no significant group differences in the speech recognition performances for none of the conditions (for p < .05). The ASD and the control group did not differ significantly in the average amount of head movements (for p < .05).

Conclusions: Our findings suggested that in ASD the processing of speech is particularly reduced in the left IFG under noisy conditions. These differences might be important in explaining restricted speech comprehension in noisy environments in ASD.

343 **219.343** Relationships between Self-Reported Social Reward and Neural Response to Peer Interaction in Children with Autism Spectrum Disorder and Typical Development

K. A. McNaughton[1], *D. Moraczewski*[1], *L. A. Kirby*[2], *H. A. Yarger*[3], *K. R. Warnell*[4], *A. Cechaviciute*[3] *and E. Redcay*[5], *(1)Neuroscience and Cognitive Science Program, University of Maryland, College Park, MD, (2)Yale Child Study Center, New Haven, CT, (3)University of Maryland, College Park, MD, (4)Department of Psychology, Texas State University, San Marcos, TX, (5)Department of Psychology, University of Maryland, College Park, MD*

Background: The social motivation hypothesis proposes that individuals with autism spectrum disorder (ASD) have reduced motivation to engage in social interactions compared to children with typical development (TD). However, neuroimaging and behavioral support for this hypothesis is mixed. These inconsistent results could be a relic of neuroscience paradigms typically used to assess social reward, which rely on static images rather than the social reward experienced in a real-time interaction with a peer.

Objectives: To assess the relationship between self-reported enjoyment of social interaction and the neural response of a reward network brain region, the ventral striatum, to a real-time peer interaction in children with TD and ASD.

Methods: Children with ASD (*n*=26, 2 female, 7-15 years old) and TD (*n*=26, 2 female, 8-14 years old) engaged in a social chat paradigm while their brain activity was measured using functional magnetic resonance imaging. Groups did not differ on age or full scale IQ (*p*s>0.10). In the chat paradigm, participants sent messages about their interests to a perceived peer or computer. Participants then received messages back indicating engagement or disengagement from the peer ("Me too"/ "I'm away") or computer ("Matched"/ "Disconnected"). Ventral striatum response to computer engagement was subtracted from ventral striatum response to peer engagement to create a metric of neural response to social engagement with a peer. This difference score was correlated with the Admiration subscale of the Social Reward Questionnaire (SRQ), measuring trait level enjoyment in receiving others' approval, as well as children's self-reported enjoyment of engaging with the peer minus enjoyment of engaging with the computer after the paradigm.

Results: Children with TD and ASD did not differ in their self-report of enjoyment of interacting with the peer compared to the computer ($t(50)=-0.60$, $p>0.10$) or in their self-report of enjoyment in receiving others' approval (SRQ-Admiration; $t(39)=-0.52$, $p>0.10$). However, the relationship between these two measures of self-reported enjoyment of social reward and ventral striatum response to peer engagement differed between the two diagnostic groups. Increased enjoyment in the peer interaction compared to the computer interaction was associated with increased ventral striatum response to peer compared to computer in children with TD ($r(24)=0.57$, $p<0.01$), but not children with ASD ($r(24)=-0.002$, $p>0.10$). These correlations significantly differed from each other ($p<0.05$). In contrast, decreased enjoyment in others' approval (SRQ-Admiration) was associated with increased ventral striatum response in children with ASD ($r(21)=-0.35$, $p<0.10$), while there was a non-significant association in the opposite direction in children with TD ($r(16)=0.34$, $p>0.10$). Again, these correlations significantly differed from each other ($p<0.05$).

Conclusions: The relationship between self-reported social reward and neural response to real-time peer interaction differs between children with TD and ASD. While increased self-reported social reward was associated with increased activation of a reward network brain region in children with TD, the opposite relationship was present in children with ASD. These findings highlight the importance of more thoroughly characterizing the neural correlates of social reward in children with ASD within ecologically valid contexts and determining their relevance to real-world social interactions.

344 **219.344** Social Learning Relies on Distinct Cognitive Mechanisms in Adolescents with and without Autism

G. Rosenblau[1,2], *C. Korn*[3], *A. Dutton*[1], *D. Lee*[1] *and K. A. Pelphrey*[4], *(1)Yale University, New Haven, CT, (2)George Washington University, Washington DC, DC, (3)Institute for Systems Neuroscience, University Medical Center Hamburg-Eppendorf, Hamburg, Germany, (4)University of Virginia, Charlottesville, VA*

Background:

Many of our efforts in social interactions are dedicated to learning about other persons' preferences, mental states, and behaviors—abilities referred to as Theory of Mind (ToM). ToM abilities continue to develop throughout adolescence and are associated with positive peer relationships and emotional wellbeing. Adolescents with ASD have core deficits in ToM, which have been a main focus in social skill trainings and interventions for this age group. Despite the large body of research specifying ToM deficits and intervention outcomes of adolescents with ASD, a mechanistic understanding of how individuals integrate environmental cues to learn about others is lacking.

Objectives:

Here we aim at revealing the cognitive mechanisms underlying learning about others' preferences in adolescents with ASD using a computational modeling approach. In a next step, we will explore the neural implementation of these cognitive mechanisms.

Methods:

We devised a novel preference task, in which TD adolescents (N=23), and adolescents with ASD (N=21) rated how much three peers liked a variety of items (e.g. activities, fashion items and food) in the scanner. After each rating, they received feedback about the peer's preference ratings. Participants could improve predictions about a new item by integrating feedback about similar past items into their judgements. After this learning task, participants rated their own preferences for the same items outside the scanner.

The preference profiles used in the learning task were of real adolescents who participated in an online preference survey. In total, we obtained 103 preference profiles. Three profiles were selected for the learning task and the remaining 100 were used to compute learning priors (e.g. an individual's prior knowledge about their peers' preferences).

Results:

Prediction errors, the difference between participants' judgements and the trial-by-trial feedback, did not differ between groups. To test finer-grained group differences in learning strategies, we devised various computational models: non-learning regression models and reinforcement learning (RL) models. RL models describe participants' judgements over time based on previous feedback alone, or based on a combination of feedback and either own preferences or priors. We also tested more sophisticated models, which assume that participants represent similarities between item preferences for their peer group (e.g., participants know that preferences often are similar for apples and pears but not necessarily so for apples and kale). Prediction errors are then scaled according to these fine-grained similarities between the items (similarity-RL model). Bayesian model comparison revealed that preference ratings of TD adolescents relied on a combination of similarity-RL and participants' own preferences. In contrast, preferences of ASD adolescents were best described by a non-learning model that relied on simple priors (i.e. peers' average preference ratings) for each item.

Conclusions:

We show that computational models are well suited to differentiate between social learning strategies of TD and ASD samples. In a next step, we will explore how parameters derived from the winning model for either group are implemented in brain activity. This will provide biological validity for the models and help specify differences in the underlying neural mechanisms of social learning in adolescents with ASD.

345 **219.345** Visual Scanning Patterns of School-Age Children Completing an Adapted Reading the Mind in the Eyes Test

Z. Arnold[1], *J. M. Moriuchi*[1], *E. T. Crehan*[2], *E. V. Ocampo*[1] *and L. Soorya*[1], *(1)Department of Psychiatry, Rush University Medical Center, Chicago, IL, (2)Eliot-Pearson Department of Child Study & Human Development, Tufts University, Medford, MA*

Background: Impairments in mentalizing represent a key deficit in social cognition for children with autism spectrum disorder (ASD). Explicit measures of mentalizing abilities, such as the Reading the Mind in the Eyes Test (RMET), generally show between-group differences with lower performance in individuals with ASD compared to typically-developing controls. However, some individuals with ASD do achieve high accuracy on explicit mentalizing measures, often representing a discrepancy from continued difficulty in applying mentalizing skills within everyday social contexts. One hypothesis is that individuals with ASD may utilize compensatory strategies, such as relying on verbal reasoning skills, to solve mentalizing problems in a different way than typically-developing peers. To help understand the underlying mechanisms of children's mentalizing performance, we developed a computer-based version of the RMET co-registered with eye-tracking. By examining visual scanning patterns as participants completed the RMET, we were able to measure not just whether individuals were accurate in social attributions, but also how individuals were attempting to make social attributions on a moment-by-moment basis.

Objectives: The aims of the current study were (1) to compare performance on a computerized version of the RMET to autism severity metrics and (2) to identify visual scanning patterns predictive of RMET performance and severity of autism symptomatology.

Methods: Participants included 17 children with ASD (15 male, 2 female) between the ages of 8 and 11 years old. Children were verbally fluent (Full Scale IQ: mean=100.7 [17.5]) and represented a broad range of level of social disability (ADOS-2 Calibrated Severity Score: mean=6.9 [2.4], range=1 to 10). Participants were enrolled in a randomized clinical trial of a combination behavioral-pharmacological treatment targeting social cognition and social behavior; the current study focuses only on data at baseline, pre-treatment.

Eye-tracking data were collected while participants completed an adapted, computerized version of the child RMET (Figure 1). Percentage of visual fixation time on the eyes image and on word response options was calculated for each child. In addition, visual scanning patterns were evaluated using more temporally- and spatially-sensitive measures of saccade frequency and directionality.

Results: Performance on the RMET ranged from 25 to 90% correct responses. Greater accuracy on the RMET was correlated with reduced autism symptomatology as assessed both by clinician rating on the ADOS-2 ($r=-0.66$, $p<0.005$) and parent rating on the SRS-2 ($r=-0.52$, $p<0.05$). RMET performance was also positively correlated with higher cognitive functioning ($r=0.56$, $p<0.05$). Participants who exhibited higher visual attention to the eyes image of RMET stimuli and lower visual attention to word response options tended to have less severe symptomatology (eyes: $r=0.62$, $p<0.05$, words: $r=-0.53$, $p<0.05$). There was no significant relationship between visual attention measures and cognitive functioning. Ongoing analyses are examining visual scanning patterns that may mediate the relationship between cognitive functioning and RMET performance.

Conclusions: The adapted, computerized RMET yielded a broad range of mentalizing performance and was predictive of social functioning in our pilot sample of school-age children with ASD. By evaluating both mentalizing accuracy and underlying mechanisms, this new approach holds promise as a more sensitive measure of social cognition.

Keynotes and Awards
- Welcome and Sponsor Update
8:45 AM - 9:00 AM - Room: 517AB

Welcome and Sponsor Update.

Oral Session -
Invited, Keynote Speakers, Awards
226 - Keynote Address - Elizabeth Berry-Kravis, MD, PhD
9:00 AM - 10:00 AM - Room: 517AB

9:00 Transcending Barriers to Development of Targeted Treatments for Fragile X Syndrome

E. Berry-Kravis*, Pediatrics, Neurological Sciences, & Biochemistry, Rush University Medical Center, Chicago, IL*

Despite extensive molecular, cellular and animal model data supporting disease pathway-targeted treatments in fragile X syndrome, initial clinical trials based on FDA precedents failed to show benefit for behavior in adult and adolescent humans with FXS. Rethinking of translational models and drug development strategies based on this experience has revealed gaps in understanding of optimal age of treatment, trial designs, need for better outcome measures and biomarkers that assay core aspects of the disease, and potential need to measure drug effects in the setting of a learning paradigm. Work has been done to address these issues and this process has informed design of more recent FXS trials, including novel trial designs in progress to show disease modification in terms of learning and functional improvements. Lessons learned in FXS trials and new designs developed for FXS can inform design of trials of targeted treatments for other single gene models of ASD, and for idiopathic ASD.

Panel Session
Biomarkers (molecular, phenotypic, neurophysiological, etc)
227 - Novel Imaging Approaches to Biomarker Discovery in Autism Spectrum Disorder: Recent Findings from the Pond and EU-AIMS Networks
10:30 AM - 12:30 PM - Room: 517C

Panel Chair: Eva Loth, *Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Over recent years, precision medicine has become a key focus of autism research. The aim is to combine new pathophysiologically based therapies with stratification biomarkers to predict which therapy may be beneficial for a particular autistic person. This approach chiefly relies on new 'translatable' methods that help linking findings from animal models to humans, and new methods to make predictions of individuals and to identify subgroups. Here we present several novel, complementary approaches adopted in two international autism consortia – the POND Network and EU-AIMS/ AIMS-2-TRIALS. Both consortia include multi-disciplinary preclinical and large-scale clinical programmes. In this panel, we will be sharing innovative new methods, ideas and data to advance biomarker discoveries and validation, and increase robustness and replication of findings.

10:30 **227.001** Animal Population Imaging - Linking Molecular Pathways to Autism Clusters in the Mouse Using the Neuroanatomy.

J. Ellegood[1], *Y. Yee*[1,2], *L. R. Qiu*[1], *B. C. Darwin*[1], *R. M. Henkelman*[1,2] *and J. P. Lerch*[1,2], *(1)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada, (2)Medical Biophysics, University of Toronto, Toronto, ON, Canada*

Background: Autism is extremely heterogeneous, not just in behaviour, but also in genetics, and neuroanatomy. Over the past 10 years, we have established a magnetic resonance imaging (MRI) database of mouse models related to autism, which allows the investigation of the neuroanatomy in a large autism population in the mouse. Addtionally, this dataset provides us with a metric by which we can cluster these models and examine commonalities and differences between them in the hope of subcategorizing autism.
Objectives: The purpose here is twofold. 1) To further our previous work, which examined 26 different mouse models of autism (Ellegood et al. 2015), in an effort to characterize and cluster our current dataset of 92 different mouse models, and 2) to look for existing molecular pathways which may explain these clusters.

Methods: The data used in this study was collected from 92 different autism related mouselines and includes over 3,700 mice. Imaging was performed ex-vivo using a 7T MRI with a T2 weighted, 3D fast spin echo sequence which acquires data at an isotropic resolution of 40 µm (Spencer Noakes et al. 2017).

Data Analysis – To visualize and compare any differences, the images are registered together (Lerch et al., 2011). From this the volumes of 182 different regions (Dorr et al. 2008, Ullmann et al. 2013, and Steadman et al. 2014, Richards et al. 2011, Qiu et al. 2018, Beera et al. 2017) were calculated. Group differences in each of the 182 regions across the different mouse models were calculated (measured as effect size) and used to group the different models using hierarchical clustering algorithms.

Bioinformatics – Online databases, including StringDB (string-db.org), the Molecular Signatures Database (software.broadinstitute.org/gsea /msigdb) and the KEGG Database (www.genome.jp/kegg), were used to link specific molecular pathways to our clusters to provide more information about potential common determinants that underlie the models.

Results: Our data suggests that the autistic phenotype both preferentially affects key regions of the brain, but also divides the autism neuroanatomical phenotype based on directionality and localization of the differences throughout the brain. In total, four different clusters were found from the 92 different models. Additionally, what appears to link these clusters together, outside of the neuroanatomy, is a shared molecular pathway. The first cluster, which includes the models Chd8 and Dvl1, links significantly to the Wnt signaling pathway. The second cluster, which includes the models Arid1b and Tsc1, links to MapK and mTor signaling pathways. The third cluster, which includes the models Nlgn1, Nlgn3, Nrxn1, and Shank3, links to cell adhesion. The final cluster does not link significantly to any specific pathway, which may indicate the need for further refinement of our clusters.

Conclusions: The heterogeneity of autism is problematic. Therefore, finding ways to link autism models or genetic modifications together can be very powerful. The hope with techniques such as this is ultimately to subcategorize and increase the diagnostic specificity of autism.

10:55 **227.002** Sex Difference in Structural Hemispheric Asymmetry in ASD

D. L. Floris[1], *T. Wolfers*[2], *M. Zwiers*[2], *L. G. EU-AIMS*[3], *J. K. Buitelaar*[4] *and C. B. Beckmann*[5], *(1)Donders Centre for Cognitive Neuroimaging, Nijmegen, Netherlands, (2)Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, Netherlands, (3)EU-AIMS Organization, London, United Kingdom, (4)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (5)Centre for Functional MRI of the Brain (FMRIB), University of Oxford, Oxford, United Kingdom*

Background: Autism spectrum disorder (ASD) is characterized by a striking male preponderance with three times more males being affected than females. While neuroimaging studies have started to pick up on studying sex differences in ASD, none has addressed the question of sex differences with respect to hemispheric specialization. ASD is characterized by a disruption of specialization in the brain with findings pointing to atypical hemispheric asymmetry across hemispheres (Herbert et al., 2002; Floris et al., 2016). Sex differences in hemispheric specialization have frequently been reported in neurotypical (NT) individuals with males showing more pronounced patterns of lateralization than females, however, no study has addressed this question in ASD.
Objectives:

We aimed to explore sex differences in hemispheric lateralization across individuals with ASD and NT controls.

Methods:

We selected high quality structural T1-weighted MRI data from the Longitudinal European Autism Project dataset including 94 females with ASD aged 6-30 years, 260 IQ-and age-matched males with ASD as well as 166 age-matched NT males and 90 NT females. T1-weighted images were preprocessed using SPM12 and the CAT12 toolbox. Specific preprocessing steps were adopted to meet requirements for the analysis of asymmetry: 1) images were segmented using a symmetric tissue probability map; 2) segmented images were flipped along the x-axis; 3) original (OI) and flipped images (FI) were used to create a symmetric DARTEL template and subsequently registered to it; 4) laterality indices was calculated at each voxel by the formula:(OI–FI)/(OI+FI)*2. Laterality images were restricted to the right hemisphere (RH) and smoothed with a 4mm FWHM kernel. Main effects and interactions were tested by regression of a GLM at each voxel with group and sex as fixed factors and age and scanning sites as nuisance covariates. Significance levels for clusters were set at a voxel-level cluster-forming $p<0.001$ and by their number of expected voxels (spatial extent threshold) according to Gaussian Random Field theory. Statistical outcomes were corrected for multiple comparisons at the cluster-level by controlling the topological false discovery rate (FDR) at $q<0.05$. Significant results were correlated with symptom measures such as

the ADOS and ADI.

Results:

Voxel-wise analysis of laterality in the RH revealed significant group-by-sex-interactions in the posterior cingulate cortex and the pars trinagularis. Males with ASD showed reduced leftward asymmetry compared to NT males, while ASD females showed increased leftward asymmetry compared to NT females. The opposite pattern was evident in the angular gyrus and supplementary motor area with ASD females showing reversed rightward asymmetry compared to NT females and ASD males showing reversed leftward asymmetry compared to NT males. Results remained the same when including handedness and FIQ as nuisance covariates. Correlation analyses with ADI- and ADOS-subscales did not yield any significant results.

Conclusions:

Males and females with ASD exhibit differential patterns of structural hemispheric lateralisation compared to NT controls in language processing regions and default network hubs. While males with ASD show patterns that resemble those in NT females, females with ASD exhibit neural masculinization suggesting that models of 'gender-incoherence' of ASD also apply to atypical hemispheric lateralization.

11:20 **227.003** Using Canonical Correlation Analysis Approaches to Develop a Circuit-Based Clinical Measure of Autism Core and Associated Symptoms

E. Loth[1], *C. Moessnang*[2], *C. H. Chatham*[3], *J. Ahmad*[1], *S. Baumeister*[4], *G. Dumas*[5], *E. J. Jones*[6], *D. V. Crawley*[1], *B. Oakley*[1], *J. Tillmann*[7], *D. W. Evans*[8], *T. Charman*[9], *H. Tost*[2], *A. Meyer-Lindenberg*[2], *R. Leech*[10], *J. K. Buitelaar*[11], *D. G. Murphy*[12] *and M. J. Brammer*[13], *(1)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Department of Psychiatry and Psychotherapy, Central Institute of Mental Health, University of Heidelberg, Mannheim, Germany, (3)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development. Roche Innovation Center Basel, Hoffmann La Roche, Basel, Switzerland, (4)Department of Child and Adolescent Psychiatry and Psychotherapy, Central Institute of Mental Health, Medical Faculty Mannheim/Heidelberg University, Mannheim, Germany, (5)Human Genetics and Cognitive Functions Unit, Institut Pasteur, Paris, France, (6)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (7)King's College London, London, United Kingdom of Great Britain and Northern Ireland, (8)Department of Psychology, Bucknell University, Lewisburg, PA, (9)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (10)Neuroimaging, King's College London, London, United Kingdom, (11)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (12)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (13)Centre for Neuroimaging, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:

Key challenges for clinical trials of autism include the clinical and etiological heterogeneity of the condition, and the lack of sensitive outcome measures. Existing clinical measures typically assess a collection of autism-related clinical symptoms. However, it is likely that various behavioural symptoms – even within specific domains – may have different neurocognitive or neurobiological underpinnings. Moreover, due to the diversity of autism the *same* behavioural symptom may result from different neurobiological abnormalities in *different autistic individuals*. Therefore, purely behaviourally-defined measures that encompass various neurobiological processes may not be sufficiently sensitive to detect treatment effects. Here we adopt a novel approach starting with robustly defined brain circuits that underpin fundamental social, emotional, motivational, and cognitive processes, and then mapping brain-behaviour relationships to different subgroups.

Objectives: To create a "circuit-based clinical outcome measure" we used Canonical Correlation Analysis (CCA) based approaches to identify items from existing clinical measures that best covary with brain function in robust, pre-defined brain circuits, and explored whether these brain-behaviour relationships vary between different autism subgroups

Methods:

Combined clinical-fMRI data sets were available from ~100-300 autistic individuals and 80-220 control participants from the EU-AIMS Longitudinal European Autism Project. We used two CCA-based methods that allow us to identify relationships between two multivariate datasets (here clinical items and fMRI regions-of-interests) using information from cross-covariance matrices and that employ internal cross-validation mechanisms to enhance the robustness of the fitting. Regularised CCA can handle more samples than participants when required and maximise the correlation between clinical items and brain regions. To estimate the robustness of the canonical scores we used bootstrapping to generate clinical and imaging variable loadings on a subset of participants and then used these variable loadings to calculate median values of the estimated canonical scores on the excluded subset.

Canonical Vector Regression (CVR) uses variable loadings from CCA to obtain a regression fit to group membership (TD/ASD). We then entered individual scores from both methods into a cluster analysis using fuzzy c means and affinity propagation-based clustering with bootstrap estimation of the optimal cluster number. By combining CVR and RCCA we simultaneously separated individuals on two complementary aspects of the data - maximal correlation between brain and clinical symptoms and maximal distance between groups.

Results:

Preliminary analyses revealed robust correlations between network function and clinical symptoms between autism 'subgroups'. For example, RCCA and CVR between the Strength and Difficulties Questionnaire (SDQ) and ROIs in a reward task showed significant correlations in the first canonical variate (RCCA p=.001, CVR p=.024). 4 items significantly covaried with changes in ROIs; while ventral striatal activity in two conditions significantly covaried with changes in SDQ.

We found four observed clusters; two of which largely separated an ASD-subgroup from controls (Fig 1a) and maintained high predictive accuracy based on the predicted output (Fig 2).

Conclusions:

These CCA-approaches can identify clinical items that differentially covary with network function in ASD "subgroups". Next, we will sort clinical items according to network function across four fundamental bio-behavioural domains, and 'harmonise' them in terms of response format.

11:45 **227.004** Regression Clustering for Discovering Multiple Types of Brain-Behaviour Associations in a Sample: Data from the Pond Network

*S. Panahandeh[1], E. Anagnostou[2], J. P. Lerch[3] and **A. Kushki**[4], (1)Institute of Biomaterials and Biomedical Engineering, University of Toronto, Vaughan, ON, Canada, (2)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (3)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada, (4)Bloorview Research Institute, Toronto, ON, Canada*

Background: The autism spectrum is associated with significant heterogeneity in etiology, biology, and phenotype. This heterogeneity challenges traditional statistical tools used for examining brain-behaviour associations (e.g., linear regression), which do not take into account the possible presence of subgroups that can be characterized by different regression models. To address this challenge, we propose a novel data-driven and unsupervised approach to discover multiple types of brain-behaviour associations in a sample. This approach clusters the sample data into K groups, each with its own linear regression function. The difference between this method and traditional clustering is that the proposed approach groups data points based on their relative similarly to a regression line, not direct similarity to each other.

Objectives: Our objective was to discover multiple regression lines that explain the association of brain-phenotype patterns in ASD. Specifically, we looked at associations between cortical thickness and social communication function quantified using the Social Communication Questionnaire.

Methods: Data from a sample of 121 participants with a diagnosis of ASD were obtained from the POND Network (age:11.9(3.6); 98 male). Brain data included cortical thickness measurements from 76 regions of the brain obtained using the CIVET pipeline, corrected for total gray matter volume, sex, age, and scanner. Behavioural data were scores on the social communication domain of the SCQ. Analyses were performed using a machine learning pipeline which employs regression clustering to clusters the sample data into K groups that are characterized by different regression functions. To ensure stability of the found patterns, the analyses were run on 100,000 random partitions of the data, each including 5% of the participants. Th RANSAC algorithm was used to fit linear models to each subset of the data, and similarity matrices were built based on whether or not data points were on the same regression line. Spectral clustering was used to cluster the similarity matrices. Number of clusters was chosen to maximize the within-to-between scatter ratio. Clusters were validated by ensuring that the scatter ratios were significantly different than those for randomly generated data.

Results: Our results support the notion that SCQ-cortical thickness association can be characterized using multiple regression lines for several cortical regions previously implicated in ASD. These included the orbital part of the right superior frontal gyrus (2 clusters; regression slopes -3.5(0.2) and 10.7(0.4); p<0.00001) and the right posterior cingulate gyrus (2 clusters; regression slopes -4.6(0.2) and -3.7(0.3) ; p<0.00001). These results are shown in Figure 1. As seen in this figure, 2 clusters of points that lie on the same regression line are identified for each regions.

Conclusions: Our results demonstrate the feasibility of using data-driven approaches to model heterogeneity in brain-behaviour associations.

Panel Session
Biomarkers (molecular, phenotypic, neurophysiological, etc)
228 - Autism Spectrum in Tuberous Sclerosis Complex (TSC): Using Biomarkers to Connect Preclinical Models to Early Intervention
10:30 AM - 12:30 PM - Room: 518

Panel Chair: Darcy Krueger, *Cincinnati Children's Hospital Medical Center, Cincinnati, OH*

Autism spectrum disorder (ASD) and intellectual disability (ID) are severe neurodevelopmental conditions with early childhood onset and considerable clinical overlap. Able to be diagnosed at birth and with high penetrance of both ASD and ID, Tuberous Sclerosis Complex (TSC) provides unique opportunity for characterizing the earliest stages of ASD with and without coexisting ID. A comprehensive strategy spanning preclinical and clinical studies is being pursued in TSC to develop imaging and electrophysiologic biomarkers that predict ASD/ID risk and gain insight into the underlying structural and functional changes associated with the earliest stages of ASD and ID. The learning objectives of this panel are to (1) understand the phenotypic features of ASD and ID in TSC throughout the lifespan; (2) appreciate the challenges in ASD and ID assessment and treatment (including both pharmacologic and non-pharmacologic interventions) at young ages in high-risk populations such as TSC; and (3) review the latest progress in both animal models and human studies of TSC to develop imaging and electrophysiologic biomarkers that predict disease risk and assess treatment response in early ASD and ID.

10:30 **228.001** Behavioral and Developmental Characteristics of Infants and Young Children with Tuberous Sclerosis Complex (TSC)

J. Capal[1], *D. S. Murray[2], A. W. Byars[1], N. Bing[1], B. Kent[1], L. A. Bucher[3], M. E. Williams[4], S. E. O'Kelley[5], D. A. Pearson[6], M. Sahin[7] and D. A. Krueger[1], (1)Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (2)Autism Speaks, Boston, MA, (3)Developmental and Behavioral Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (4)Univ. of Southern California/Children's Hosp. of Los Angeles, Los Angeles, CA, (5)University of Alabama at Birmingham, Birmingham, AL, (6)McGovern Medical School, Univ. TX Health Sci Cntr-Houston, Houston, TX, (7)Boston Children's Hospital/Harvard Medical School, Boston, MA*

Background: Autism spectrum disorder (ASD) has been reported in approximately 50% of individuals with Tuberous Sclerosis Complex (TSC). The severity and underlying causes of ASD are complex and highly variable, which presents a major barrier to identifying at-risk infants. In addition, many young children with TSC present with neurodevelopmental comorbidities including developmental delay and seizures, that make the diagnosis of ASD difficult.

Objectives: Describe behavioral and developmental characteristics of young children with TSC who have been evaluated by developmental and autism-specific assessments.

Methods: Children ages 0-36 months with TSC participated in the TSC Autism Center of Excellence Network, a large, multicenter, prospective observational study evaluating natural history of ASD in TSC. Children were evaluated longitudinally with Mullen Scales of Early Learning (MSEL), Vineland Adaptive Behavior Scales, 2ndEdition, Survey Interview (VABS-II), and Preschool Language Scales, 5thEdition (PLS-5). Autism-specific assessments, including the Autism Observation Scale for Infants (AOSI) administered at 12 months, and Autism Diagnostic Observation Schedule-Second Edition (ADOS-2) and Autism Diagnostic Interview-Revised (ADI-R), were administered at 24 and 36 months at which point a diagnosis of ASD or not ASD was assigned by expert clinical team. Multiple analyses were performed including utility of using the AOSI to predict positive ADOS-2 at 24 and 36 months determining differences in diagnostic ASD categories (ADOS-2 negative/ASD diagnosis negative (non-ASD)), ADOS-2 positive/clinical ASD diagnosis negative (Mixed), and ADOS-2 positive/ASD diagnosis positive (ASD) groups).

Results: As expected, the ASD group exhibited lower scores on all measures compared to the non-ASD group (p<0.01). The mixed group (N=23)

exhibited lower scores on nearly all measures of the MSEL, VABS-II, and PLS-5 compared to the non-ASD group (N=55) and higher scores for most of the same when compared to the ASD group (N=19) (p<0.05). Percentage-wise, 100% children in the ASD group at 24 months were developmentally delayed (SS<85 on the MSEL Early Learning Composite) compared to 70% in the mixed group and 44% in the non-ASD group. At 36 months, the mixed group (N=8) was more similar to the non-ASD group (N=35) than the ASD group (N=15)(p<0.05). The mean AOSI total score in patients diagnosed with ASD at 24 months was 13.3 ±6.7 versus 7.5 ±6.0 in patients not diagnosed with ASD (p=0.007). At 36 months, mean AOSI total score continued to be predictive of clinical diagnosis of ASD (12.4 ± 7.2 vs 7.1 ±4.3, p=0.032).

Conclusions: Autism specific characteristics may be present in young children with TSC that can be identified at 12 months by the AOSI. In addition, autistic traits are present in children with TSC that do not meet full criteria for ASD. This third group may represent a broader autism phenotype in TSC.

10:55 **228.002** Translatable EEG Measures in Mouse Models of Tuberous Sclerosis Complex (TSC)

M. E. Modi[1], *S. Gurnani*[1], *E. Bainbridge*[1], *S. Dhamne*[1], *B. Tracey*[2], *A. Rotenberg*[3] *and M. Sahin*[4], *(1)Neurology, Boston Children's Hospital, Boston, MA, (2)Electrical and Computer Engineering, Tufts University, Boston, MA, (3)Neurology, Harvard Medical School, Boston, MA, (4)Boston Children's Hospital/Harvard Medical School, Boston, MA*

Background: Tuberous sclerosis complex (TSC) is a rare genetic disorder associated with autism spectrum disorder (ASD) and epilepsy. Dysregulation of the mTOR pathway in TSC results in a loss of white matter integrity evident in imaging of patients, which is thought to be caused by alterations in axon outgrowth and synapse formation seen in animal and cellular models of Tsc1/Tsc2 mutation. Critical to harnessing the translational potential of animal models for drug discovery is the development of biomarkers that can be measured in both people and animals with high fidelity. The consequences of white matter disruption can be explored at the systems level in both animal models and patients through the measurement of neural activity via electroencephalography (EEG) to identify signatures of impairment associated with specific behavioral phenotypes and in response to pharmacological intervention.
Objectives: To identify translationally conserved alterations in neural activity associated with TSC related mutations, we characterized EEG based measures in transgenic mouse models of TSC that could be analogously measured in the patient population.

Methods: Utilizing mouse lines expressing a hypomorphic *Tsc2* allele or a restricted *Tsc1* mutation associated with selective social deficits, chronic *in vivo*EEG was recorded under baseline conditions and after either acute or chronic treatment with an mTOR inhibitor. Spectral features and seizure activity were characterized longitudinally over development and auditory evoked potentials elicited from auditory gating and mismatch negativity paradigms were extracted in adulthood.

Results: Mice with reduced expression of *Tsc2* have lower oscillatory power in low frequency bands (theta) but an increase in power in the high frequency bands (beta and gamma), which evolves over development. The changes in spectral power are associated with a progressive seizure phenotype that ultimately results in the premature death of the animals. Paradoxically, chronic treatment with an mTOR inhibitor reduces the seizure burden of the animals but exacerbates the spectral phenotype. Mutant animals also have alterations in the evoked response to auditory tones, relative to control animals, characterized by enhanced early components and diminished late components of the response waveform that are analogous to the responses seen in the patient population. Changes in spectral power and auditory evoked potentials are induced with chronic but not acute rapamycin treatment that parallel functional rescue.

Conclusions: Features of resting state EEG and auditory evoked potentials in TSC mouse models both recapitulate early findings in patients with TSC and are responsive to treatment with mTOR inhibitors. Upon validation, these features could be used to drive biomarker selection for ongoing clinical trials with mTOR inhibitors in TSC. More broadly, the conservation of neurophysiological phenotypes across animal models and patient populations in TSC supports the use of EEG as a translational modality for exploring neural deficits associated with connectivity and synaptopathy.

11:20 **228.003** Electrophysiological Biomarkers of ASD and Cognitive Impairment in Infants with Tuberous Sclerosis Complex (TSC)

S. Jeste[1], *A. H. Dickinson*[1], *K. J. Varcin*[2] *and C. A. Nelson*[3], *(1)University of California, Los Angeles, Los Angeles, CA, (2)Telethon Kids Institute, Perth, WA, Australia, (3)Boston Children's Hospital, Boston, MA*

Background: Tuberous sclerosis complex (TSC) is an autosomal-dominant genetic syndrome highly penetrant for neurodevelopmental disorders, with estimates of ASD diagnosis in 25-60% (Jeste et al., 2008; Granader et al., 2010; Vignoli et al., 2015), and cognitive impairment in 50-75% (Yang et al., 2017). Disrupted patterns of neuronal connectivity account for atypical neurodevelopment in TSC (Peters et al., 2012; Julich & Sahin, 2014). No studies to date have measured disrupted patterns of neural function and connectivity in infancy that precede behavioral signs of ASD in TSC. EEG studies in infants with TSC can help elucidate neural mechanisms underlying atypical development and inform the development of biomarkers of change with early intervention.
Objectives: We examined electrophysiological (EEG) metrics of alpha oscillations (6-12 Hz) in infants TSC, with focus on alpha phase coherence (APC) and peak alpha frequency (PAF) (Dickinson *et al.*, 2017).We had three specific aims: (1) Do PAC and PAF differ between infants with TSC and infants without TSC? (2) Do APC and PAF differentiate those infants with TSC who develop ASD from those that do not develop ASD? (3) Does PAF predict cognitive function at 36 months in infants with TSC?

Methods: As part of a longitudinal multi-site study of ASD prediction in TSC (PI: Nelson), spontaneous EEG data were collected at several time points across the first two years of life in infants with TSC, alongside a low risk (LR) comparison group without TSC. Infants with TSC were then subdivided into TSC/ASD or TSC/no ASD based on clinical evaluation of ASD symptoms at 36 months (Jeste et al, 2014). After extensive cleaning using independent component analysis (ICA), EEG data were transformed into current source density (CSD) estimates using a Laplacian transform. Alpha phase coherence was computed between every possible electrode pair combination. Peak alpha frequency was estimated using a robust curve-fitting procedure for three regions of interest: frontal, central and occipital.

Results: (1)At 12 months, infants with TSC (M=.24, SD=.03; N=18) showed hypoconnectivity in long range interhemispheric alpha phase coherence compared to LR controls (M=.31, SD=.09; N=20) (P<0.00013, adj P<0.04). At 24 months, PAF was lower in TSC (N=28) infants compared to LR controls (N=12) across frontal (P=.009) and central (P=.026) regions. (2) At 24 months, infants with TSC/ASD (M=0.23; N=14) showed a pattern of long range hypoconnectivity compared to TSC/no ASD (M=0.28; N=13). (3) Across all participants, PAF at 24 months was associated with verbal (P=.001) and

non-verbal cognition (P<.001) at 36 months.

Conclusions: Alterations in functional neural development can be quantified in infants with TSC, with patterns of long range hypoconnectivity and slower peak alpha frequency, most prominent in those with ASD and developmental delay. These biomarkers of atypical development in TSC can (1) help us to further stratify risk, identifying those infants requiring targeted developmental interventions from very early in life; and can (2) inform future studies examining the effect of intervention on neural function and connectivity, as these brain changes may mediate developmental gains in these infants at high risk for ASD.

11:45 **228.004** Early Disruption of Neural Circuits for Social Communication in Tuberous Sclerosis Complex (TSC)

S. K. Warfield[1], *A. Prohl*[1], *B. Scherrer*[1], *J. Peters*[2], *D. A. Krueger*[3] *and M. Sahin*[4], *(1)Computational Radiology Laboratory, Department of Radiology, Boston Children's Hospital, Boston, MA, (2)Department of Neurology, Boston Children's Hospital, Boston, MA, (3)Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (4)Boston Children's Hospital/Harvard Medical School, Boston, MA*

Background: Tuberous Sclerosis Complex (TSC) is a genetic disorder with high prevalence of autism spectrum disorder (ASD). Prior work has identified MRI features associated with ASD in both adult and pediatric TSC patients. Multiple abnormalities exist throughout the brain and alter over time, with varying degrees of severity. Comorbidities including seizures and intellectual disability are also common in TSC and add to the severity of imaging features. There is an urgent unmet need for imaging biomarkers that can be used in the first year of life to identify and direct early intervention towards infants most likely to develop ASD.

Objectives: We sought to determine if early disruption of the microstructural integrity of the neural circuitry of brain regions for social communication is associated with later diagnosis with ASD.

Methods: This research was conducted under a prospective, ongoing, multisite TSC Autism Center for Excellence Network (TACERN) study. We analysed 125 MRI scans of 50 infants between birth and three years of age, with recruitment planned for the first year of life, and annual MRI thereafter until reaching age three. 3T MRI of the brain was acquired using conventional structural MRI and diffusion MRI with multiple non-zero b-values and b=0 images with reversed phase-encoding directions for distortion compensation. Images were aligned to 1 mm^3T1-weighted MPRAGE, followed by segmentation into 114 cortical and subcortical regions so that whole brain single-peak diffusion tensor imaging (DTI) and multi-peak diffusion compartment imaging (DCI) tractography could be performed. Neuronal circuitry measured via DTI and DCI fingerprint connectivity of the left and right fusiform gyrus to the remaining 113 compartments was determined and associated with AOSI measures of social communication assessed at 12 months.

Results: The DCI connectivity fingerprint had a direct, in-sample prediction of AOSI with a high correlation. Our quantitative analyses revealed four key findings. First, the fusiform fingerprint-estimated AOSI was significantly correlated with the actual 12-month AOSI at all time points (12mo: p<1e-06 / 24mo: p<1e-06 / 36mo: p<1e-06). The correlation was weak at 12mo (r2=0.49) but strong at 24mo (r2=0.68) and 36mo (r2=0.75). Second, the correlation monotonically increased with age (r2: 0.49 →0.68 →0.75) while the error consistently decreased with age (RMSE: 6.43 →4.71 →3.79). Third, the area under the receiver operating characteristic curve (AUC) when classifying AOSI≥10 and AOSI<10 was high and consistently increased with age (AUC: 87.8% →90.6% →94.1%).

Conclusions: The DCI fingerprint of FUSG characterized the neural circuit underlying the structure of abnormal connectivity in infants at risk of ASD. The improved specificity and sensitivity of the fixel-based DCI analysis, over DTI, was substantial. This is due to the benefit of separately characterizing fascicles and free water. In contrast, the inability of DTI to adequately represent diffusivity properties of individual fascicles lead to a poorer association. Our work demonstrates that changes in the structure of the brain in children at risk of ASD occur early in life and strongly associate with AOSI measures at 12 months.

Panel Session
Drug Discovery and Development
229 - Drug Discovery and Development in ASD
10:30 AM - 12:30 PM - Room: 517A

Panel Chairs: Joseph Buxbaum, *Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY*

Mustafa Sahin, *Boston Children's Hospital/Harvard Medical School, Boston, MA*

This panel will begin with a summary by J.F. Hipp of the process of drug discovery and development, including the critical need for biomarkers in early stage drug development. Next, two presentations will focus on rare genetic disorders in autism. J. Serrats will show how recent genetic findings provide a platform for neurobiologically-driven drug discovery and O. Khwaja will summarize recent advances in the use of genomic medicine in these rare disorders. Finally, G.J. Pandina will discuss the critical need for robust outcome measures in ASD in order to show efficacy of interventions, as well as a study of one such measure. These four talks will provide an inclusive picture of early through late stage drug development, including biomarkers and outcomes measures, and summarize how to leverage molecular genetic discoveries in autism for the development of novel therapeutics.

10:30 **229.001** The Importance of Biomarkers for Early Drug Development

J. F. Hipp, *Neuroscience and Rare Diseases (NRD), Roche Pharma Research and Early Development, Roche Innovation Center, Basel, Switzerland*

In this presentation, I will first describe the early drug development process comprising the pre-clinical phase, phase I to establish safety, tolerability and a good understanding of pharmacokinetics, and phase II that aims at providing a proof of concept for a given indication. I will then review different types of biomarkers that are of high relevance for drug development in neuropsychiatric disorders including (1) pharmacodynamic biomarkers that allow demonstrating modulation of brain activity, (2) biomarkers that quantify specific aspects of the disease pathophysiology or symptomatology, and (3) biomarkers that could be used to identify sub-populations that respond to a specific treatment. I will illustrate the different types of biomarkers using specific examples from our work at Roche. The goal is to convey the importance, the impact, and the challenges of using biomarkers in early drug development from an industry perspective.

10:55 **229.002** Drug Discovery for Neurodevelopmental Disorders: Current Approaches for the Medicines of Tomorrow

***J. Serrats**, Takeda, San Diego, CA*

BACKGROUND. Current available therapies for neurodevelopmental disorders do not address the major clinical needs in this patient population. Many of the therapeutics being progressed through the clinical pipeline are re-purposed drugs that were developed and initially thought to address broader patient populations. We take a patient-centric approach to drug discovery and start this very challenging process by understanding patient biology, and patient symptoms, to generate precision medicines that will address clinical needs of patients with neurodevelopmental disorders.

OBJECTIVES. Our goal is to generate a discovery pipeline of pre-clinical programs that will address, once they reach clinical development, major clinical needs that are present in patients with neurodevelopmental disorders. We focus on genetic syndromes where gene mutations are known to be highly penetrant and that play a very important role in disease initiation, progression and manifestation. This focus starts with a syndrome with a known genetic lesion that can then be studied at different levels (cellular, circuitry, network and animals).

METHODS. We focus on a few genetic syndromes where the gene lesion is known. We obtain patient cells that are reprogrammed to induced pluripotent stem cells and further differentiated into cellular types of interest, like neurons and neuronal subtypes as well as glia-like cells like astrocytes. These cells are characterized throughout the different stages of development in comparison with cells that do not have the genetic mutation. Differences between both genetic backgrounds are studied to understand the differences between cells from patients with gene lesions versus cells from normally developing individuals. Furthermore, we generate 3D cellular systems where a more complex relationship among cells and glia is established. These *spheroids* can then be used to characterize connectivity differences between neurons and glia as well as electrical recordings can be obtained to start elucidating potential changes in connectivity among these more complex cellular organizations. Finally, we generate rodent models where the same mutation (or as close as possible) that is present in our patients is present in the animal model. These models are then used to characterize potential biomarkers that resemble clinical biomarkers present in our patients, which could be used to establish relationships between drug effect and biomarker changes and ideally disease effect.

RESULTS. Initial efforts in characterizing patient-derived cells are underway in our facilities, as well as generation of *spheroids* from cells derived from patients. Once phenotypes are identified and characterized, we will proceed to major screening efforts of our internal compound libraries to identify chemical leads that can modify the identified phenotypes. Additionally, alternative modalities are being studied to modify/replace gene products that may be missing or in excess in patients with neurodevelopmental disorders.

CONCLUSIONS. Recent advances in genetics and genomics are enabling the understanding of the underlying biology of patients with neurodevelopmental disorders. In addition, advancement in innovative drug discovery areas like antisense oligonucleotides, gene therapy or availability of patient-derived cells to screen small molecule libraries are opening the door to future precision medicines in neurodevelopmental disorders.

11:20 **229.003** Novel Therapeutic Modalities for Neurodevelopmental Disorders

***O. Khwaja**, Voyager Therapeutics, Inc., Cambridge, MA*

Background

The biology of neurodevelopmental disorders and ASD has benefited from the identification of genetic and molecular pathologies, particular in rare syndromic and monogenetic disorders. Drug discovery for ASD and neurodevelopmental disorders has however been constrained by limitations in the ability to adequately pharmacologically-modify genetic targets through traditional small molecule and protein engineering approaches.

Objectives

To describe novel therapeutic modalities to directly modulate RNA and DNA-based targets in neurological disorders and identify how they may be deployed in ASD and critical success factors in translating such therapies to the clinic.

Methods

We will review recent experience with gene modulation and RNA therapies with a particular focus on targeting the central nervous system, the promise and limitations of genomic medicine in ASD as well as emerging technologies that can be applied to drug discovery and development in ASD.

Results

Genomic medicine for CNS disorders are a reality and have the potential to greatly expand the drug discovery toolbox and target space in ASD. Experience with the current generation of DNA and RNA-modulating therapies also highlight areas of uncertainty and opportunity in development of next-generation technologies as well as important factors in drug candidate selection prior to entry into humans. We primarily review vector-based, oligonucleotide and small molecule approaches.

Conclusions

Advances in drug technologies are poised to have a significant impact to modulate genetically-defined targets in people with ASD. These will begin to provide answers to the salience of these targets in the neurobiology and pathophysiology of these conditions as well as a new generation of investigational therapies for ASD and associated disorders.

11:45 **229.004** Utility of Outcome Measures in ASD – Are We Measuring What We Think We Are Measuring?

***G. J. Pandina**, Janssen Research & Development, Titusville, NJ*

Background: While many different outcome measures are available to measure the core and associated symptoms of Autism Spectrum Disorder (ASD), traditionally these scales have been utilized to facilitate diagnosis, or to measure change over longer time periods. While there are both clinician (observational and interview) and caregiver/parent measures available, most frequently studies utilize parent/caregiver measures due to their extensive knowledge of the child or adult with ASD. The very nature of early clinical drug development requires that a measure that meets several criteria: 1) comprehensively measure the core symptoms of autism, and ideally some associated symptoms; 2) is responsive to change over

short time periods (ie, 3-6 months) by measuring aspects of behavior that might be expected to change with treatment; 3) is understandable from the first administration, without explanation or support from the clinician or study staff to avoid bias; 4) and avoids burnout over time by being brief and repeatable.

Objectives and Methods: This presentation will focus on the results of a recently completed caregiver cognitive debriefing study (N=50 parents/caregivers) with a validated measure of core and associated ASD symptoms, the Autism Behavior Inventory (Bangerter et al, 2017).

Results: The ABI is a part of the JAKE ® (Janssen Autism Knowledge Engine) System, a set of tools and technologies designed to optimize clinical trials for ASD. While the vast majority of comments from caregivers regarding the ABI reflected their clear comprehension of the items and concepts, small changes to item wording and examples resulted in improved acceptance and understanding and reduced scale length.

Conclusions: Examples of caregiver feedback and impact on utility of the ABI for clinical trials will be discussed.

Panel Session
Epidemiology/Population Studies
230 - Leveraging Polygenic Risk Scores to Advance Autism Epidemiology
10:30 AM - 12:30 PM - Room: 517B

Panel Chair: Diana Schendel, *Aarhus University, Aarhus, Denmark*

Discussant: Christine Ladd-Acosta, *Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD*

The expansion in 2018 of GWAS data on persons with autism, through the iPSYCH and Psychiatric Genetics Consortium, has finally resulted in a sufficiently powered sample size (n=46,350) to detect common variants associated with ASD. These precise SNP-based association effect estimates enable derivation of a polygenic risk score (PRS), which captures the overall burden of genetic susceptibility to ASD (ASD-PRS). Quantitative PRS measures of individual genetic liability can serve as powerful tools to address pressing questions in autism research across a wide-range of settings. This panel will showcase the use of PRS to gain insights into ASD. First, we show that the iPSYCH-PGC PRS, discovered in a predominantly European sample, also associates with ASD case status in a racially and ethnically diverse US-based epidemiology sample (Benke; SEED sample). Second, we use PRS to determine the contribution of common variants to phenotypic variation in quantitative autistic traits among a clinically ascertained familial sample (Constantino; AGRE sample). Third, we compare PRS-based measures of ASD risk to psychiatric family history-based ASD risk (Schendel; Danish iPSYCH sample). Fourth, we use PRS concepts to provide insights into ASD subphenotypes (Grove; Danish iPSYCH sample). Our discussant will summarize emerging themes and future directions in ASD-PRS research.

10:30 **230.001** Polygenic Risk for Autism Spectrum Disorder in the Study to Explore Early Development

K. S. Benke[1], *C. Ladd-Acosta*[2], *C. J. Newschaffer*[3], *M. D. Fallin*[2], *L. A. Croen*[4], *L. Schieve*[5], *J. Daniels*[6], *A. M. Reynolds*[7] *and D. Schendel*[8], *(1)Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (2)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (3)AJ Drexel Autism Institute, Philadelphia, PA, (4)Division of Research, Kaiser Permanente, Oakland, CA, (5)Centers for Disease Control and Prevention, Atlanta, GA, (6)University of North Carolina at Chapel Hill, Chapel Hill, NC, (7)University of Colorado Denver School of Medicine, Aurora, CO, (8)Aarhus University, Aarhus, Denmark*

Background:

Autism spectrum disorder (ASD) is a polygenic disease that is moderately to highly heritable. Genome-wide association studies (GWAS) have been successful in identifying common genetic variants that predispose to complex traits.

The largest ASD GWAS meta-analysis to date includes >9 million single-nucleotide-polymorphisms (SNPs) in 18,381 ASD cases and 27,969 controls from the Psychiatric Genomic Consortium (PGC) and iPSYCH projects. These results provide, precise SNP-based association effect sizes that allow derivation of a polygenic risk score (PRS) to represent genetic susceptibility to ASD (ASD-PRS).

Objectives:

We applied GWAS effect sizes from the recent PGC/iPSYCH results to SNP data from the independent US population-based Study to Explore Early Development (SEED) to derive ASD-PRS and examine associations between ASD-PRS and ASD classification.

Methods:

SEED is a multi-site case-control study of children aged 3-5 years with ASD and a control group drawn from the general population, born between September 2003 and August 2006. Genotyping was performed on either Illumina or Affymetrix arrays and imputed using SHAPEIT and IMPUTE2. ASD- PRS was generated via pruning, thresholding and scoring in PLINK. The same process was used to derive a psychiatric cross-disorder PRS using PGC results (http://www.med.unc.edu/pgc/results-and-downloads). All ASD-PRS associations with ASD were assessed by logistic regression, accounting for sex and five principal components of genetic ancestry.

Results:

The PRS analysis included 1302 SEED children: 861 boys (467 with ASD) and 441 girls (115 with ASD). After evaluating Nagelkerke's R-squared statistic across a range of discovery p-value thresholds, we observed that pdiscovery=0.30 maximized the variance explained. All PRS associations reflect this cutoff for SNPs to be selected into the summed score. The odds ratio of ASD for a single standard deviation increase in the ASD-PRS score, adjusted for sex and genetic ancestry, was 1.42 (95%CI: 1.13, 1.78; p-value=0.0028), which explained 0.87% of the variance in ASD status. A similar finding was observed for a subset of 799 children with European ancestry (OR=1.49; 95%CI: 1.12, 2.00; p-value=0.0066), which explained 1.1% of the variance in ASD status. We also observed an association with the CrossDisorder-PRS in the full sample (OR=1.28, 95%CI: 1.09,1.49, pl=0.0021) and in children of European descent (OR=1.46, 95%CI: 1.17, 1.82, p=0.0008). In a model that includes both ASD-PRS and CrossDisorder-PRS, the odds ratio for ASD-PRS, adjusted for the CrossDisorder-PRS, was 1.43 (95%CI: 1.07, 1.92, p=0.015), and the odds ratio for CrossDisorder-PRS, adjusted for ASD-PRS, was 1.43 (95%CI: 1.14, 1.79, p=0.0017).

Conclusions:

To our knowledge, this is the first effort to leverage the PGC/iPSYCH GWAS discovery results to investigate the utility of an ASD-PRS in a population-based ASD case-control sample. We show a strong main effect indicating genetic susceptibility for ASD, in a multi-ethnic sample and stratified by European ancestry. The variance explained, though small (~1%), is similar to PGC-based PRS for other psychiatric conditions (i.e., schizophrenia). We additionally show that the ASD-PRS association persists after adjustment for a general genetic susceptibility to psychiatric disorders. Further work will compare these results to similar analyses using a non-psychiatric phenotype to confirm the specificity of this finding.

10:55 **230.002** Common Variant Burden Contributes to the Familial Aggregation of Quantitative Autistic Traits

J. N. Constantino[1], *R. E. Wagner*[2], *W. Howells*[3], *M. Panther*[1], *J. Lowe*[4] *and D. Geschwind*[5], *(1)Washington University School of Medicine, St. Louis, MO, (2)Child and Adolescent Psychiatry, Washington University School of Medicine, St. Louis, MO, (3)Psychiatry, Washington University School of Medicine, St. Louis, MO, (4)Semel Institute, University of California, Los Angeles, Los Angeles, CA, (5)University of California, Los Angeles, Los Angeles, CA*

Background: Both rare and common genetic variation act additively to contribute to autism spectrum disorder (ASD) risk in simplex and multiplex families. Quantitative autistic traits (QAT) aggregate in families affected by multiplex ASD, but no study to date has examined the extent to which common variants contribute to ASD risk in a familial multiplex sample encompassing the entire range of QAT. Critically, large epidemiological studies have demonstrated that family members of affected individuals exhibit subclinical QAT. Further, evidence from both twin and genomic studies suggests a genetic correlation between ASD and QAT in the general population.
Objectives: The goal of this study was to employ ASD polygenic risk scores (PRS) to predict the full range of phenotypic variance comprehensively characterizing QAT and establish common variant burden in a familial sample.

Methods: In a sample of clinically-ascertained subjects (N=634) from multiplex families in the Autism Genetic Resource Exchange, including individuals with and without ASD diagnosis, we calculated the amount of variance in QAT predicted by ASD-PRS, derived from the Psychiatric Genomics Consortium (PGC) ASD Genome Wide Association Study (GWAS) (N=10,610).

Results: The ASD-PRS explained 6.8% of the phenotypic variance in our sample. Across all subjects, the estimated correlation of the ASD-PRS with QAT was r=0.24 (p=1.17e-09). In females (N=232), the correlation was r=0.31 (p<.0001); and in males (N=402), the correlation was r=0.19 (p=0.0003). Further, we found a significant interaction of sex with ASD-PRS (p<.05). In the PGC-ASD sample, genetic complex trait analysis (GCTA) revealed the SNP heritability (which by definition measures only common, additive variation) of ASD to be 17%, setting an upper limit on how much variance a PRS can explain. Thus, it is notable that these PRS results capture 40% of the possible phenotypic variance. Similar analyses using summary statistics from the recently expanded 2018 iPSYCH-PGC ASD GWAS are underway and will be presented.

Conclusions: These results demonstrate a significant contribution of common polygenic variation to the familial aggregation of QAT. PRS enrichment in families was observed in both males and females, but this polygenic burden was significantly higher in females. Since multiplex families are preferentially selected for clinically-ascertained males, de novo mutations disrupting the relationship between PRS and phenotype may be more prevalent in males in this sample. Further, PRS derived from the largest ASD-GWAS to date, the Danish iPSYCH-PGC collaboration (N=46,350), explained 2.45% of variance in ASD diagnosis in a case-control sample; an estimate which, at 6.8%, our estimate nearly triples. To further contextualize these results, two previous studies attempting to employ ASD-PRS to predict subcomponents of QATs explained only .13% and .54% of the phenotypic variance. While it is possible that due to the multiplex nature of our sample, our subjects were enriched for common variant burden, a recent study demonstrated that the degree of over-transmission of ASD-PRS did not differ between simplex subjects and PGC-ASD probands. These results speak to the critical importance of employing QAT measurement in efforts to elucidate the genetic architecture of ASD.

11:20 **230.003** Polygenic Risk Score and Psychiatric Family History in Autism Spectrum Disorder

D. Schendel[1], *T. Laursen*[1], *C. Ladd-Acosta*[2], *M. D. Fallin*[2], *B. K. Lee*[3], *K. S. Benke*[4], *J. Grove*[5], *B. Vilhjalmsson*[1], *A. Kalkbrenner*[6], *C. B. Pedersen*[1], *L. Ejlskov*[1], *P. Mortensen*[7], *A. Bøglum*[8], *O. Mors*[1], *T. Werge*[9], *M. Nordentoft*[10], *D. Hougaard*[11] *and E. Agerbo*[1], *(1)Aarhus University, Aarhus, Denmark, (2)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (3)Epidemiology and Biostatistics, Drexel University, Philadelphia, PA, (4)Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (5)Center for Genomics and Personalized Medicine, Department of Biomedicine - Human Genetics, Bioinformatics Research Centre, Aarhus University, Aarhus, Denmark, (6)University of Wisconsin-Milwaukee, Milwaukee, WI, (7)National Centre for Register-based Research, Aarhus University, Denmark, 8210 Aarhus V, Denmark, (8)Biomedicine, iPSYCH, Aarhus University, Aarhus, Denmark, (9)MHC-SCT. hANS CPH-UNI, Roskilde, Denmark, (10)Mental Health Center Copenhagen, Copenhagen, Denmark, (11)Statens Serum Institute, Copenhagen, Denmark*

Background: Both psychiatric family history and genetic liability are linked to autism spectrum disorder (ASD) and there is considerable familial and genetic overlap between ASD and specific psychiatric conditions.
Objectives: We performed a population-based integration of family history and genetic liability, using the ASD polygenic risk score (ASD-PRS; derived from the ASD iPSYCH-PGC GWAS), in ASD risk. We examined ASD-PRS variation associated with distinct psychiatric family histories and ASD risk from both psychiatric family history and ASD-PRS.

Methods: The iPSYCH study population comprised all Denmark-born singleton births, 1 May 1981-31 December 2005; resided in Denmark on their one-year birthday; and mother known. ASD cases comprised study persons with an ICD-10 ASD diagnosis reported through 2012 (n=16,146) to the Danish Psychiatric Central Research Registry (PCRR). iPSYCH controls comprised a random sample of 30,000 persons from the study population (2%). ASD cases and non-ASD controls in this study additionally comprised persons whose parents were born in Denmark (84% ASD cases, 84% controls) and, among these, had an ASD-PRS (91% ASD cases, 88% controls with Denmark-born parents). We defined eight non-overlapping family history categories based on PCRR diagnoses reported through 2016 in parents or full siblings: ASD; schizophrenia; developmental disorders or intellectual disability; ADHD; affective disorders; adult personality disorders; any other psychiatric diagnosis; no psychiatric diagnoses. We estimated least-squares means (LSMean) for PRS z-scores by psychiatric family history category and adjusted odds ratios (adjOR) for ASD by decile of PRS and by psychiatric family history category. All analyses were adjusted for the first 5 genetic ancestry principal components, year of birth, age at end of follow-up, sex, parental ages at birth, and having a sibling (Yes/No). ORs by PRS decile were additionally adjusted for psychiatric family history and ORs by psychiatric family history were additionally adjusted for PRS.

Results: Psychiatric family history was observed in 36% of ASD cases (n=12,346; 9% with ASD family history) versus 19% of non-ASD controls

(n=21,904; 2% with ASD family history). ASD risk increased by PRS decile (10th decile adjOR 2.21 (1.98-2.46)) and by each psychiatric family history category (highest risk, ASD family history (adjOR 6.71 (5.91-7.61); lowest risk, other psychiatric family history (adjOR 1.73 (1.58-1.90)). There was virtually no attenuation of ASD risk after adjusting PRS ORs for psychiatric family history or adjusting psychiatric family history ORs for PRS. After Bonferroni correction, among ASD cases the only significant pair-wise difference in PRS z-score LSMean by psychiatric family history was between cases with an ASD family history and no psychiatric family history. The PRS z-score LSMean of controls with an ASD family history was comparable to that of ASD cases, regardless of family history, and significantly higher than the control LSMean with no psychiatric family history.

Conclusions:

ASD polygenic burden and psychiatric family history appear to independently contribute to ASD risk, yet better understanding of factors contributing to ASD-PRS variation with psychiatric family history is warranted. Integration of individual genetic liability and psychiatric family history is critical for understanding ASD risk architecture.

11:45 **230.004** Polygenic Heterogeneity in Autism and in Related Phenotypes

J. Grove[1] *and .. The iPSYCH-Broad/MGH Autism Working Group*[2]*, (1)Center for Genomics and Personalized Medicine, Department of Biomedicine - Human Genetics, Bioinformatics Research Centre, Aarhus University, Aarhus, Denmark, (2)iPSYCH/Broad/MGH, Aarhus, Denmark*

Background: The aetiology of Autism Spectrum Disorder (ASD) is complex and largely unknown, but ASD is highly heritable with common variation estimated to explain half of the genetic risk. Shared genetics between different psychiatric disorders is well documented and genetic correlation of psychiatric disorders with phenotypes such as educational attainment and IQ has been reported. Recently, iPSYCH and Broad/MGH conducted the largest GWAS of ASD to date comprised of 13,076 cases and 22,664 controls from Denmark and subsequently meta-analyzed with 10,610 samples from the Psychiatric Genomics Consortium (PGC). As part of these analyses, we introduced a novel polygenic risk score (PRS) analysis utilizing the genetic overlap with related phenotypes to show for the first time genetic differences between the ICD10 ASD diagnostic subgroups (childhood autism, atypical autism, Asperger's syndrome, other pervasive developmental disorder, pervasive developmental disorder, unspecified).

Objectives: We expand these novel PRS analyses to ASD and attention deficit hyperactivity disorder (ADHD) comorbid subgroups (ASD/noADHD, ASD+ADHD, ADHD/noASD) and new and more powerful PRS.

Methods: iPSYCH is a population sample comprised of cases with one or more psychiatric diagnoses identified in the Danish Psychiatric Central Research Register and a 2% random sample from the corresponding birth cohort as controls. Archived dried blood spot samples for participants were identified in the Danish Neonatal Screening Biobank. DNA was extracted, whole-genome amplified and genotyped on the PsychChip, a customized HumanCoreExome chip. QC, imputation, PCA and polygenic risk scoring were conducted using the Ricopili pipeline of PGC. For the PRS, we used summary statistics from the latest GWAS of educational attainment (EA, n~766,000), intelligence (n~270,000) and 12 neuroticism items from the UK Biobank (n~200,000). These PRS were regressed on the ASD diagnostic and ASD and ADHD comorbid subgroups in a multivariate multiple regression model adjusted for principal components and genotyping batches. This model accounts for the correlation between different PRS and makes it possible to test an array of hypotheses.

Results: With the more powerful PRS, we reproduced our previous findings that sharing of alleles between ASD and EA is concentrated in Asperger's syndrome and childhood autism, but not in the other ASD diagnostic subtypes. Moreover, the EA and intelligence PRS profiles of the ASD diagnostic subgroups are now distinguishable (p=0.048). With respect to PRS for neuroticism items, we found only minor differences across ASD diagnostic subgroups but marked differences across ASD and ADHD comorbid subgroups. For example, there were significant trends for mood swing PRS ($p=1.0x10^{-88}$) and feeling fed-up PRS ($p=6.2x10^{-74}$) across the comorbid subgroups, and while ASD/noADHD and ASD+ADHD had higher PRS scores for worrying too long after embarrassment, ADHD/noASD did not ($p=8.1x10^{-14}$).

Conclusions: Although current ASD GWAS are too small to identify individual genetic loci associated with ASD subgroups, using a polygenic perspective and powerful regression method we can distinguish ASD clinical subgroups . Moreover, we can begin characterizing ASD subgroups by their PRS loading for selected behavioural phenotypes, thereby, leveraging the power of GWAS to chip away at the multidimensional biology behind ASD.

Panel Session
International and Cross-Cultural Perspectives
231 - Cultural and Structural Factors Underlying Diagnostic and Service Disparities Among Racial/Ethnic Minority Children in the U.S.
10:30 AM - 12:30 PM - Room: 524

Panel Chair: Sandra Vanegas, *School of Social Work, Texas State University, San Marcos, TX*

Discussant: Sandy Magaña, *University of Texas, Austin, Austin, TX*

For individuals with ASD, access to early identification, diagnosis, services and supports can improve children's developmental trajectories and increase opportunities for education and employment in adulthood (Kirby, Baranek, & Fox, 2016). However, numerous disparities have been identified in access to diagnosis and services for children from racial/ethnic minority backgrounds in the U.S. (Liptak et al., 2008). Children from racial/ethnic minority backgrounds are less likely to be referred for ASD diagnostic evaluations (Tek & Landa, 2012), receive ASD diagnoses later than non-minority White children (Mandell et al., 2002), and are less likely to access therapeutic services and supports (Magaña et al., 2013). Therefore, it is critical to understand the cultural and structural factors underlying these disparities to improve outcomes for racial/ethnically diverse children. In this panel, presentations will examine the cultural (e.g., language, values) and structural (e.g., therapy services, health insurance) factors that affect access to diagnosis and services among Latino, African-American, and Korean-American children/youth with ASD in the United States. This panel will characterize how families from diverse racial/ethnic cultures navigate structural systems and provide recommendations on steps to address disparities from infancy to young adulthood. This research will inform global approaches in minimizing disparities affecting individuals with ASD worldwide.

10:30 **231.001** How Do You Translate "Peek-a-Boo" When "Peek-a-Boo" Doesn't Exist? Cultural Adaptation of a Parent-Report Screening

Tool

M. DuBay[1] *and C. Rojevic*[2]*, (1)University of North Carolina, Chapel Hill, NC, (2)Occupational. Therapy, University of Southern California, Los Angeles, CA*

Background: Parent-report screening and assessment tools are frequently used to identify children showing behaviors associated with autism spectrum disorder. Most available tools were created and validated with non-minority English-speaking individuals in western countries, then translated for diverse populations. A basic forward-back methodology has traditionally been used (Brislon, 1970). However, this methodology does not sufficiently prevent translation errors and fails to account for cultural differences (Beaton et al., 2000; Gjersing et al., 2010). Without appropriate translation methods, actual rates of over- or under-identification may differ between instrument versions, possibly resulting in a poor-quality assessment tool (Soto et al., 2015). This could contribute to disparities in identification among non-English-speaking communities.
Objectives: This presentation will describe the application of a rigorous translation and cultural adaptation process for a parent-report infant screening tool, including broader implications for Latin-American Spanish-speaking populations.

Methods: Three native-Spanish translators, from a variety of linguistic and professional backgrounds, collaboratively translated the instructions, items, and answer choices of the First Years Inventory (Baranek, et al., 2013). The quality of this forward translation was checked through preliminary pretesting and back translation. All translators, original instrument creators, and research team members developed a pre-final translated version by reviewing data collected during each of these phases. The pre-final version was tested with twenty target population members using cognitive interview strategies. Identified discrepancies in semantic, idiomatic, experiential, or conceptual equivalence between each item's original intent and its meaning as understood by participants revealed areas in need of additional cultural adaptation. A final revision was developed based on qualitative and quantitative data from throughout the process.

Results: Pre-testing results indicate that Spanish-speaking parents had difficulty choosing from frequency-based answer choices. When narrating their decision-making process for selecting answer choices, parents largely considered which answer would describe typical development. This was evident in two patterns: First, parents assumed all items described typical behaviors and tended to respond positively, even to items describing atypical behaviors (i.e. reverse-scored items). Second, parents tended to adjust their answers based on their child's age. If parents felt that an item described a behavior or skill that was developmentally advanced for their child, they adjusted the meaning of the item to describe a similar but more age appropriate behavior, and answered the item according to their modification. Parents also had difficulty understanding items with descriptions of actions (e.g. gestures, pretend play, motor milestones, motor-based RRBIs), some adjectives, and complex grammatical structures. Back-translation methods yielded some false impressions of the translation.

Conclusions: When translating a tool for use with a new population, significant revisions to instructions, answer choices, and item wording may be necessary to maintain conceptual equivalence across cultures. Results illustrate the importance of pre-testing as a quality checking procedure. Without data from pre-testing, significant issues identified would likely have influenced the way Spanish-speaking parents responded to items, in turn inflating or minimizing risk-scores inappropriately. Similar patterns may be relevant for other parent-report tools and other cultural groups. Additionally, some difficulties experienced by pre-testing participants may be relevant cross-culturally.

10:55 **231.002** Identifying Predictors of Age of Diagnosis for Latino Children with ASD in a U.S. Sample

S. Vanegas[1] *and S. Magaña*[2]*, (1)School of Social Work, Texas State University, San Marcos, TX, (2)University of Texas, Austin, Austin, TX*

Background: Data from research, administrative, and public health surveillance efforts finds significant disparities in Autism Spectrum Disorder (ASD) screening and diagnosis of Latino children. Barriers that have been reported by parents often include family-level (e.g., low-income/low-resources; Liptak et al., 2008), provider-level (e.g., Spanish-speaking providers, differential treatment by providers; Zuckerman et al., 2014, 2017), and systemic-level (e.g., complexity of diagnostic system, Magaña et al., 2013) factors that present as significant obstacles. However, little is known about specific demographic or service level factors that promote earlier diagnosis among Latino children.
Objectives: The objective of this study was to identify demographic and service-level factors associated with the age of diagnosis for Latino children with ASD in a U.S. sample.

Methods: Latino families of children with ASD or Developmental Disabilities (DD) were recruited as part of a study examining the validity of Spanish-language diagnostic assessment tools. Families were recruited through parent support groups and clinics in the Midwest region of the United States. All families completed demographic questionnaires, the Autism Diagnostic Interview-Revised, and provided access to medical records to confirm their child's diagnosis and age of first diagnosis for their respective disorders. The final sample included 46 children (ASD n = 28; DD n = 18).

Results: Variables examined as possible predictors included child sex, maternal employment, maternal marital status, maternal education, household income, Spanish as home language, age of first concern, receipt of early intervention, and receipt of early childhood special education services. No group differences were found across all variables of interest. Linear regression analyses were then run separately for the ASD and for the DD groups to identify the demographic and service-level that accounted for variances in age of diagnosis. Results from a stepwise linear regression analysis found that receipt of early intervention (β = -.44) and age of first concern (β = 0.41) were significant predictors of the age of diagnosis for children with ASD, accounting for 52.7% of the variance in age of diagnosis, R^2 = .53, $F(2, 25)$ = 13.95, p < .001. Receiving early intervention was associated with a lower age of diagnosis, whereas the age of diagnosis increased when age of first concern increased. No significant factors emerged as predictive of age of diagnosis for children with DD.

Conclusions: In this study we examined demographic and service-level factors that could affect the age of diagnosis among Latino children with ASD. Overall, receiving early intervention and the child's age when parents were first concerned were significantly associated with the age of diagnosis. These findings suggest that early diagnosis of Latino children with ASD can be facilitated through early entry into the early intervention system. This can be due to early access to professionals who are knowledgeable about ASD and can therefore assist families with referrals for diagnostic evaluations and can assist families in navigating the complex educational and health care systems. This research has significant implications for improving the early identification of Latino children with ASD.

11:20 **231.003** Structural Inequities and Autism Disparities

J. S. Singh*, Georgia Institute of Technology, Atlanta, GA*

Background: Disparities in various domains of autism services including age at diagnosis, access to therapeutic interventions, and representation in special educational services exist in the U.S. Although these disparities are evident based on social factors such as race, ethnicity, and social class, there is limited qualitative research that investigates the interrelated social and structural inequities that place children and their families at risk of delayed assessment, diagnosis, and/or services.

Objectives: The objective of this research is to identify structural inequities contributing to autism services from the perspective of underserved people and their families who experience autism service disparities. Specifically, this research aims to better understand the experiences of navigating autism services among single Black women with limited resources and who rely on Medicaid, the U.S. public health insurance program for people with low income.

Methods: This research is based on in-depth interviews (*n* = 20) with single Black women who rely on Medicaid public health insurance in the U.S. All participants were recruited at a community-based autism clinic in Atlanta, Georgia. Participants were asked to describe their experiences before, during, and after receiving a diagnosis of autism for their child. All interviews were audio recorded, transcribed, and coded using grounded theory methods.

Results: Structural inequalities evident in the data circulate around issues of government systems of care - such as the limits of Medicaid services or bureaucratic mechanisms within state-operated family and child services; quality of education – including under-resourced inner-city and racially divided schools; lack of flexibility in work policies, especially for women; and the boundaries created through public transportation. These structural inequities are also embedded in historical housing and transportation policies in Atlanta, Georgia, which have shaped limitations in public transportation and racial segregation. Based on the experiences of single Black women who are raising a child with autism, these structural inequities do not operate in isolation but work together and are mediated by race, gender, and social class. These intersecting forms of structural inequities contribute to the disparities evident in autism services and disproportionately shape the challenging and frustrating experiences of navigating autism services among single Black caregivers.

Conclusions: The perspectives of navigating autism services for single Black women with limited resources begin to make visible the complexity and embodied experience of raising a child with autism in a structurally unequal society. These alternative experiences have been excluded in the representations of autism disparities thus far and offer important insight to the inextricable link between autism disparities and the structural, historical, and situational contexts of Black women's lives as shaped by race, social class, and gender. Although this research focused on single Black women, this knowledge can certainly help us imagine experiences of other marginalized groups who confront differential access to autism services. Further, the insight from these women offers important ways forward to address autism disparities, including the development of mobile therapy units or community resource supports for under resourced neighborhoods.

11:45 **231.004** Future Service Planning for Korean-American Parents Raising Children with Autism Spectrum Disorder (ASD)

I. Kim[1]*, S. Dababnah*[2] *and Y. Wang*[3]*, (1)School of Social Work, University of Maryland, Baltimore, Baltimore, MD, (2)University of Maryland, Baltimore, Baltimore, MD, (3)Social of Social Work, University of Maryland, Baltimore, Baltimore, MD*

Background: The transition to adulthood is an ongoing process that starts in early childhood and continues through adolescence. Individuals with autism spectrum disorder (ASD) and their families can experience unique challenges during transition periods. Parents' future service plans for their children vary by culture. In the U.S., independence and autonomy are dominant values in adulthood, which shape expectations for social services for adults with ASD. However, parents from minority ethnic groups in the U.S. often hold different values and views of services designed to support these transitions.

Objectives: This study examines future service planning among Korean-American (KA) parents raising children with ASD in the U.S.

Methods: We utilized a qualitative, in-depth interview method. Fourteen first-generation KA parents (10 mothers; 4 fathers) participated in the study. The average age of the children was 16.1 years (SD=7.2). All children resided in parents' homes in the southeast U.S. None of the adults with ASD (*n*=4) were employed. The semi-structured interviews ranged from 60-90 minutes. We conducted a thematic analysis of the interview transcripts concurrent with data collection to develop primary themes.

Results: We identified three themes. First, all of the mothers placed a low value on their child's future independence. They preferred their children live at home as long as possible. However, this was a point of conflict with fathers in the study, who primarily hoped to develop plans for their child's independence. Nonetheless, both fathers and mothers indicated a desire to employ their children in their own businesses in the future, rather than in outside employment.

Secondly, few parents utilized mainstream services for their children with ASD. KA parents who resided in America for more than 20 years reported that they used mainstream services when their child was young, but encountered challenges, such as food aversions or high costs, in adult day programs or group homes. Some parents indicated a preference for Korean service providers. However, several participants reported that their state family support funds could not be used for a day program administered by their Korean churches.

Lastly, some participants, particularly recent immigrants or those who lived in areas without a large Korean community, lacked information and support regarding service planning. All parents of older adolescents or adults indicated that their final IEP meeting did not provide their child with an adequate transition plan. Some parents considered returning to Korea, where they perceived vocational training was more comprehensive.

Conclusions: Parents need support to navigate an increasingly complex service system as their children transition to adulthood. Participants, especially mothers, expressed a cultural mismatch with the individually focused U.S. service system. More funding for parents caring for their children at home, or with the support of community-based providers, is necessary. Furthermore, training ASD service providers to be culturally responsive to the needs of ethnic minority individuals with ASD and their families is critically important. KA parents who recently immigrated or who do not live in a large KA community might need more assistance to care for their children throughout their lifespan.

Panel Session
Service Delivery/Systems of Care
232 - Examining Experiences of Individuals in Communities from Diagnosis to Adulthood: Results from a Large State Needs Assessment Survey
10:30 AM - 12:30 PM - Room: 516ABC

Panel Chair: Lindsay Shea, *A.J. Drexel Autism Institute, Philadelphia, PA*

Discussant: Paul Turcotte, *Drexel University, Philadelphia, PA*

More than 8,000 adults with autism and caregivers of individuals with autism of all ages responded to the Pennsylvania Autism Needs Assessment, which covered a wide range of topics from individual demographic and clinical characteristics to service experiences. Most respondents consented to link their survey to secondary claims data, allowing for a robust data source capturing both individual opinions and preferences and observed service usage. The purpose of this panel is to present a series of focused analyses reaching from early diagnosis experience through adulthood community participation and living arrangement status and satisfaction. At the conclusion of this panel, attendees will have learned from a large dataset new information about autism diagnosis, self-reported health status, community participation, and living arrangement data. Attendees will also learn about opportunities to link individual survey data to secondary data sources to amplify the utility of results and more thoroughly observe individuals' and family experiences.

10:30 **232.001** Self-Reported Health Status Among Individuals with Autism

P. F. Turcotte[1], *K. Verstreate*[2], *K. Croce*[2], *S. Nonnemacher*[3] *and L. Shea*[4], *(1)Drexel University, Philadelphia, PA, (2)Drexel University, Policy and Analytic Center, A.J. Drexel Autism Institute, Philadelphia, PA, (3)Pennsylvania Bureau of Autism Services, Harrisburg, PA, (4)A.J. Drexel Autism Institute, Philadelphia, PA*

Background:

As service systems evolve for individuals with autism, self-reported health status is an integral method to understand how individuals with autism and their families perceive their healthcare and service needs.[1] Self-rated health is used in the other disabilities and diseases, as well as in limited previous autism-specific research to detect and track changes in health status across medical and physical domains.[2,3] Previous research has demonstrated that needs of individuals with autism change as they age.[4]

Objectives:

- Identify demographic characteristics and other predictors of self-reported health status changes over the previous year.
- Leverage free text responses to categorize and qualify changes in self-reported health status

Methods:

The Pennsylvania Autism Needs Assessment , conducted in 2017, included a survey of individuals with autism over 18 years of age responding for themselves, and a survey of caregivers of individuals with autism of all ages. Information on demographic characteristics, service needs, and self-reported health, as well as a range of other topics was collected. Self-reported health status change over the previous year was reported as better, worse, or the same. Free text responses were available to explain reasons for the change in status.

Results:

Individual with autism over the age of 18 (n=1,250) were an average age of 28 and were predominately Caucasian (81.4%). Most individuals' health remained the same (67.2%), followed by 19.9% reporting "better", and 12.9% reporting "worse." Individuals who reported "worse" health outcomes were less likely to be living with parents (58.3% vs 75.1% for "same" and 70.3% for "better" respectively) and were living independently with support or in a group home, had lower average income, lower rates of private insurance coverage, and a higher level of comorbid mental health diagnoses.

The average age of an individuals with autism for whom a caregiver responded (n=5,382) was 15, and this group was also predominately Caucasian (81.4%). Most caregivers reported their child's health remained the "same" (64.6%), followed by 24.7% reporting "better", and 10.7% reporting "worse." Caregivers who were responding for children of younger ages were more likely to have selected "better", especially in the 0-5 age range (15.5% better, 6.0% the same, and 6.6% worse). This relationship switches as the child's age increases, and caregivers of individuals with autism who were 16-20 years old age reported 16.7% better,24.3% the same, and 25.0% worse.

Conclusions:

Most adults with autism (87.1%) and caregivers responding about their child (89.3%) reported that their health remained the same or improved over the previous 12 months. There were important differences in self-reported health status over the past year, including the age of the individual with autism, as well as the living situation and income. Additional analyses will use logistic and linear regression methods to identify predictors of a "worse" self-reported health status change, including comorbid diagnoses, hospitalizations, and other socio-economic factors. Qualitative analysis of the "other" text response will determine if other reasons for self-reported health status caused changes.

10:55 **232.002** Community Participation Experiences and Preferences Among Adults with Autism

W. Schott[1], *K. Verstreate*[1], *K. Croce*[1], *P. F. Turcotte*[2], *S. Nonnemacher*[3] *and L. Shea*[4], *(1)Drexel University, Policy and Analytic Center, A.J. Drexel Autism Institute, Philadelphia, PA, (2)Drexel University, Philadelphia, PA, (3)Pennsylvania Bureau of Autism Services, Harrisburg, PA, (4)A.J. Drexel Autism Institute, Philadelphia, PA*

Background:

As the prevalence of autism spectrum disorder (ASD) has increased, growing numbers of adolescents with ASD are aging into adulthood. Advocacy organizations and new policy directives at the federal level have called for increased attention to successful community integration of adults with ASD.[1,2] Research on neurotypical populations has suggested that active and meaningful integration in one's community is beneficial, including decreased social isolation,[3-5] increased wellbeing,[6,7] improved quality of life,[8,9] improved feelings of depression and anxiety, and improved self-rated health.[10] Limited research on community participation among individuals with ASD has primarily focused on children. Compared to their neurotypical peers, children with ASD participate at lower rates in recreation, leisure, social, and community-based activities and events.[11-13] One study of young adults found that community participation among individuals with ASD was significantly lower than that of their neurotypical peers.[14] It remains unclear whether benefits from community integration for adults with ASD would be similar, whether current participation levels align with individual preferences and community characteristics, and whether additional supports, policies, and programs are needed to facilitate community integration.

Objectives:

- Characterize levels of community participation and satisfaction with participation
- Examine differences in community participation by race, income level, urban vs. rural residence, and level of service support.

Methods:

We examine data from a statewide survey of individuals with ASD in Pennsylvania (PA) conducted by the ASERT Collaborative and commissioned by the PA Bureau of Autism Services. The survey collected information on demographic characteristics, service needs, and community integration, among other topics, in 2017. Community integration was measured by the Temple University Community Participation measure (TUCP), a standardized measure examining community participation and allowing adult respondents to report on frequency of participation in a range of activities and the value they place on those activities.

Results:

The average age of adult respondents (n=1,302) was 28 (range 18-98); 29% were female, 83% were White, 21% lived in urban areas, and 72% lived with a family member. Less than half (44%) reported participation in social activities with friends, and fewer than one in three (30%) participated in groups, clubs, or organizations. About one quarter (26%) participated in volunteer work. Of these activities, the most time was spent on social activities with friends (average 5.3 hours per week).

Most respondents felt they "did not participate enough" in advocacy groups (69%), social groups (70%), civic or political activities (70%), and library activities (58%). However, participation in these activities was "important" for many: social groups were important for 43%, library activities for 38%, advocacy groups for 25%, and civic/political activities for 19%.

Conclusions:

Most adults with autism surveyed said they did not participate enough in a range of community activities. However, for a substantial portion, these activities were viewed as important. Strategies to assess and meet individual preferences for community integration, both in frequency and scope, are needed. These could include enhanced home and community-based service supports, additional service coordination, expansive dissemination of integration opportunities, and ongoing evaluation of satisfaction with current levels of community integration.

11:20 **232.003** Establishing Correlates of Successful Living Arrangements Among Adults with Autism

S. Nonnemacher[1], *K. Verstreate*[2], *P. F. Turcotte*[3], *K. Croce*[2], *W. Schott*[2] *and L. Shea*[4], *(1)Pennsylvania Bureau of Autism Services, Harrisburg, PA, (2)Drexel University, Policy and Analytic Center, A.J. Drexel Autism Institute, Philadelphia, PA, (3)Drexel University, Philadelphia, PA, (4)A.J. Drexel Autism Institute, Philadelphia, PA*

Background: A common benchmark during the transition from adolescence into adulthood is to move out of a parent or family home and into independent living, with or without roommates. Previous research has found that equal proportions (42%) of adults with ASD expect to reside and not to reside with their parents as they transition into adulthood.[1] Research summarizing the variability in reported rates of independent or semi-independent living stresses the wide range of the proportion of adults with ASD living independently and that those fluctuations are highly dependent on ASD presentation (e.g., with or without ID).[2] The majority of this previous research has relied on relatively small sample sizes and generally included only adults with ASD who are described as 'high functioning.' Additional research remains needed across larger and widely varying ASD populations to establish estimates of adults with ASD across living arrangements and describe their characteristics.
Objectives: The objectives of this study are to describe rates of living arrangements across a large, statewide sample of adults with ASD, and to determine correlates of living arrangement satisfaction reported by adults with ASD.

Methods: The Pennsylvania Autism Needs Assessment, completed in 2018, is a statewide survey of adults with ASD over the age of 18 completing the survey for themselves and an accompanying survey of caregivers of individuals with ASD of any age. More than 1,100 adults with ASD completed the Pennsylvania Autism Needs Assessment and the majority of these individuals consented to have their survey responses linked to their Medicaid claims data. The type of living arrangement as well as satisfaction with the living arrangement was reported by adults with ASD. Additional analyses will merge demographic and clinical data, as well as other characteristics of adults with ASD to report on living arrangements among adults with ASD.

Results: Most (72.0%) adults with ASD who completed the survey for themselves reported living with their parents, relatives, or in a family home. The next most common living arrangements were living independently with support (7.0%), living independently without support (5.7%), and living with a roommate or spouse (5.5%). The majority (82.3%) of adults with ASD reported they were happy or very happy with their current living arrangement, but almost one in five (17.7%) adults with ASD reported they were unhappy or very unhappy with their living arrangement. Additional results focused on differences in living arrangement and satisfaction by living arrangement will be stratified by age, symptom presentation, geographic location, and other factors will be produced using logistic regression.

Conclusions: Most adults with ASD who responded to the PA Autism Needs Assessment were living at home, as has been reported in previous research. Most adults with ASD were also satisfied with their living arrangement, although this dimension of independent living has been relatively unexplored in precious research. Additional analyses to describe and understand living arrangement preferences, successes, and challenges among adults with ASD will be conducted and produced.

11:45 **232.004** Comparing Parent-Reported Autism Diagnoses to Administrative Claims

L. Shea[1], *P. F. Turcotte*[2], *W. Schott*[3], *K. Croce*[3], *K. Verstreate*[3] *and S. Nonnemacher*[4], *(1)A.J. Drexel Autism Institute, Philadelphia, PA, (2)Drexel University, Philadelphia, PA, (3)Drexel University, Policy and Analytic Center, A.J. Drexel Autism Institute, Philadelphia, PA, (4)Pennsylvania Bureau of Autism Services, Harrisburg, PA*

Background:
Surveys of parents and caregivers for individuals with autism present a unique opportunity to gain valuable information about the diagnosis experience. Previous research has found that the diagnostic process for children with autism is often confusing for parents, that diagnostic terminology is difficult to understand, and that the length of time the diagnostic process takes to complete is stressful and disorienting.[1]

Comparing parent-reported experiences of the diagnosis process to administrative data allows for the detection and prioritization of opportunities to provide needed information to parents and caregivers navigating the diagnostic process. [2,3]

Objectives:

- Determine overlap of parent-reported diagnoses for their children and administrative records, before and after an autism diagnosis.
- Identify child- and parent-level characteristics that predict alignment in parent-reported diagnoses and diagnoses captured in administrative data.

Methods:

The Pennsylvania Autism Needs Assessment, conducted in 2017, included a survey of parents/caregivers of all ages. Information on demographic characteristics, service needs, and self-reported health, as well as a range of other topics was collected. Parents answered multiple questions about the diagnostic process, including diagnoses received before an autism diagnosis for their child, as well as diagnoses that are currently present. In addition, parents could consent to link their survey responses to administrative claims data for their child. This sample includes 530 children under age 11 whose parents consented linking to their administrative records.

Results: The average age of the children for whom a caregiver responded was 7.1 years old. Most children were male (79.9%) and were predominately Caucasian (82.9%). About half (49.4%) of the caregivers indicated that getting a diagnostic evaluation for their child was somewhat or very difficult. About two thirds (68.2%) indicated receiving at least one prior diagnosis to their autism diagnosis. The most common diagnoses reported before receiving an autism diagnosis were Developmental Delays (43.4%), ADHD (21.5%), and Learning Disability (12.8%). The most common current diagnoses were ADHD (39.1%), Developmental Delays (33.7%) and Anxiety Disorder (21.3%). These diagnoses will be linked to administrative records to determine if the diagnoses were present prior to the autism diagnosis, and if the child had services billed for the diagnoses. Socio-economic factors, child age, and overall experience of obtaining an autism diagnosis ("easy" vs "difficult") will be examined to determine predictors of alignment in parent-reported diagnoses.

Conclusions:

Previous research has examined validity of parent-reported diagnoses in autism populations with the goal of understanding and supporting the diagnostic process.[4] Determining differences in how families understand the diagnoses a child may have is important for treatment planning. Recent research on the parent-reported prevalence of autism underscore the importance of examining the feasibility of using administrative claims to validate parent-reported.[5] This research also has important implications regarding resource development and policy planning to better support families in the diagnostic process, and to quantify the role of socio-demographic factors and other characteristics in facilitating an accurate and timely autism diagnosis.

Poster Session
233 - Adult Outcome: Medical, Cognitive, Behavioral, Social, Adaptive, Vocational
11:30 AM - 1:30 PM - Room: 710

1 **233.001** Self-Harm and Premature Death in Young Individuals with Autism – Preliminary Results from a Total Population Study in Sweden

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Background:

There is increasing concern that people with autism are more likely to die prematurely, particularly by suicide. However, there are little data on the extent of increased mortality and on risk and protective factors. While self-harm behavior in typically developed individuals is a strong predictor of later suicide and death by any cause, its characteristics and impact on mortality in autism is unknown. A detailed understanding of these matters are crucial for prevention of premature mortality in autism.

Objectives:

To examine the association between self- harm and mortality (all cause and by suicide) across the whole spectrum of ASD in a nation-wide contemporary cohort of adolescents and young adults in Sweden. To investigate risk and protective factors in this association, with emphasis on sex, co-morbid conditions, familial and social characteristics.

Methods:

We conducted a total population study using data from Psychiatry Sweden, a comprehensive record-linkage study. Data on probands, followed-up from 10 to maximum 32 years of age by 2016, their first and second degree relatives, was collected prospectively by record linkage. A total 2 372 500 individuals (51.4 % male), of whom 49 633 were diagnosed with autism (66.3% male) were included in the analyses. The total number of deaths was 8 417.

Exposure was cross-classified as a diagnosis of autism and at least one episode hospital admission for self-harm (ICD-10 codes X60-84 and Y10-34). The outcome was subsequent death, by any cause and by suicide, determined from national Cause of Death Register. Cox hazard proportional regression models were used to estimate hazard ratios (HRs) with 95% confidence intervals (CIs) of death by any cause and by suicide in four groups; neither autism nor self-harm, autism without self-harm, self-harm without autism, and autism with self-harm.

Results:

Among individuals diagnosed with autism, 0.2% with no history of self-harm and 3.4% of those with a history of self-harm had died by suicide. The adjusted HRs of suicide in autism without self-harm and in self-harm without autism were 2.4 (95% CI 1.8-3.2) and 20.7 (18.1-23.7), respectively. Among those with both autism and self-harm, the adjusted HR was 42.7 (33.3-58.8). Further results on risk and protective factors in the association

between self-harm (including characteristics of the self-harming behavior) and suicide (as well as all-cause mortality) will be presented.

Conclusions:

Our findings indicate that individuals with autism who engage in self-harm have a particularly elevated risk of premature death and suicide. This suggests that identification and treatment of this subgroup is important, and that clinical guidelines for suicide risk assessment may have to be revised to recognize this new knowledge.

2 **233.002** Service Use in Adolescents and Adults in Latin America. Results from a Multisite Study

C. Montiel-Nava[1], *G. Garrido*[2], *R. A. Garcia*[3], *D. Valdez*[4], *S. H. Cukier*[5], *C. S. de Paula*[6], *A. Rosoli*[7], *A. Shih*[8] *and A. Rattazzi*[5], *(1)Psychological Sciences, University of Texas Rio Grande Valley, Edinburg, TX, (2)Universidad de la República, Montevideo, Uruguay, (3)Universidad de Chile, Santiago, CHILE, (4)Universidad de Buenos Aires- FLACSO, Buenos Aires, Argentina, (5)PANAACEA, Buenos Aires, Argentina, (6)Developmental Disorder Program, Universidade Presbiteriana Mackenzie, São Paulo, Brazil, (7)Projects, Organizacion Estados Iberoamericanos, Santo Domingo, Dominican Republic, (8)Autism Speaks, New York, NY*

Background: Individuals with ASD are users of different type of educational and medical services. There is increasing evidence that recognizes ASD as a lifelong disorder; however, studies about type and frequency of services used by adolescents and adults within the spectrum is scarce. Objectives: This study aimed to explore perceptions about the use of services of caregivers of adolescents and adults with Autism Spectrum Disorders in Latin America.

Methods: This study was carried in 6 different countries in South America: Argentina, Brazil, Chile, Dominican Republic, Uruguay, and Venezuela. A sample of convenience was drawn from each country. The total sample was made up by 592 caregivers from Argentina, Brazil, Chile, Dominican Republic, Uruguay, and Venezuela. 49.83% (n=295) were adolescents (13-18 years-old), and 50.17% (n=297) were adults (>18 years-old). Caregivers completed a survey either by an interview, by phone, or online, either assisted by a clinician or not. The survey contains four sections: family demographics, affected individual characteristics, service encounters and parent/caregiver perceptions.

Results:

The most prevalent diagnosis among adolescent's sample was Asperger Syndrome (33.22%) followed by ASD (26.10%). For the adults, Asperger was the most common diagnosis as well (35.69%), followed by Autism (28.62%). 11.85% of the adolescents and 21.54% of the adults had at least one medical comorbidity. For both age groups, Epilepsy was the most frequent comorbidity. The most common type of service used was medication (41.02% in adolescents, and 48.48% in adults); followed by physical therapy (26.77% in adolescents, 24.93% in adults), and Behavior Therapy/Behavior Modification (24.41% in adolescents, 24.93 in adults). The least commonly reported services were psychodynamic therapy (16.94% in adolescents, 15.15% in adults), biomedical treatments (0.68 in adolescents and 8.08% in adults), and relational therapy (floor time and sonrise) (0.34% in adolescents, 2.02% in adults). There was statistical significance between the two age groups for the frequency of use of medication (x^2=139.954, α=0.001) biomedical treatments (x^2=25.313,α=0.001), and relational services (x^2=15.868,α =0.14).

Conclusions: Although exploratory data from caregivers in Latin America results from our sample suggest a decrease in the use of services from adolescence to adulthood. Only medication, psychodynamic therapy, and biomedical treatment were more frequent in adults than adolescents. It could be a function of the scarce availability of services for this population in Latin American countries. It could also describe a more medical oriented approach or conceptualization of ASD in this culture. With a representation of 6 countries, results have clear implications for public health and educational policies and practices

3 **233.003** The Influence of Autistic Traits and Trait Anxiety on Attentional Bias to Emotional Faces: An Eye-Tracking Study in Healthy Young Adults

W. Wu[1], *B. Wan*[1] *and J. Jing*[2], *(1)Sun Yat-sen University, Guangzhou, China, (2)Maternal and Child Health, Sun Yat-sen University, Guangzhou, China*

Background: Healthy individuals, as well as adults with autism, usually demonstrate the anger superiority effect (ASE), i.e., reaction time (RT) to angry faces faster than positive faces, which is not associated with anxiety. While, in addition to the ASE, the time duration of negative relative to positive faces can reflect the emotional processing in the field of attentional bias. Yet, it is unknown whether autistic and anxiety level affect the emotional processing or not.

Objectives: The present study aimed to clarify the association between autistic traits/trait anxiety in healthy young adults and the time duration of negative relative to positive faces with a free-view paradigm.

Methods: We recruited fifty-two healthy adults (age: Mean=20.8, range 18~25 years, sixteen males), and their autistic traits and trait anxiety were self-reported using Autism Spectrum Quotient (AQ, including five subscales of autistic behavior: social skills, attention switching, attention to detail, communication, and imagination) and State-Trait Anxiety Inventory (STAI) respectively. Total fixation duration (TFD) and first fixation duration (FFD) indices of attention bias to emotional information [negative (angry and sad) and positive (happy), compared with neutral faces] were calculated in Tobii Spectrum Pro software.

Results: The individuals' trait anxiety level was positively correlated with AQ total, social skills, attention switching, and communication scores (r=0.504, 0.421, 0.419, 0.456, respectively; df=50; all p<0.005). There was no significant correlation between autistic traits/trait anxiety and TFD/FFD of negative relative to positive faces. Nevertheless, the trait anxiety was significantly correlated with FFD of angry relative to happy faces (r=-0.298, df=50, p=0.032); and AQ social skill was significantly correlated with FFD of sad relative to happy faces (r=0.304, df=50; p=0.028). The associations were robust with adjustment for age, sex and state anxiety during the eye-tracking experiment.

Conclusions: Our findings suggest that adults with deficit of social skills show long-term attention of sad relative to happy faces and adults with higher trait anxiety show short-term attention of angry relative to happy faces in emotional processing. The present study provides preliminary results for emotional processing in clinical autism spectrum disorder and clinical anxiety disorder.

4 **233.004** Sex Differences in Cognitive and Symptom Profiles of Older Adults with Autism Spectrum Disorder

M. Walsh[1], *L. C. Baxter*[2], *C. J. Smith*[3], *E. Foldes*[4], *C. Webb*[4], *A. Gonzales*[5] *and B. B. Braden*[4], *(1)Arizona State University, Tempe, AZ, (2)Radiology, Barrow Neurological Institute, Phoenix, AZ, (3)Southwest Autism Research & Resource Center, Phoenix, AZ, (4)College of Health Solutions, Arizona State*

University, Tempe, AZ, (5)Arizona State University, Phoenix, AZ

Background: Theories have suggested that females with autism spectrum disorder (ASD) demonstrate higher levels of symptom masking relative to males, and a proposed masking mechanism is executive functioning. Declines in executive functioning are a hallmark of normal aging and are also observed in aging adults with ASD, suggesting that aging may reduce masking abilities. Furthermore, if females with ASD are preferentially engaging executive function strategies for symptom masking, aging may have a greater effect on age-related symptom exacerbation for females than males. However, no studies have characterized executive function sex differences in an older adult sample and its relationship with ASD symptoms.

Objectives: We aimed to provide a preliminary characterization of sex differences on two measures of executive functioning in mid-to-older adult men and women with ASD and its association with ASD traits.

Methods: Participants were mid-to-older (40-70 years) adult men or women of average intellectual functioning with ASD or NT development (female ASD: *n*=11; female NT: *n*=12; male ASD: *n*=29; male NT: *n*=23). Sex, diagnosis, and sex by diagnosis interactions were examined using Analysis of Variance for a behavioral regulation (Wisconsin Card Sorting Task; WCST) and a metacognitive (Tower of London; ToL) measure of executive functioning. Relationships between executive functioning and ASD traits were examined using the Social Responsiveness Scale – 2nd Edition (SRS-2) Social Cognition Subscale and the Adult Repetitive Behaviors Scale (RBQ-2A). IQ was included as a covariate in all analyses.

Results: For WCST, there was a significant main effect of diagnosis ($F_{1,71}$=12.878, p=0.001) and a significant diagnosis by sex interaction ($F_{1,71}$=4.030, p=0.049). Both women and men with ASD made more errors than their NT counterpart (women: p=0.004, novel finding; men: p=0.044, one-tailed replication); but, the magnitude of difference was greater for women with ASD (women: d=0.97; men: d=0.48; Fig. 1a). No significant main effects or interaction were observed for the ToL. However, exploratory post hoc analysis showed that females with ASD demonstrated more planning errors than males with a moderate effect size (d=0.46) that approached significance (p=0.107; Fig. 1b). In male and female ASD groups, correlations were observed between the SRS-2 Social Cognition Subscale and ToL performance, such that worse ToL performance was associated with increased ASD-related social behavior (female ASD: r_7=0.70, p=0.036; male ASD: r_{27}=0.39, p=0.045; Fig. 2a). Alternatively, the RBQ-2A showed a correlation with WCST performance in females with ASD but not males (female ASD: r_8=0.70, p=0.026; male ASD: r_{21}=-0.09, p=0.69), such that more errors were associated with increased repetitive behaviors (Fig. 2b).

Conclusions: In one of the first investigations of sex differences in mid-to-older adults with ASD, this study shows a tendency toward greater executive function difficulties in women with ASD, compared to men with ASD. Furthermore, women with ASD showed stronger associations between ASD traits and executive functioning than men. This suggests that older adult women with ASD may capitalize even further on executive functioning for symptom masking relative to men with ASD. Longitudinal research on sex differences in age-related cognitive and symptom changes are warranted.

5 **233.005** Sleep Determines Quality of Life in Autistic Adults: A Longitudinal Study

M. K. Deserno[1]*, D. Borsboom*[1]*, S. Begeer*[2]*, J. Agelink van Rentergem*[3]*, K. Mataw*[4] *and H. M. Geurts*[5]*, (1)Department of Psychology, University of Amsterdam, Amsterdam, Netherlands, (2)VU University Amsterdam, Amsterdam, Netherlands, (3)Psychology, University of Amsterdam, Amsterdam, Netherlands, (4)Vrije Universiteit Amsterdam, Amsterdam, Netherlands, (5)University of Amsterdam, Amsterdam, Netherlands*

Background: Many individuals with autism report generally low Quality of Life (QoL). Identifying predictors for pathways underlying this outcome is an urgent priority.

Objectives: We aim to examine multivariate patterns that predict later subjective and objective QoL in autistic individuals.

Methods: Autistic characteristics, comorbid complaints, aspects of daily functioning and demographics were assessed online in a two-year longitudinal study with 598 autistic adults.

Regression trees were fitted to baseline data to identify factors that could predict QoL at follow-up.

Results: We found that sleep problems are an important predictor of later subjective QoL, while the subjective experience of a person's societal contribution is important when it comes to predicting the level of daily activities.

Conclusions:

Sleep problems are the most important predictor of QoL in autistic adults and may offer an important treatment target for improving QoL. Our results additionally suggest that social satisfaction can buffer this association.

6 **233.006** Social Conversational Improvements Associated with the Social Tools and Rules for Transitions (START for Young Adults with ASD) Program

S. J. Cohen*, J. A. Ko, E. McGarry, A. R. Miller and T. W. Vernon, University of California Santa Barbara, Santa Barbara, CA*

Background: Young adults with autism spectrum disorder (ASD) often struggle with social communication and relationship formation (APA, 2013; Howlin, Moss, Savage, & Rutter, 2013). These challenges are significantly associated with poorer outcomes related to academic and vocational success, mental health, and quality of life (Zager & Alpern, 2010; Eaves & Ho, 2008). Unfortunately, support resources for adults with ASD are often limited, as is research on effective interventions to support adults with ASD in their social development. Targeted group socialization interventions may be a promising model for addressing social motivation, insight, and skill deficits for this growing population (Vernon, Miller, Ko, & Wu, 2016; Laugeson, Gantman, Kapp, Orenski, & Ellingsen, 2015). Within these intervention models, socially valid measurement of social skill performance is crucial, as program participation must yield observable social conversational improvements within everyday interactions to be clinically meaningful. Coding of live peer conversations may be a promising strategy for obtaining objective measurement of social gains (e.g. Vernon et al., 2016; Mitchell, Regehr, Reaume, & Feldman, 2010).

Objectives: The present study aims to determine whether participation in the START group leads to observable improvements in the use of key social communication skills during conversations with unfamiliar peers.

Methods: The Social Tools and Rules for Transitions (START) program is a 20-week peer-mediated socialization group intervention that combines experiential learning and instructional lessons, in addition to weekly social outings in the community that serve as "field work" settings to practice the targeted social strategies. A randomized clinical trial was used to assess the efficacy of this intervention with 28 adults with ASD, aged

18-25. Participants were randomly assigned to an immediate treatment or waitlist control group. At pre- and post-intervention, all participants completed two video-recorded 5-minute "get to know you" conversation probes with unfamiliar, untrained young adult peers who were unaware of study hypotheses and the diagnostic status of the participants. Videos were coded for both verbal (social inquiries made, conversational turn taking) and nonverbal social communication strategies (eye contact, directed facial expressions). 25% of all videos were coded by a second naïve rater to assess inter-rater reliability. Repeated measures ANOVAs were to determine whether the treatment group shows significant improvements over time, compared with the control group.

Results: Preliminary coded conversational data from a subset of the total trial cohort is indicative of significant increases in verbal and nonverbal social communication behaviors unique to the START participant group. Video coding and data analysis of the entire trial cohort will be completed by March 2019.

Conclusions: Preliminary data is indicative of live social conversational improvements in participants of the START program for young adults. Such data is indicative of an objective and observable enhancement of social functioning that can be applied to future peer interaction and relationship formation.

7 **233.007** Supporting Employers in Hiring Young Adults on the Autism Spectrum: Lessons Learned from a Corporate Internship Program

C. J. Grantz[1], *A. Gulsrud*[2], *E. A. Laugeson*[3] *and J. McCracken*[4], *(1)Psychiatry, UCLA Semel Institute CAN Clinic, Los Angeles, CA, (2)UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA, (3)Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA, (4)UCLA Semel Institute, Los Angeles, CA*

Background: Young adults with ASD have poor postsecondary employment outcomes, with high rates of unemployment or underemployment. Employers are becoming aware of the skills young adults with ASD can bring to the workplace. However, lack of knowledge regarding how to best support such individuals within the workplace and concern regarding how to determine appropriate positions for such individuals are impacting employer outreach to young adults with ASD.

Objectives: The UCLA Child and Adult Neurodevelopmental (CAN) Clinic and the PEERS© Clinic are collaborating with a national company to develop employment training for college students with ASD and employer education for potential employers in the Greater Los Angeles area. The aim of the current study is to conduct qualitative interviews with employers to determine how to best support employers in hiring interns with ASD and supporting them in the workplace. Employers at the partner company who participated in a pilot internship program for young adults with ASD were invited to participate in a focus group to identify the "key ingredients" needed during the hiring and support process for individuals with ASD in the workplace.

Methods: A 1-hour focus group was led by a Licensed Psychologist with members of the company's ASD internship program, as well as members of a partner firm's pilot ASD internship. The group was audiotaped with permission from all participants, transcribed verbatim, and independently coded for major conceptual models. Exploratory, qualitative analyses was conducted using a modified grounded theory approach.

Results: Salient themes from the interview with employers included identifying appropriate expectations for interns, flexibility in management style and frequency, and flexibility in tasks assigned based upon intern strengths and weaknesses. Difficulties managing schedule, speed of completing tasks, and difficulties with flexible problem solving were reported to be significant challenges affecting intern success. Greater frequency and intensity of management, particularly when learning new tasks, was described as significantly improving intern success. The corporate culture was also described as an essential component of intern success, with both companies reporting some brief psychoeducation with employees and clients regarding interns' strengths and needs. Improved social interaction skills and confidence in managing job-related tasks were observed across the internship period. Financing for the internship program was stable, as both companies have on-going internship budgets.

Conclusions: Integrating young adults with ASD into the corporate workplace is feasible with appropriate expectations and sufficient management support. Variability in intern strengths and weaknesses impacts job content and pace; intern skills must be determined prior to the internship to ensure appropriate fit. Creating an accepting corporate culture that supports interns and their supervisors in navigating challenges is of great importance. Improvement in social functioning was reported without targeted intervention in this domain, suggesting that the workplace setting may provide in-vivo social communication training for young adults with ASD. Evaluation of employer' knowledge of, comfort with, and needs for working with individuals with ASD is needed and ongoing to support development of broader employer outreach and training.

8 **233.008** Supporting Students with Autism Spectrum Disorder in Post-Secondary Education Settings: Common Barriers and Needed Accommodations and Supports

R. T. Paskins*, Counseling and Rehabilitation, University of Wisconsin-Stout, Menomonie, WI*

Background: Although there is greater attendance in Post-Secondary Education settings, the graduation rate of students with autism is below the standard average, with some evidence of graduation rates being lower that the general population of people with disabilities. In an effort to take a step toward addressing this concern, the current study began the exploratory process of identifying whether services provided by campus disability resources centers align with the best practices that enhance the success of students with ASD.

Objectives: The purpose of this study was two-fold. The objectives were to explore: From a disability service professional perspective, what are the most common barriers that prevent students with autism spectrum disorder from completing post-secondary education? From a disability service professional perspective, what are the most beneficial supports to help students with autism spectrum disorder complete post-secondary education?

Methods: A three-round Delphi survey with expert panels consisting of disability service professionals was implemented. The study began by asking an expert panel consisting of disability service professionals to develop and agree upon a list of (a) barriers in providing academic accommodation (b) individual and systemic barriers faced by the student, and (c) supports that can help reduce these barriers.

Results: The final instrument identified 34 barriers to providing academic accommodation, 47 systemic barriers, and 37 individual barriers students with ASD experience in PSE settings. Additionally, DRC counselors identified 45 supports and services that would help address the identified barriers. Of the items identified, the expert panel was provided opportunity to compare their scores with the group mean score with the

opportunity to change their score to match the group mean. From these results the interquartile range was calculated to identify items that achieve consensus. The items which demonstrated a strong consensus (IQR < 1.5) were identified as significant.The survey items that demonstrated a median of 4.00 or above and an IQR of 1.5 or lower were considered to have high frequency and strong consensus and were therefore considered to be a high priority. Of the 163 items reviewed, 71 identified barriers met these criteria. All items identifying supports were measured by a similar level of benefit rating ranging from one to seven. The same measurement of median and IQR was applied and 35 items met the criteria and were rated as high priority.

Conclusions: The findings from this study have important implications for disability services in PSE. Notably, the identified barriers experienced, and services provided to students with ASD, may guide professional development opportunities (i.e., in-service training, workshops, etc.) for disability service professionals and other campus faculty and staff. Because of their diverse educational and professional backgrounds, disability service professionals may not be prepared to provide best practices to students with ASD. This study also could primarily impact those who face the identified barriers first hand, namely the students. If university policy makers will take into consideration the finding of this study, then a discussion of “equal opportunity,” “equal access,” and best practice can be brought to the table for further exploration.

9 **233.009** Testing Social Cognition As a Mediator between Neurocognition and Social Outcomes

***N. J. Sasson**, K. E. Morrison and A. E. Pinkham, University of Texas at Dallas, Richardson, TX*

Background: The specific contributors to poor social functioning outcomes for adults with autism are poorly understood. Neurocognitive abilities (e.g., working memory) and social cognition (e.g., social perception and appraisal) are frequently targeted in intervention studies to improve social outcomes, but to date no studies have empirically tested the contribution of these constructs to social functioning.
Objectives: We examined the relative contribution of neurocognition and social cognitive domains to predict both social skills and functioning. We also tested these constructs for mediation, hypothesizing the effect of neurocognition on outcomes is mediated through a serial pathway between social perception and social appraisal abilities.

Methods: Adults with autism (N=103; age M=24.28; 11 females) completed a battery of tasks. Social perception was measured by computing a composite score of tests measuring ability to recognize emotion in static faces (ER-40; Kohler et al., 2003; Reading the Mind in the Eyes; Baron-Cohen et al., 2001), dynamic videos (Bell Lysaker Emotion Recognition Task; Bryson et al., 1997), and point-light walkers (Emotional Biological Motion; Biological Motion; Kern et al., 2013), as well as ability to recognize faces (Benton Facial Recognition Task; Benton et al., 1968). Social appraisal was measured by computing a composite score of tasks assessing mentalizing abilities (The Awareness of Social Inference Task; MacDonald et al., 2003; Hinting Task; Corcoran et al., 1995) and the Relationships Across Domains task (Sergi et al., 2009), assessing understanding of social relationships.

Participants also completed the MATRICS Consensus Cognitive Battery (MCCB; Nuechterlein et al., 2008), measuring working memory, short term memory, and processing speed through pencil and paper tasks.

Social skill outcomes were assessed through trained coders’ average rating of six skills displayed in a three minute interaction with a researcher role-playing meeting a new neighbor (Social Skills Performance Assessment; Patterson et al., 2001). Social functioning was assessed with the UCSD Performance-based Skills Assessments (UPSA; Mausbach et al., 2007), a performance-based task measuring daily living skills.

Results: Gender, age, neurocognition, social perception, and social appraisal entered as predictors accounted for 48% of variance in social functioning scores and 30% of social skills scores. In both models, older participants and participants with stronger neurocognitive ability scored higher on social functioning and skills (ps<.001), and social appraisal ability predicted better social functioning (p=.003).

Controlling for age, we examined indirect effects and the bootstrapped confidence intervals around the estimate to test for evidence of mediation (Figure 1). The indirect serial pathway was significant in predicting social functioning (b=.08, bootstrapped lower limit=.03, bootstrapped upper limit=.15), suggesting social cognition is a mechanism through which neurocognition influences social functioning. There was no evidence for mediation in predicting social skills (b=.02, bootstrapped lower limit=-0.05, bootstrapped upper limit=.09).

Conclusions: Neurocognition is a significant predictor of social functioning and social skills for adults with autism. The mediation results show neurocognitive ability is transmitted through social perception and social appraisal ability for social functioning, suggesting interventions targeting neurocognition may benefit social cognitive skill and functioning. However, our results suggest social skill is a function of a different mechanism.

10 **233.010** Testing a Model of Sexual Minority Orientation in Individuals with and without the Broad Autism Phenotype

***L. R. Qualls**[1,2], N. Kreiser[2], J. F. Paulson[3] and K. Hartmann[2], (1)Virginia Consortium Program for Clinical Psychology, Norfolk, VA, (2)Eastern Virginia Medical School, Norfolk, VA, (3)Old Dominion University, Norfolk, VA*

Background: Individuals with the Broad Autism Phenotype (BAP) are similar to those with Autism Spectrum Disorder (ASD) in that they are more likely to endorse a sexual minority orientation than those with typical development (TD; Qualls et al., 2017). However, no empirical studies have examined factors that contribute to higher rates of sexual minority orientation in this population. A biopsychosocial model (Dillon, Worthington, & Moradi, 2011)has been tested in a pilot study with sexual minority individuals with ASD and found to have potential for explaining differences in the rate of sexual minority orientation between TD and ASD/the BAP. This model proposes that current sexual minority orientation is affected by factors related to biology, social context, culture, religion, gender norms and socialization, and systematic homonegativity.
Objectives: 1) Examine whether the biopsychosocial model described above has good fit in describing factors related to sexual minority orientation and 2) if these factors have different explanatory power for individuals with and without the BAP.

Methods: The demographics questionnaire contains questions concerning participant’s age, birth gender, gender identity, race, religion, family income, parent’s education, respondent’s education, and formal ASD diagnosis. The Broad Autism Phenotype Questionnaire (BAPQ) is used to assess for characteristics of the BAP. The Autism Spectrum Quotient-10 (AQ-10) is used to assess symptoms relating to ASD. The Klein Sexual Orientation Grid (KSOG) is used to provide an estimate of each participant’s present and ideal sexual orientation and preferences. The factors from the Worthington et al. (2002) model are measured as follows: biological, number of sexual minority family members; social contextand culture, a modified version of the Sexual Prejudice Scale (SPS); religion, Religious Orientation Questionnaire-Intrinsic (RIQ); gender norms and

socialization, the Attitudes Toward Women Scale (AWS) and the Male Role Norms Inventory-Short Form (MRNI-SF); and systematic homonegativity, Daily Heterosexist Experiences Questionnaire (DHEQ). Structural Equation Modeling (SEM) will be used to determine the relationship between the observed and latent variables and to test the fit of the proposed model in each of the groups.

Results: After one month of data collection, 43 responses that met criteria for inclusion (sexual minority, ages 18-30, complete data, no ASD diagnosis) have been collected. Collection of a further 157 responses is planned over the next four months to obtain a final N of 200 (100 individuals in each group). Preliminary data from a subgroup of 30 individuals (*M*age=22.46,19 female, 6 male, 5 transgender/genderfluid /genderqueer) revealed a positive correlation between sexual orientation and BAP traits as has been found in previous literature, $r = .38$, $p < .05$ (Qualls et al., 2017). These results should be interpreted with caution due to small sample size but are promising.

Conclusions: It is predicted that the biopsychosocial model will have adequate explanatory power for both groups. It is further predicted that while biological factors will be similar between the groups, there will be differences in psychological and social influences. Results from this study will help further define the unique characteristics of sexual minority orientation in individuals with the BAP.

11 **233.011** The Connect Project and Its Lessons for Future Multistakeholder Research on Adult Autism

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Background: Launched in 2017 and developed under Canada's national Strategy for Patient-Oriented Research, the CONNECT project (CONtiNuity of carE and services for autistiC adulTs) was the first Autistic co-led research collaboration bringing together autistic adults, caregivers of people living with autism, researchers, service providers, and policy decision-makers from across the Maritimes Provinces.
Objectives: The goal of the project was to collect and disseminate much-needed hard data on the health, socioeconomic status and service needs of the autistic adult community living in New Brunswick, Nova Scotia and Prince Edward Island.

Methods: When nearing the closing stages of the project, the CONNECT team decided to take a step back and to reflect critically on the study's life cycle, from its genesis to the production and dissemination of its intended deliverables. Researchers were not the only ones reflecting upon their experience with this pioneering patient-engagement initiative. Patient partners also pondered the highs and lows of the CONNECT project and the lessons learned from their participation, using a feedback questionnaire to comment on such aspects as recruitment methods, group dynamics, the nature and scope of their engagement as well as the impact that their engagement had on the project and on their own personal development.

Results: The CONNECT project proved to be a tremendous learning experience for all those involved. Yet it was not without its learning curve, nor without its difficulties and growing pains. At the same time, this presentation will also show that the CONNECT project had many unanticipated outcomes which suggest that the full potential and transformative value of such collaborative enterprises has yet to be completely understood. When the name "CONNECT" was initially chosen for the project, it was meant to signify a paradigm shift in autism research by initiating a dialogue between autistic adults, service providers and policy makers. Indeed, when individuals living with autism reach adulthood, they are often "disconnected" from the various supports and services that were available to them during childhood. Yet as time passed and as the team reached its various milestones, the CONNECT name gradually took on a new meaning, bringing into more clearer focus the various human and personal "connections" that were being forged among autistic adults themselves. These connections were described by one Autistic patient partner as a form of "Autistic Oxygen." When reflecting on the significance of the data collected and especially on the value of their engagement in the CONNECT project as patient partners, another Autistic partner summed their experience this way: "We're the stakeholders with the most at stake."

Conclusions: The CONNECT project can be used as a prism through which one can see more clearly the myriad benefits and challenges of adopting a collaborative multi-stakeholder approach when studying adult autism, whether viewed from the perspective of the autistic community, the research community or the policy-maker and service-provider communities. In looking through the CONNECT experience lens, this presentation will offer practice-based recommendations for other teams that are considering using such an approach in their own research.

12 **233.012** Services for Family-Dependant Adults with Autism Spectrum Disorder, Why Some Are Received and Others Are Not

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Background: Autism, a neurological difference is a large spectrum of conditions characterized by a variety of communication, sensory and social disabilities which lead to important challenges in day-to-day activities. While there has been an increased focus in providing early intervention programs for children with autism spectrum disorder (ASD), there remains a shortage of programs and services tailored to autistic adults with ASD, specifically to support employment and independence. The literature indicates that employment rates range between 4-49%, and as many as 70-80% are not living independently, with family members being the primary source of support and care.
Objectives: This research sought to determine priorities in terms of service needs for autistic adults with ASD living with family and examine factors influencing whether or not these services were being received.

Methods: This study included 104 respondents from the CONNECT project cohort (n = 164) who completed the needs assessment survey and lived with one or more family members: 41 self-reporting adults with ASD (aged 19-55 years) and 63 adults with ASD (aged 18-63 years) whose information was provided by their caregivers. Frequency distribution were calculated to examine service need priorities and reasons behind their lack of receipt. Logistic regression was used to examine which factors were associated with receiving priority services.

Results: The mean annual income of the respondents was $11,307, mainly originating from provincial government support and family. 56% of adults with ASD living with family members were unemployed and had a mean number of 1.96 co-occurring mental health or neurodevelopmental conditions. The top service priorities endorsed by over 40% of the sample included employment counselling, housing/residential options, life skills training and provincial disability program. Despite being identified as top service priorities, these services were only being received by 1.9 to 37.5% of the sample. The most common reason for not receiving these services were lack of availability for all except the provincial disability program (not meeting criteria). Adults who perceived themselves as having good mental health had a higher likelihood of receiving life skills

training and individuals with intellectual disability were likelier to receive provincial disability program. Adults receiving government support to assist with accessing services were likelier to receive both life skills training and provincial disability.

Conclusions: Overall, the results of this study highlight the need for greater access to services that support employment and independence for adults with autism. Our results also suggest that achievable changes, such as increased mental health care services and offering more government support to assist with accessing services, could meaningfully improve the outlook for autistic adults with ASD seeking to live full and independent lives.

13 **233.013** The Influence of Psychiatric Diagnoses upon Social Engagement, Social Skills, Problem Behaviors, and Loneliness Among Young Adults

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Background: Research suggests psychiatric disorders are common in those with autism spectrum disorder (ASD), with some estimates revealing 70% of individuals with ASD have at least one comorbid diagnosis, and 41% have two or more (Simonoff 2008). These comorbidities often include attention-deficit/hyperactivity disorder (ADHD) (30-50%) and anxiety disorders (25-55%) (Leyfer 2006). While many of these individuals experience impaired social functioning as a consequence of their disorders, including poor social engagement, problem behaviors, and loneliness, little is known about the differences in symptom profile across these diagnostic groups.

Objectives: This study examines the influence of psychiatric diagnoses upon social engagement, social skills, problem behaviors, and loneliness among young adults with ASD, ADHD, and/or anxiety.

Methods: Participants included 165 young adults (74.5% male; mean age=22.44; *SD*=3.88) with ASD, ADHD, anxiety, or no diagnosis, presenting for social skills treatment through the UCLA PEERS® Clinic. 80 participants met clinical criteria for ASD and anxiety (ASD+ANX; 48.5%), 27 for ASD, anxiety, and ADHD (ASD+ANX+ADHD; 16.4%), 6 for ASD and ADHD (ASD+ADHD; 3.6%), 23 for ASD with no comorbidities (ASD; 13.9%), 20 for anxiety with no comorbidities (ANX; 12.1%), and 9 who did not meet clinical criteria for a developmental or psychiatric condition (NO DX; 5.5%). Diagnoses were assessed using caregiver-reports on the Social Responsiveness Scale-Second Edition (SRS-2; Constantino 2012) for ASD, the Swanson, Nolan, and Pelham Questionnaire-4th Edition (SNAP-IV; Bussing 2008) for ADHD, and the Social Anxiety Scale (SAS; La Greca 1999) for anxiety. Young adults completed the Social Skills Improvement System (SSIS; Gresham 2008) to measure overall social skills and problem behaviors, Quality of Socialization Questionnaire (QSQ; Laugeson 2010) to assess frequency of social engagement, and Social and Emotional Loneliness Scale for Adults (SELSA; DiTommaso 1993) to measure social loneliness and overall loneliness.

Results: One-way ANOVAs and post-hoc Tukey Tests revealed significant differences between groups related to social skills [$F(5, 153)=17.11$, $p=.01$] on the SSIS, suggesting that participants with ASD+ANX and ASD+ANX+ADHD demonstrate the greatest impairment in overall social skills across the six groups. Analyses further revealed significant differences between these two groups related to problem behaviors [$F(5,155)=13.23$, $p=.01$] on the SSIS, revealing that those with ASD+ANX and ASD+ANX+ADHD exhibit the highest levels of problem behaviors. Interestingly, Tukey Tests revealed young adults with ASD+ADHD presented with average levels of social skills, but the highest levels of problem behaviors ($p=.01$). Participants with ASD and no comorbidities presented with average levels of social skills and the lowest levels of problem behaviors, while those with anxiety only and those with no diagnosis presented with the least impairment in social skills and problem behaviors ($p=.01$). No significant differences were observed between groups related to social loneliness [$F(5,146)=2.43$, $p=.04$] and overall loneliness [$F(5,145)=2.22$, $p=.05$] on the SELSA, or frequency of social engagement [$F(5,147)=.83$, $p=.53$] on the QSQ.

Conclusions: Results suggest that diagnostic groups significantly differ in levels of social skills and problem behaviors, with individuals with ASD and comorbid anxiety (sometimes in combination with ADHD) having the poorest social profile. These findings may provide useful information for delivering targeted interventions with these vulnerable populations.

14 **233.014** The Influence of Socioeconomic Position on Vocational Rehabilitation Service Utilization and Outcomes of Transition-Age Young Adults with Autism

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Background: In the United States, the Vocational Rehabilitation (VR) program closes cases for approximately 19,000 transition-age youth and young adults with autism spectrum disorder (ASD) annually who apply for VR services are found eligible. The federal VR program provides grants to states to help individuals with disabilities find, maintain, or regain employment. Generally, about 70% of youth and young adults with ASD who are eligible for VR services receive them, and about 60% of service recipients are employed at VR exit. Disparities in who receives VR services, and who achieves employment, are understudied.

Objectives: We explored whether factors of socioeconomic position (e.g., race, ethnicity, public benefits use, education level) predict receipt of VR services, timely development of individual plans for employment services, and employment outcomes among young adults with ASD.

Methods: We analyzed VR service utilization and employment outcomes for 14,319 young adults with autism (ages 18-24) in the federal Rehabilitation Services Administration (RSA) database who had a VR case that closed in FFY 2016. We used binary analyses and logistic regression to examine the association of race and ethnicity, financial disadvantage, and education on VR service use and outcomes.

Results: Young adults with ASD in the RSA dataset were primarily male (82.7%), White (75%), receiving financial support from family and friends (68.6%), and had a "most significant" level of disability (71.2%). Fewer were non-Hispanic Black (10.9%), Hispanic (8.4%), or recipients of supplemental security income (SSI) benefits at the time of VR application (34.9%). Young adults with ASD were significantly less likely to receive VR services if they were other/multiple races and non-Hispanic (OR=0.81), Hispanic (OR=0.84) (compared to non-Hispanic White young adults), or if they had public health insurance (OR=0.71) or no insurance (OR=0.85) (compared to having any private insurance). They were slightly more likely to receive VR services if they were SSI beneficiaries (OR=1.1) compared to those who were not. Young adults with ASD were significantly more likely to experience timely development of an employment plan with each year increase in age (OR=1.18) and if they were Hispanic (OR=1.26), but less likely if they were SSI beneficiaries (OR=0.75). Young adults with ASD were significantly less likely to be employed at VR exit if they were female (OR=0.79), SSI beneficiaries (OR=0.77), or if they had public health insurance (OR=0.73) or no insurance (OR=0.71) (compared to any private

insurance). They were slightly more likely to be employed at exit with each year increase in age (OR=1.11) or if they had any post-high school education (OR=1.22).

Conclusions:

We found significant differences in VR service utilization, timely development of employment plans, and successful employment following VR services based on several aspects of socioeconomic position including race, ethnicity, education level, receipt of public benefits and type of health insurance, in addition to gender. Reducing socioeconomic disparities is a stated priority in the 2017 federal plan for autism research. Results speak to the importance of recognizing the potential impacts of socioeconomic disadvantage on variation in VR program performance at the local, state, and national levels.

15 **233.015** The Reality of Executive Function Difficulties for Autistic Adolescents: Personal and Parental Perspectives

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Background: The executive function (EF) abilities of autistic people have been extensively researched. Nevertheless, our ability to know whether these difficulties are relevant to the lives of young autistic people remains limited by the methodologies hitherto applied in EF research. Specifically, the voices of young autistic people are completely absent from the literature pertaining to EF in autism.
Objectives: The current study sought to directly examine the views and experiences of autistic adolescents and their parents towards their executive skills. It also sought to understand the perceived consequences of any EF difficulties and whether autistic young people conceive of their EF difficulties as related to being autistic or not.

Methods: Eleven autistic adolescents (11 male, 1 female), aged 12 - 19 years, and eight of their parents (all mothers) participated in separate, semi-structured interviews. Participants were asked several open-ended questions about their perceptions of their own/their children's EF abilities, with a focus on their higher order abilities, such as the ability to manage their time, to multitask, to retain information and to adapt flexibly to changes in task demands. Transcripts were analysed using Thematic Analysis from an inductive (bottom-up) perspective where themes were created within a 'contextualist' framework of critical realism.

Results: A central theme identified in the data was that EF is dependent on contextual and motivational factors and so is not fixed. While parents tended to laud their children's increased desire for independence, they were also acutely aware that with increasing age, the societal expectations placed on their children continue to change and parents often worried that increasing societal expectations outpaced their child's developments in EF. Young autistic people were often very accepting of their cognitive differences, simply reflecting on them as intrinsic aspects of who they are. Finally, the young people interviewed acknowledged that they drew heavily on the support of family and friends, who often provided an external locus of EF, and they highlighted that there was often a mismatch between the supports and accommodations they were offered and the types of executive difficulties they experienced.

Conclusions: The insights from this study could help redress the research and practice gap that currently exists about EF in autism. Specifically, in future, EF and autism researchers should; (i) develop assessments that tap the specific difficulties described by autistic people (e.g., getting started on a task or decoding multi-step instructions), (ii) measure performance on an assessment *and* measure the contextual factors like motivation and anxiety that are likely implicated in performance and (iii) be sensitive toward those who do not want support or interventions that might change their cognitions, and in turn, change their identity. On a broader scale, the current study demonstrated the value of supplementing positivist research into the cognitive processes of autistic people with phenomenological methods, not only to better understand the lived experience of those we study, but also to facilitate the development of an evidence base that more accurately captures these experiences and, as a result, better serves autistic people's needs.

16 **233.016** The Relation between Motor Abilities, Adaptive Behavior, and Quality of Life: A Study of Middle-Aged Adults with ASD

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Background:

Emerging evidence suggests motor skill deficits are a cardinal feature of ASD and reliably predict other ASD-related difficulties in cognitive functioning and adaptive behavior (MacDonald et al., 2015; Travers et al., 2017). However, few studies have examined motor-related difficulties in later adulthood and their relation to adult outcomes.

Objectives:

To assess motor abilities in middle-aged adults with ASD, and examine the relation between motor performance, adaptive behavior (e.g., daily living skills), and quality of life (QoL).

Methods:

Participants were 55 adults with ASD in mid-adulthood (27-57 years of age, M=37 years) who had previously participated in a larger study of adult outcomes (e.g., employment, education, QoL). All adults were diagnosed with an ASD during childhood (M=6 years). Participants completed a comprehensive in-person assessment including diagnostic (ADOS-2 and CARS-2), intellectual functioning (Stanford-Binet-5), adaptive behavior (VABS-II, Waisman ADL), and motor ability [grip strength (GS), finger tapping test (FTT), D-KEFS Motor Speed, Timed-up-and-go (TUG)]. Childhood assessment data from the Vineland Adaptive Behavior Scale (VABS) was also available and used as a covariate in the analyses. Three participants were unable to complete the motor measures and dropped from analyses.

Results:

Examination of motor performance revealed similar GS (M=51.6,SD=19.6) and FTT (M=47.1,SD=15.3) between dominant and non-dominant hands (p's≥.06). Average completion time (seconds) for D-KEFS Motor Speed and TUG test was 62.5s (SD=45.2) and 10.63s (SD=3.0), respectively. Across tasks, motor functioning was substantially below what would be expected for individuals without ASD and similar intellectual functioning (Cuesta-Vargas & Hilgenkamp, 2015). FTT, TUG, and GS were significantly correlated with adaptive behavior (r's ≥ .43, p's < .03), however only FTT and GS

correlated with QoL (r's ≥ .27, p's < .05). Motor Speed was not significantly correlated with the adult outcome measures (r's < .21, p's > .29). To assess the relation between motor functioning, adaptive behavior, and QoL, separate hierarchical linear regressions were conducted for each motor measure by first entering the adult with ASD's age, symptom severity (CARS-2), IQ, childhood VABS as covariates, followed by motor performance. Results indicated that of the four motor measures only FTT remained a significant predictor of adaptive behavior and QoL after controlling for the above mention variables (VABS-II: R^2=.06, β=.26,p=.04; Waisman ADL: R^2=.12, β=.38,p=.02; QoL: R^2=.23, β=.53,p=.003). Similar findings were also observed for the VABS-II subscales.

Conclusions:

Relative to published norms, the current findings suggest this middle-aged cohort of adults with ASD exhibit sub-optimal performance across a range of motor-related tasks. While GS and FTT were among the strongest motor abilities related to adaptive behavior and QoL, only finger tapping speed remained a significant predictor after controlling for age, IQ, ASD symptom severity, and childhood adaptive behavior. These findings document the important role of fine motor ability in predicting real-world outcomes in middle-aged adults with ASD. In light of emerging evidence suggesting poor adult outcomes in ASD, these findings point to specific motor abilities that could to be targeted in interventions to maintain, or possibly improve functional autonomy and quality of life in this aging population.

17 **233.017** Using Amazon's Mechanical Turk to Recruit Transition Age Adults with Autism

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Background:

Amazon's Mechanical Turk (MTurk) has been described as comparable to other online platforms and in person laboratory studies within the social sciences and for clinical psychology (Thomas & Clifford, 2017). However, researchers have recently reported a decline in data quality on MTurk due to the use of Virtual Private Servers (VPS) which allow participants to circumvent traditional screening methods that allow the researcher some control over participant recruitment (Dennis, Goodson, & Pearson, 2018). Further, the use of MTurk in clinical populations has led to demographic deception (i.e., misrepresentation of personal characteristics for eligibility requirements) which can result in incorrect conclusions drawn from the data (Chandler & Paolacci, 2017; Kan & Drummey, 2018).

Objectives:

We examined issues related to MTurk and asked the following: What percentage of participant attempts in a survey of daily living activities are usable in a clinical sample of caregivers or individuals with a self-reported ASD diagnosis aged 18-22? What are the most common reasons for non-payment (i.e., failed to meet study eligibility)? What are qualitative and quantitative differences in responses from VPS-respondents and non-VPS respondents?

Methods:

Participants were 370 individuals with a self-reported ASD diagnosis aged 18-22 years or their caregivers recruited via MTurk to answer questions about daily activities. Several screening questions (e.g., Individualized Education Program in school, formal diagnosis of ASD) designed to filter out ineligible participants were included. Once filtered, these participants were sent to the end of survey without payment. Further, additional questions were asked in multiple formats (e.g., age) to ensure eligibility (e.g., are you 18-22, what year were you born, how old are you?). Last, qualitative responses comparing respondents from VPS participants versus traditional internet providers were analyzed.

Results:

Out of 604 total attempts (including participants who attempted the survey multiple times), 39 were deemed usable leading to a 6.5% return rate. On average, participants responding from VPS servers attempted the survey four times while non-VPS participants attempted the survey two times. The most frequent reason for non-payment was failure to meet demographic criteria (e.g., out of age range, additional sensory diagnoses) and multiple attempts with inconsistent responses. Over fifty percent of response attempts were deemed unusable within the first seven demographic questions. Twenty percent of non-VPS respondents reported having an ASD diagnosis in one version of the survey and then reporting they did not have an ASD diagnosis in a different version, indicating participants switch their answers to meet inclusion criteria. VPS respondents use less words and nonsensical short answer responses when given open ended questions (see Table 1 for an example).

Conclusions:

Despite the inclusion of several screening criteria, usable return rates were low with demographic deception occurring at high percentages. Thus, research conclusions based on MTurk samples should be interpreted with caution as traditional screening methods may not be adequate for screening out low quality or invalid responses. Consistent with previous recommendations, open-ended responses within surveys can assist in flagging problematic responses (Dennis, Goodson, & Pearson, 2018).

18 **233.018** Validity of Subcategories of Repetitive Behaviors in Adolescents and Adults with ASD.

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Background: Restricted and repetitive behaviors (RRBs) are core features of ASD. Previous studies have suggested two domains of RRBs measured by the Autism Diagnostic Interview-Revised (ADI-R): Repetitive Sensory Motor (RSM) and Insistence on Sameness (IS; e.g., Cuccaro et al., 2003). Bishop and colleagues (2013) demonstrated convergent validity of these domains with the Repetitive Behavior Scale-Revised (RBS-R) in a sample of school-age children. Consistent with previous studies, IS on both instruments were not significantly associated with IQ. A third domain, Circumscribed Interests, was positively correlated with IS, but showed differential associations with IQ across instruments. Studies have not yet considered the validity of RRB subcategories specifically in older adolescents or young adults. There is some evidence that broad domains of RRBs may change with age (e.g., Lord et al., 2015), suggesting a need to understand whether the constructs defined in children are valid in older samples.

Objectives: To investigate the construct validity of subcategories of RRBs measured by the ADI-R and RBS-R in adolescents and young adults.

Methods: Participants were 544 adolescents and adults (M age= 15.73, SD=2.40 years) selected from existing samples of research-referrals with

ADI-R, RBS-R and NVIQ data. RSM and IS domains were computed for each instrument; circumscribed interests (ADI-interests) was omitted from ADI-IS to allow for separate analysis (Bishop et al., 2013). Pearson correlations between measures and domains were examined in the overall sample and by age (13-15, 16-17 and 18+; Figure 1).

Results: There were significant (p<.001) associations between ADI-RSM and ADI-IS (r=.28) and ADI-IS and ADI-interests (r=.22), but not ADI-RSM and ADI-interests. When divided by age, the ADI-IS:ADI-interests correlation was comparable for 13-15-year-olds, but not significant for the older groups. In the overall sample, NVIQ was negatively correlated with ADI-RSM (*r*=-.44) and positively correlated with ADI-interests (*r*=0.30), but NVIQ:ADI-IS association was not significant. When divided by age, ADI-RSM:NVIQ associations were nonsignificant in adults.

Significant correlations were also observed for RBSR-RSM:RBSR-IS (*r*=.33) and RBSR-IS:RBSR-interests (r=.57); associations were comparable for all age groups. In contrast to the ADI-R, RBSR-RSM and RBSR-interests were moderately correlated (r=.33). Correlations were comparable in adolescents and strong for adults. Neither RBSR-IS or RBSR-interests were correlated with NVIQ. RBSR-RSM showed a moderate negative association with NVIQ for both adolescent groups, but not adults.

Associations between measures were moderate-to-strong for IS and RSM across all age groups; interests exceeded .3 for only the 18+ group. Significantly fewer adults than children were rated as having circumscribed interests reported on the ADI-R (X^2=9.02, p<.05); rates did not differ on the RBS-R.

Conclusions: Consistent with previous studies of school-age children, RSM and IS subscales on the ADI-R and RBS-R demonstrate reasonable convergent validity in adolescents and adults, though the relationship between circumscribed interests and IQ differed across instruments. Preliminary analyses suggest that, for adults, RSM behaviors may not be associated with IQ and the ADI-R may underestimate circumscribed interests. Data from an additional 56 adults will be integrated; confirmatory factor analyses and further investigation of possible differences in the manifestation of RRBs in adults will be conducted.

19 **233.019** What We Can Learn from Adult Self-Report Versions of Parent-Report Measures: Results of a Pilot Study

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Background:

Self-report measures allow researchers and clinicians to hear directly from individuals about their strengths and concerns. However, the development of self-report measures often involves simply switching the perspective of the question (e.g., from "How often does your child..." to "How often do you...") without assessing whether responses capture the same phenomenon as the parent report. Previous work has shown inconsistencies between parent- and self-report (Robinson et al., 2018). In this pilot study, we explore this effect in autism-specific and general self-report measures in a group of adults.

Objectives:

Illustrate how adult self-report measures coincide with previous work with parent-report measures and younger populations

Methods:

We recruited 32 adults (14 with a diagnosis of autism,18 without). Participants completed a social responsiveness scale (SRS-2-SR, Constantino, 2012), Theory of Mind Inventory (ToMI; Hutchins, Prelock, & Bonazinga, 2012), Liebowitz social anxiety screener (LSAS; Fresco et al., 2001), adaptive scales from the Adult Self-Report (Achenbach & Rescorla, 2003), eye tracking paradigms, and a brief IQ screener (WASI; Wechsler, 1999). Self-report scores were compared by diagnosis and correlations among self-report measures were explored.

Results:

Complete data were available on 30 participants. Predicted significant group differences emerged between the autistic and non-autistic groups on the autism-specific measures, with the autistic group reporting lower scores on the advanced ToMI scale t(30) = 3.636, *p*=.001 and four of the SRS subscales; cognition t(15.421) = -3.302, *p*=.005, communication t(30) = -4.209, *p*<.001, motivation t(30) = -3.847, *p*=.001, and autistic mannerisms t(15.133) = -4.544, *p*<.001.The autistic group scored significantly higher on the LSAS Fear/Anxiety scale t(30) = -2.321 p = .027. On the ASR adaptive scales, the autistic group demonstrated significantly lower scores on the family t(28) = 2.73, p = 0.011 and friends scales t(28) = 2.094, p = .045.

Exploratory correlations between self-report measures showed that SRS motivation was significantly correlated with early Theory of Mind (*r*= -.499 p<.005) and SRS Communication was significant at the trend level (*r*= -.476, p = .006). Early ToMI was significantly correlated with LSAS Avoidance (*r* = -.526, p<.005).

Conclusions:

The use of self-report measures is critical to focus research on the needs and wants of a studied population. Particularly in the study of autism and developmental disabilities, incorporating the perspectives of impacted individuals has not consistently been a research priority. We must develop strong methodological approaches to reflects the interests of autistic adults. Even in this small sample, our data show similar group differences on autism-specific measures as observed in parent-report measures. Exploratory correlations reflect trends from studies in younger samples. For instance, although the effect is smaller, the pattern of correlations between ToM and social responsiveness is similar in shape to the pattern shown in childhood (Lei & Ventola, 2018). Consistent with our findings, the relation between ToM and later social functioning has seemed weak in other studies using parent-report (Bennett et al., 2013).Next steps include directly comparing parent- and self-report measures in an adult population to illustrate what information is being missed by relying solely on parent report.

20 **233.020** Women and Social Communication Abilities

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Background:

The ability to communicate effectively is highly valued by employers and there is growing evidence that women with ASD and average intelligence present with better social communication skills than their male equivalents which may positively influence employability for women.

Employment*Works* Canada (EWC), a national employment preparation program for young adults with ASD that is embedded within the community,

is gathering practice based evidence about social communicative abilities using the Communication Checklist – Adult (CC-A). The CC-A is an informant questionnaire that measures structural language abilities (speech, syntax and semantics), pragmatic skills (matching language to context), and social engagement. It provides information regarding one's use of language from an informant's perspective derived from daily interactions with the individual.

Objectives:

1. Are the EWC participants' scores on the CC-A comparable to the CC-A normative sample of individuals with ASD (not in an employment cohort)?
2. Do EWC participants' scores on the CC-A differ based on gender?

Methods:

Secondary data analysis was conducted using the CC-A normative sample (n=55) and 147 EWC participants who completed the CC-A as a baseline measure for EWC.

Results:

An independent t-test was conducted to compare the scaled scores of EWC participants to the CC-A normative sample. The CC-A normative sample had significantly lower Language Structure scaled scores, t (205) = 2.14, p =.034, d =0.38; as well as lower Pragmatic skills scaled scores, t (205) = 2.15, p =.033, d =0.39, compared to all of the participants from Canada.

Because the CC-A normative sample only had one female and there is some evidence that women with autism may present with better social communication skills the participants from EWC were grouped according to gender. Of importance, independent samples *t*-tests and Chi-square tests (p>.05) indicated the female and male participants in EWC were similar in age, educational attainment, understanding of single word vocabulary and reported severity of autistic symptoms as measured by the Social Responsiveness Scale-2. A comparison of the female EWC participants, male EWC participants, and CC-A mixed normative sample using a one-way ANOVA was conducted. There was a statistically significant main effect for group on the Language Structure domain, [F (2, 199) = 5.84, p = .003]. Post-hoc tests (Table 1) revealed the female EWC participants scored significantly higher than participants from the CC-A normative group and the male EWC participants. No significant difference were noted between the CC-A normative sample and male EWC participants.

Conclusions:

Although the female EWC participants had significantly better structural language skills than the male EWC participants and the CC-A normative sample, their low pragmatic skills scores are consistent with an autism profile derived from the CC-A. Likewise, their communicative difficulties, having two or more scaled scores of 6 or less, will have an impact on everyday life. These findings raise provocative questions about assumptions about gender-mediated differences, and invite critical reflection on social interaction challenges for females and males with ASD in the workplace.

21 **233.021** Women with ASD: Outcomes of a Pre-Employment Program

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Background:

Current research on women with autism spectrum disorders (ASD) and employment success is lacking. To date, studies that have reported on predictors of employment and gender have been mixed. Employment*Works* Canada (EWC), a national program embedded within the community, is gathering practice based evidence in relation to gender and employment.

Objectives:

To compare the employment outcomes of young women and men with ASD following participation in EWC, an employment preparedness training and experiential community-based job sampling program, and to capture the lived experiences of the young women.

Methods:

Data was extracted from the application or baseline measures and employment rates were derived from follow-up phone calls with participants. Phone interviews were completed with 10 young women following participation in the EWC program.

Results:

Participants (n=262) from 9 provinces across Canada completed the EWC program; 76% (n=199) were men and 24% (n=63) were women. The men and women were comparable on a number of personal factors; age, educational attainment, minority representation, understanding of single word vocabulary (a proxy for Verbal IQ) as measured by the Peabody Picture Vocabulary Test - Fourth Edition (PPVT-4), reported severity of autistic symptoms based on the Social Responsiveness Scale - 2 (SRS-2), independence in activities of daily living as measured by the Waisman – Activities of Daily Living (W-ADL), independence of transportation, and previous work history (Table 1).

Differences were noted in relation to age of diagnosis and co-existence of mental health concerns (Table 1). Significantly more women (46%) received a diagnosis in adolescence or adulthood compared to men (29%). Women were more likely to have heightened experience related to depression (49%) and panic attacks (36%), than men (27% and 20% respectively).

Both men and women had similar employment rates at the beginning of the program but 3 months after completion, women were significantly more likely to have found a job with over half of the women indicating that they were employed (Figure 1).

Themes from follow-up interviews focused on challenges related to receiving a diagnosis later in life and limited awareness about women with ASD. Most participants stressed the importance of believing in oneself, the need for self-advocacy and connecting with others.

Conclusions:

For women in the program, the age of diagnosis and identified depression or panic attacks did not negate post-program employment.

22 **233.022** "I Was Exhausted Trying to Figure It out": The Experiences of Females Receiving an Autism Diagnosis in Middle Adulthood

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of Sheffield, Sheffield, United Kingdom

Background: Females often receive Autism Spectrum Condition (ASC) diagnoses later than males, and their experience may differ in a number of ways as a result of this and gender related issues. Whilst the prevalence of autism diagnosis in females in middle adulthood is increasing there is little understanding of their lived experiences.
Objectives: To investigate the lived experiences of female adults diagnosed with an ASC in middle adulthood.

Methods: Participants were females (n=11) who received an ASC diagnosis in the UK, over the age of 40 years. Participant mean age at diagnosis was 47 years (range 40-62 years); mean current age was 51 years (range 43-64 years). In-depth semi-structured interviews with each participant were analysed using Interpretative Phenomenological Analysis (IPA).

Results: Four super-ordinate themes emerged: The hidden nature of ASC in females (pretending to be normal and fitting in; mental health and mislabelling); the process of acceptance (initial reactions and search for understanding; re-living life through a new lens; grief and reflections on the past); the impact of others post-diagnosis (initial reactions; stereotyped assumptions); a new identity on the autism spectrum (negotiating relationships, connections and community; changing well-being and views of the self; the meaning of diagnosis).

Conclusions: Several common factors affect the experience of late diagnosis in females, including the widespread limited understanding of others. The process of diagnosis tended to be experienced as facilitating transition from being self-critical to self-compassionate. Participants experienced a change in identity that enabled greater acceptance and understanding of the self. However, this was painful to adjust to at such a late stage. Recommendations to practitioners are that strategies to conceal features of ASC should be considered at assessment; autistic-led training of service providers to support earlier recognition is needed; females should be assessed by skilled clinicians who are able to approach the diagnostic process critically.

23 **233.023** "Reasons I Interact with the Outside World": Motivations and Barriers to Community Engagement and Social Interaction in Adults on the Autism Spectrum

T. A. M. McDonald[1]*, Z. J. Williams*[2]*, M. Harden*[3]*, F. Ye*[4]*, R. Fan*[4] *and B. A. Malow*[1]*, (1)Sleep Disorders Division, Department of Neurology, Vanderbilt University Medical Center, Nashville, TN, (2)Medical Scientist Training Program, Vanderbilt University School of Medicine, Nashville, TN, (3)Department of Neurology, Sleep Disorders Division, Vanderbilt University Medical Center, Nashville, TN, (4)Department of Biostatistics, Vanderbilt University Medical Center, Nashville, TN*

Background:
As children with autism age into adolescence and adulthood, their social environment becomes increasingly more complex, yet the number of programs, services, and interventions (PSIs) available to them dramatically decrease. Compared to interventions for children with autism, there are relatively few interventions targeting skill development and engagement for adults with autism. Although the literature investigating the perceptions, experiences, and values of adults with autism is growing, the current literature base is still sparse and remains a priority for research. Understanding the perspectives of adults on the autism spectrum is critical for developing meaningful PSIs for this population.

Objectives:

To increase the social validity of PSIs for this population, this study sought to investigate the self-reported life goals as well as the motivations and barriers to community engagement perceived by 42 adults on the autism spectrum.

Methods:

Participants (ages 18 – 34 years) completed an anonymous online survey that included multiple-choice, multiple-response items and open-ended items related to demographic questions, intervention history, interests, goals, and barriers to activities or social engagement. Open-ended items included: "Please list one or two of your most important goals", "What motivates you to engage in activities outside the home?", and "What motivates you to engage with others?" Qualitative analysis and inter-coder agreement of survey responses by multiple authors was performed.

Results:

Participants reported a wide range of goals, with common themes of employment/vocation and education/training, but also independence, relationships, health, humanitarian causes, emotions, character, and religious/spiritual domains. Participants also identified barriers to engagement in activities or social interactions related to social difficulties and desire, emotions, transportation, employment and financial affairs, health and sensory input, and scheduling, with the majority (80%) of adults identifying more than one barrier. Over 40% of respondents were not in employment, education, or training (NEET). Inter-coder agreement was high.

Conclusions:

While employment was regarded as a major goal, many other goals were identified by participants. A wide range of barriers were also identified. PSIs that serve adults on the autism spectrum should consider the wide range of goals and barriers to engagement identified by this population.

24 **233.024** Educational Achievements, Employment and Future Plans for Autistic Individuals within a Population-Based Twin Sample.

V. L. Milner*, E. Colvert and F. Happé, Social, Genetic and Developmental Psychiatry Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:
Previous research has shown a large proportion of adults with ASD (diagnosed in childhood) were not living independently, were unemployed and left school without formal academic qualifications. Past studies primarily focus on clinical samples which might not be representative. This study uses a population-based twin sample.

Objectives:

This study compared the education, employment and future plans for autistic individuals from a population-based twin sample, with those of their non-ASD co-twins and typically developing twins, measured by both self and parent-report questionnaires.

Methods:

Three groups of participants were included: 45 twins who met criteria for a research diagnosis of ASD (78% male; mean age 18 years 11 months); 24

non-ASD co-twins (33% male; mean age 18 years 11 months); 50 comparison twins (68% male; mean age 18 years 8 months). Parents of the twins were also invited to take part and three groups were included: 62 parents of ASD twins; 24 parents of non-ASD co-twins; and 56 parents of comparison twins. Parent- and twin-reports were independent, i.e. parents were not necessarily reporting on those twins who provided self-report data. Participants and their parents completed team-designed questions about education, employment and future plans as part of a wider research assessment.

Results:

The ASD group gained significantly fewer passes than the co-twin or comparison groups at GCSE (F=13.42, 2, p<.001), AS level (F=4.78, 2, p<.05) and A-level (F=8.21, 2, p<.001). The vast majority in all three sample groups were in post-16 education (96-98%) and planned to be in post-18 education (83-92%).

Parents and twins reported that the ASD group had fewer employment roles than the co-twin or comparison groups (parent-report: F=6.54, 2, p<.01; self-report: F=14.57, 2, p<.001). For the ASD group 20% of parents and 12% of twins reported requiring help in work, versus 0% of parents reporting on the co-twin or comparison groups, and only 9% of the co-twins by self-report (0% of comparison). For the ASD group the most frequently mentioned help was one-to-one support to keep on task.

The ASD twins were less likely to have considered what to do after leaving education, compared with the co-twin or comparison groups (parent-report: F=7.71, 2, p<.01; self-report: F=4.65, 2, p<.05). ASD young adults were also less likely to mention long-term relationships/marriage as something desirable in the future (parent-report: F=9.24, 2, p<.001; self-report: F=10.81, 2, p<.001). Parents rated ASD twins as less likely to want to live independently (F=6.60, 2, p<.01), but those ASD twins who provided self-report did not differ from the co-twin or comparison groups in terms of planning to live independently (F=2.94, 2, p=.06).

Conclusions:

ASD twins had fewer examination passes, employment roles and were less concerned about future planning and long-term relationships compared to co-twins and non-ASD comparison twins. For both parents and ASD twins, worries about the future in terms of independence and coping were evident.

25 **233.025** Understanding College-Specific and General Well-Being Students with and without ASD

***K. Casagrande**, K. M. Frost and B. R. Ingersoll, Psychology, Michigan State University, East Lansing, MI*

Background: The transition to college is often marked by anxiety, depression, and isolation. This transition may be especially challenging for students with ASD, who already experience increased anxiety and depression, alongside reduced life satisfaction. The College Student Subjective Well-being Questionnaire (CSSWQ) was developed to measure four specific aspects of well-being among neurotypical college students: college gratitude, academic efficacy, satisfaction with academics, and school connectedness. The CSSWQ is related to academic and psychosocial outcomes above and beyond general measures of well-being. Given the unique social deficits of ASD and risk for poor academic outcomes, it is important to understand whether predictors of college well-being are similar between students with ASD and their neurotypical peers.
Objectives: To better understand college-specific and general well-being for college students with and without ASD by answering the following questions: 1) How does college-specific and general well-being in students with ASD compare to their neurotypical peers? 2) Is the relationship between domains of college well-being and overall well-being similar across groups? 3) How do social and academic experiences relate to domains of college well-being across groups?

Methods: College students with ASD (n=42, 67% male, 91% white, 21% first-generation) were recruited through disability resource centers at several degree-granting universities in the midwestern U.S. A matched comparison of neurotypical peers (n=50, 64% male, 86% White, 18% first-generation) were recruited through an undergraduate research pool. Both groups completed an online survey containing measures of autism symptomology (Autism Spectrum Quotient; AQ), college well-being (CSSWQ), and general well-being (Satisfaction With Life Scale; SWLS). Additional descriptive information about social and academic experiences was also collected, including perceived social support, preparation for academics and independent living, aspects of social participation, and GPA.

Results: Overall well-being did not differ significantly across groups ($F(1,90)=2.228$, $p=.139$, $\eta^2=.024$). On the CSSWQ, only the school connectedness subdomain ($F(1,90)=4.253$, $p=.042$, $\eta^2=.045$) was different between groups, such that students with ASD reproted lower levels of connectedness than their neurotypical peers (see Table 1). After controlling for demographics (age, gender, race, and first-generation student status), college-specific well-being ($\Delta R^2=.329$, p<.001), connectedness specifically ($\beta=.52$, p<.001), explained a significant amount of variance in general well-being over and above the effect of autism severity alone ($\Delta R^2=.072$, p=.006). The interaction between CSSWQ domains and autism symptom severity was also not significant ($\Delta R^2=.010$, p=.610). Exploratory correlations showed that connectedness was related to a variety of other predictors of well-being, such as social support and integration, whereas other domains of college well-being were not (see Table 2).

Conclusions: While the relationship between college well-being and a more general measure of well-being was similar across groups, individuals with ASD were less likely to report feeling connected with peers in college. Furthermore, that connectedness was highly related to overall well-being even after accounting for ASD symptom severity. Given the importance of the college social experience in both college and overall well-being, significant attention should be paid to the protective role of social support systems in addition to academic services when understanding how to support individuals with ASD in the college transition.

Poster Session
234 - Biomarkers (molecular, phenotypic, neurophysiological, etc)
11:30 AM - 1:30 PM - Room: 710

26 **234.026** Hypermasculinised Facial Structures in Brothers but Not Sisters of Autistic Children

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Background:
Autism spectrum disorder (ASD) is diagnosed approximately three times more frequently in males than in females. One biologically-driven hypothesis suggests that the male prevalence in ASD may be influenced by the exposure to elevated concentrations of testosterone during pregnancy. During fetal development, the brain and the face evolve from the neural crest in synchrony. This has led to the speculation that facial structures may hold crucial information to further our understanding of atypical neurodevelopment in ASD. A recent study reported hypermasculinised facial structures of autistic boys and girls when compared to non-autistic children (Tan et al., 2017, Scientific Reports).

Twin and family studies have provided clear evidence that certain cognitive phenotypes associated with ASD, such as social difficulties, are highly heritable. In terms of facial structures, several studies have found familial factors to explain more than 70% of structural variations in faces; of which, familial factors accounted for 49% of the variations in facial masculinity in particular.

Objectives:

The present study aims to investigate whether masculinised facial features are present in full siblings of autistic children using 3D photogrammetry.

Methods:

Twenty-three boys (mean age=7.31 yrs, SD = 2.68) and 20 girls (mean age=6.95 yrs, SD = 2.76) who are non-autistic siblings of children with ASD were included in this study. Every sibling was age- and sex-matched with three typically-developing children without siblings with ASD (69 boys [mean age=7.39 yrs, SD = 2.51] and 60 girls [mean age=7.41 yrs, SD = 2.42]). Landmarks were placed on each 3D image to generate a set of linear and geodesic distances previously found to accurately differentiate between boys and girls of similar ages as those included in the current study. Using these distances, a continuous 'gender score' can be computed for each face to indicate the degree of facial masculinity. Behavioural information collected using Social Responsiveness Scale-2 (SRS-2) is available for 28 siblings (17 boys) and Children Communication Checklist-2 (CCC-2) is available for 24 siblings (14 boys).

Results:

Facial masculinity was significantly increased in the male siblings of autistic children compared to those of the male comparison group [$t(90) = 2.92$, $p = .004$, $d = .70$]. However, there was no difference in facial masculinity between female siblings and comparison group ($p = .67$). Using Spearman's rank correlation coefficient, we found that facial masculinity was unrelated to scores on SRS-2 and CCC-2 when boys and girls were analysed together and separately.

Conclusions:

Tan et al. (2017) reported hypermasculinised facial structures in both boys and girls with ASD relative to a comparison group of non-autistic children. The current study found that hypermasculinised facial features were present only in male siblings of autistic children but not in female siblings. This study suggests the possibility that facial masculinity associated with ASD may be heritable only in boys but not in girls.

27 **234.027** Identification of Neurotransmitter-Associated Metabotypes: Further Stratification of the Children's Autism Metabolome Project ASD Subjects.

E. Donley[1], *A. Smith*[2], *M. Ludwig*[2], *D. B. Sugden*[2], *L. Feuling*[2], *M. Natowicz*[3], *D. G. Amaral*[4] *and R. Burrier*[1], *(1)Stemina Biomarker Discovery, Madison, WI, (2)Stemina Biomarker Discovery, Inc., Madison, WI, (3)Pathology & Laboratory Medicine Institute, Cleveland Clinic, LL-3, Cleveland, OH, (4)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA*

Background: Autism spectrum disorder (ASD) is biologically and behaviorally heterogeneous and is associated with a diverse array of underlying genetic, metabolic, and environmental factors. We conducted the Children's Autism Metabolome Project (CAMP, ClinicalTrials.gov Identifier: NCT02548442) comprised of 1100 children to identify altered metabolism associated with ASD. Utilizing a metabotyping approach we created metabolic tests which identify subpopulations of ASD subjects. We recently published (Smith et al., 2018) Amino Acid Dysregulation Metabotypes (AADMs) associated with dysregulation of the amino acids (AA) glutamine, glycine, and ornithine in ratios with branched-chain amino acids (BCAAs). The AADMs were present in 17% of the CAMP subjects with ASD. Metabotype stratification of ASD may provide more biochemically homogenous populations that, in turn, offer the potential for more tailored pharmacological, behavioral, and dietary interventions.
Objectives: We sought to: 1) identify additional metabotypes described by plasma amine containing metabolites associated with neurotransmitters; 2) determine whether neurotransmitter-related metabotypes describe an independent population of ASD subjects that is additive to AADMs; and 3) optimize the inclusion of diagnostic metabotypes to create a battery of tests that increase overall diagnostic performance of the amine-based metabolic tests.

Methods:

The Autism Diagnostic Observations Schedule-Second Version (ADOS-2) was performed by research reliable clinicians to confirm ASD diagnoses. A training set of CAMP subjects (ASD=253, TYP=85) was utilized to identify metabotypes and create metabolic tests. The reproducibility of the tests was evaluated in an independent test set of CAMP subjects (ASD=263, TYP=79). Plasma samples from these subjects were analyzed using a quantitative mass spectrometry-based assay for amine containing metabolites. A heuristic algorithm was applied to the training set to identify biomarkers able to discriminate ASD subpopulations using a diagnostic threshold to define the subpopulation. The diagnostic thresholds were used to create panels of tests for metabotype populations and then the reproducibility of the metabotype was evaluated in the test set of subjects.

Results:

Reproducible metabotypes containing the neurotransmitter-associated metabolites kynurenine and glycine were identified in the training and test sets. The kynurenine-based metabotype also includes, ornithine, glutamic acid, and ethanolamine and identifies 8.5% of CAMP ASD subjects. The glycine-based metabotype also includes asparagine, phenylalanine, and lysine and identifies 12% of CAMP ASD subjects. Both neurotransmitter metabotypes identified ASD subjects with greater than 95% specificity. These additional metabotypes increased the overall diagnostic sensitivity from 17% defined solely by the AADMs to about 30% when all metabotypes are combined into the test battery.

Conclusions: Continued analysis of the CAMP study samples using metabotyping techniques has identified additional neurotransmitter-related metabotypes of ASD. Stratifying ASD based on metabotypes offers an opportunity to identify children earlier at risk for ASD as well as the

potential for targeting therapies based on the metabotypes for more precise and individualized treatment.

28 **234.028** Influence of Race and Ethnicity on Broader Autism Phenotype Ratings of Mothers and Fathers from the Simons Simplex Collection

R. K. Ramsey *and K. M. Walton, Nisonger Center, The Ohio State University, Columbus, OH*

Background: In simplex families, broader autism phenotype (BAP) traits tend to differ by parent sex and BAP measure (Davidson et al., 2012). Except for one study indicating no differences in BAP traits between minority and non-minority parents (Sasson et al., 2013), there are no studies analyzing BAP presentation across multiple races or ethnicity. Diagnostic rates of autism in children are shown to differ by race and ethnicity (Jo et al., 2015). Revealing similar differences in parent BAP traits may provide insight into the racial and ethnic disparities observed in the diagnosis of autism.

Objectives: This study examines whether BAP ratings of mothers and fathers of a child with autism differ by their race or ethnicity.

Methods: BAP traits were examined in 2,479 mothers (9.2% Hispanic, 4.5% Black, 5.6% Asian) and 2,516 fathers (8.1% Hispanic, 5.4% Black, 4.8% Asian) who had a single child with autism in the Simons Simplex Collection (SSC). BAP traits were measured using self-reports (Broader Autism Phenotype Questionnaire (BAPQ)), other parent ratings (Social Responsiveness Scale: Adult Research Version (SRS: ARV)), and clinical interviewer ratings (Family History Interview - Impressions of Interviewer (FHI-IoI)). BAP ratings of mothers and fathers were compared across ethnicity (Hispanic vs. Non-Hispanic) and race (White, Black, and Asian) for each measure.

Results: Regarding ethnicity, Hispanic mothers (*M*=32.89, *SD*=21.95, *n*=252) and fathers (*M*=33.24, *SD*=25.37, *n*=220) had significantly higher SRS ratings than Non-Hispanic mothers (*M*=29.28, *SD*=20.24, *n*=2,483) and fathers (*M*=29.51, *SD*=22.29, *n*=2506, *p*'s<.05). However, Non-Hispanic fathers had significantly higher BAPQ aloofness, overall BAPQ, and FHI-IoI ratings than Hispanic fathers (*p*'s<.05). Regarding race, Asian mothers (*M*=2.60, *SD*=.75, *n*=138) were significantly higher than White mothers (*M*=2.37, *SD*=.78, *n*=2210) on BAPQ aloofness (*p*=.003), while Black mothers (*M*=2.44, *SD*=.73, *n*=111) were not significantly different from either. White fathers had higher BAPQ domain and overall scores compared to Black fathers, while Asian fathers had significantly higher BAPQ pragmatic scores compared to Black fathers, but significantly lower BAPQ rigidity scores compared to White fathers (*p*'s<.05). Both Asian mothers and fathers were significantly less likely to have ASD traits based on the FHI-IoI compared to the other two groups (*p*'s<.05). While BAP ratings were generally correlated, the FHI-IoI was not correlated with other measures for mothers and fathers in the Hispanic and Asian groups (*p*'s>.05).

Conclusions: Overall, BAP trait differences were observed across race and ethnicity, which varied by measure. Generally, White fathers tended to have more BAP traits compared to others, which could be due to a higher prevalence of autistic traits in White males or an artifact of norming BAP measures on predominantly White male populations. Furthermore, other parents rated Hispanic parents higher on BAP traits, while clinical interviewers rated Hispanic and Asian parents lower. Such differences may be due to cultural biases in others' ratings or actual differences in BAP presentation by race and ethnicity. These findings caution against using a single measure to capture BAP traits (Davidson et al., 2012). More research is needed to determine whether current BAP measures accurately assess for traits in minorities.

29 **234.029** Interactions between the Hypothalamic-Pituitary-Adrenal Axis and Autonomic Nervous System As Predictors of Depressive Symptoms in Children with ASD

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Background: The hypothalamic-pituitary-adrenal (HPA) axis and autonomic nervous system (ANS) are physiological systems involved in arousal response and regulation, and independently, have been implicated in negative behavioral health outcomes, including internalizing disorders. Dysregulation of these systems has been reported in autism spectrum disorder (ASD), including elevated evening cortisol, as well as hyperarousal of the sympathetic (SNS) and under-responsivity of the parasympathetic (PNS) branches of the ANS. Previous research to identify associations with physiological dysregulation and internalizing symptoms in ASD has produced inconsistent findings, and little attention has been paid to the interactions of the distinct, yet interrelated, HPA axis and ANS.

Objectives: The current study examined differences in physiological regulation for 96 children 10-to-13 years of age with ASD (11.25 years) and typical development (TD; 11.24 years). Subsequently, interactions between the HPA axis, PNS, and SNS were examined within the ASD group. The extent to which the individual systems, as well as the interactions between them, predicted parent-reported internalizing symptoms in children with ASD was investigated.

Methods: In 96 children with ASD (N=64) and TD (N=32), diurnal rhythm of the HPA axis was measured via salivary cortisol, collected through passive drool at home over 3 days, collected in the morning (twice), afternoon, and evening. Baseline respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP) were collected in the lab via electrocardiography and impedance cardiography to examine PNS and SNS regulation, respectively. Parents completed the Child Behavior Checklist (CBCL), and the Withdrawn/Depressed, Anxious, and Internalizing subscales were included in analyses. ANOVAs were used to compare group differences, and hierarchal multiple linear regression was used to examine the extent to which physiological variables and their interactions predict internalizing symptoms.

Results: Consistent with previous research, children with ASD showed elevated evening cortisol compared to TDs ($F(1,93)=11.77$, $p=0.001$). There were no significant group differences in baseline RSA or PEP (all $p>0.05$); however, the ASD group reported higher scores on CBCL subscales Withdrawn/Depressed ($t(94)=-7.51$, $p<0.001$), Internalizing ($t(94)=-8.50$, $p<0.001$), and Anxious ($t(94)=-5.44$, $p<0.001$). No significant main effects of physiological variables on CBCL subscales were seen using hierarchal linear regression while controlling for age, IQ and gender (all $p>0.05$). However, in the next step of the model, controlling for demographics and main effects, there was a significant interaction for cortisol and RSA, which accounted for 9% of the unique variance in CBCL Withdrawn/Depressed symptoms in ASD ($\Delta F(1,42)=5.51$, $p=0.03$). Posthoc analysis revealed that ASD participants with low evening cortisol showed a negative trend association between RSA and withdrawn symptoms ($t(92)=-1.89$, $p=0.06$).

Conclusions: The results extend previous findings on physiological dysregulation in ASD to reveal the presence of unique interactions, which predict parent-reported symptoms of depression. Children with high PNS regulation and low evening cortisol showed the fewest symptoms. In contrast, hyper-arousal in the HPA axis and/or PNS was associated with elevated depressive symptoms, even in the presence of more adaptive physiological regulation in the other system. The findings underscore the importance of examining arousal across multiple systems to more

accurately identify response profiles associated with behavioral outcomes in ASD.

30 **234.030** Inverted Faces: An Indicator to Identify ASD and TD

***L. Shen**, X. He and X. Gao, School of Medicine, Tsinghua University, Beijing, China*

Background: Eye tracking technique is widely used to assist in identifying ASD due to its non-invasive and comfortable characteristic. When seeing a normal human face, ASD and TD children show big different interests, especially in eyes and mouths. Inverted human faces are interesting stimulus that cause human brain having different response than normal faces. But there's no experiment to show whether responses to inverted faces can be an indicator to identify ASD and TD.

Objectives: Our goal is to investigate whether there are significant differences between ASD and TD children on their response to inverted faces, and to set up a model identifying ASD and TD.

Methods: The experiment used SMI desktop eye tracking system with frequency 250Hz. It was designed to have 12 pictures of human faces in same size and luminance with different gender and ages. Starting with a 10 second black picture, then 9 pictures were showed continuously with 2 seconds on each, and last 3 pictures with 4 seconds on each. In the series, the 3^{rd} ,7^{th}, 10^{th}, 11^{th} ,12^{th} pictures were inverted faces. Fixation time on Area of Interest (AOI) of eyes, mouths, and faces were collected, as well as pupillary data. Data were analyzed later by SPSS and MATLAB.

Total 25 subjects of 3-6 years old children with 11 ASD and 14 TD provided valid data on this experiment. ASD children had diagnosis from hospital and double checked by CARS (Child Autism Rate Scale).

Results: Based on the experimental data, 13 factors were extracted, and 5 of them showed significant difference for ASD and TD group. Principal Component Analysis showed that 3 of these factors were critical. Naive Bayes Classifier was constructed with these 3 critical factors, and its performance was evaluated by leave-one-out method. The model gave a result of an accuracy of 88.0% and an AUC of 92.2% on its prediction.

Conclusions: Eye responses on inverted faces is a sensitive indicator to identify ASD and TD. It can be used to build up a model to assist in ASD screening on 3-6 years old children.

31 **234.031** Itarget-Autism Initiative: A Guiding Look into the Microbiome Profile in Autism Spectrum Disorders

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Background:
Autism Spectrum Disorders (ASD) are complex neurodevelopmental conditions comprised of deficits in communication, social reciprocity and patterns of restrictive behaviours with preservative interests. Along with behavioural manifestations, individuals with ASD frequently report gastrointestinal disturbances. The iTARGET Autism Initiative (http://www.itargetautism.ca/) is a collaborative initiative which aims to identify children with or at risk for ASDs and provide a framework to classify patients based on genotype and deep-phenotype (clinome, metabolome, proteome, gut microbiome) profiles.

Objectives: To determine the role of the microbiome on ASD through the gut-brain axis. The central hypothesis surrounding the gut-brain axis, in regards to autism, is that ASD behaviours can be impacted by the microbiome and their metabolites which may cross the blood-brain barrier. Our analysis endeavours to identify these microbes and their metabolites.

Methods: We recruited 39 ASD affected subjects both with and without gastrointestinal symptoms. These patients will undergo WGS analysis in addition to microbiome, metabolome and proteome analysis. A control fecal sample is collected for each patient and is provided by either a sibling or same-sex parent. All collections are done through MolecularYou (https://molecularyou.com/), a Vancouver based company. 131 serum metabolites, 137 serum proteins and 73 urine metabolites have been analyzed in each affected subject. Serum and urine metabolome and proteome analysis is facilitated through MolecularYou's affiliates, The Metabolomics Innovation Centre (TMIC; https://www.metabolomicscentre.ca/) and The British Columbia Proteomics Network (BCPN; http://bcpn.ca/). The microbiome is analysed by MolecularYou affiliate, Microbiome Insights (https://microbiomeinsights.com/). The microbiome analysis consists of 16S rDNA amplicon sequencing via the Illumina MiSeq platform to determine diversity and abundance of microbial species and shotgun metagenome sequencing to identify errors in metabolism within the microbiota.

Results: Analysis of these data from 39 ASD affected subjects is currently underway. Using the same methods, we have preliminary results from five ASD affected patients, two with available control data. Our analysis has suggested that there may be an altered microbiome profile in ASD affected individuals specifically involving the Bacteroidetes and Firmicutes species. Each of the five affected patients was found to have Bacteroidetes abundance at increased levels and Firmicutes abundance at decreased levels. Three of these subjects reported gastrointestinal symptoms, while the remaining two did not. The subjects with the most altered microbiome profile also were those with the most severe behavioural manifestations of ASD.

Conclusions: Despite the small sample size, we see promising trends consistent with the literature that there is an altered microbiome profile present in individuals with ASD. These findings act as a guide for what we might expect to find following the completed analysis of our cohort. If the unique microbiome profile reaches statistical significance in association with autism and/or its symptoms, this may have implications in regards to specific diagnostic testing, management and prevention.

32 **234.032** Language-Induced Frontal Gamma Activity Is Associated with Language Ability in 18-Month-Olds with High Familial Risk of Autism

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Background: In autism spectrum disorder (ASD), deficits in language development are often observed with varied severity, leading to great heterogeneity among individuals. Language ability also serves as a predictor for further sociocognitive deficits in this population. Improved understanding of early language development in children with ASD is needed for the development of effective language therapies. Prior studies suggest that infants with high familial risk of ASD show different EEG patterns related to language as compared to low risk controls. In typically developing infants and toddlers, brain oscillations in the gamma frequency (~35-50Hz) are thought to reflect cognitive and perceptual processing, including language acquisition. Our lab has previously found that increased resting frontal gamma activity is negatively associated with language ability in high familial risk toddlers, but not low risk controls.

Objectives: To investigate whether induced gamma power during a passive language-based task is associated with language ability in 18-month-olds at high familial risk for autism.

Methods: This study analyzed 18-month EEG data and language measures collected as part of the longitudinal Infant Sibling Project, comparing infants by their risk level for ASD development. Infants with a sibling with ASD were assigned to high-risk group (HRA) and those without siblings or first degree relatives with ASD were assigned to low-risk group (LRC). Language abilities were measured using the Mullen Scales of Early Learning (MSEL). Two types of auditory stimuli were presented while EEG was continuously recorded; 20 words were identified as "familiar" while the other 20 were identified as "unfamiliar" based on typical language development standards of MacArthur-Bates Communicative Development Inventories (MBCDI). Linear regression models were used to examine group differences in the relationship between language-induced frontal gamma power and receptive language ability. Maternal education was included as a covariate.

Results: Participants included 36 LRC and 44 HRA toddlers; of the high-risk toddlers, 12 later met criteria for ASD (HRA+) and 32 did not (HRA-). There was no significant difference in language-induced gamma between groups. There was a significant negative relationship between language-induced low gamma power (40-45Hz) in response to familiar words in the HRA+ group ($p=0.049$), but no relationship in LRC group ($p=0.94$), and a marginally significant positive relationship in the HRA- group ($p=0.058$) were observed. In addition, the relationship between gamma and language in HRA+ group was significantly different from HRA- group ($p<0.01$) and marginally different from LRC group ($p=0.07$) in response to familiar stimulus. No significant relationship was observed in any groups between the gamma response to unfamiliar words and language ability.

Conclusions: This study demonstrates early differences in brain-language associations between high-risk 18-months-olds with and without ASD. Future directions include investigation of the phase-locked gamma response to language stimuli. In addition, further investigation of the longitudinal trajectory of language-induced EEG power as it related to language development may further inform development of language specific therapies for ASD.

33 **234.033** Maternal Serum Biomarkers and Autistic Traits in Expectant Mothers and Their Children

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Background:

The prenatal endocrine environment may be a significant factor in the development of autism, as indicated by recent findings. Several steroid hormones, including androgens, are elevated in the fetal circulation of males with autism (Baron-Cohen *et al.*, 2015). Furthermore, three separate epidemiological studies have associated autism likelihood in children with maternal polycystic ovaries syndrome (PCOS), a condition associated with high androgens (Kosidou *et al.*, 2016; Berni *et al.*, 2018; Cherskov *et al.*, 2018). In contrast, low levels of estriol in maternal serum (2nd trimester) have been shown to increase the likelihood of autism in the offspring (Windham *et al.*, 2016). Therefore, the overall ratio of androgens to estrogens may be a more suitable prenatal biomarker for the development of autism and related traits.

Objectives:

To investigate: **1**. prenatal steroidogenesis in association with autistic traits in expectant mothers and their child; and **2**. the ratio of testosterone to estradiol, as a proxy of prenatal aromatisation.

Methods:

Maternal serum samples were collected from n=126 neurotypical, pregnant women, taking part in the Cambridge Ultrasound Siblings and Parents (CUSP) study, corresponding to the first trimester of their pregnancy (weeks 10 to 14). Concentrations of the following steroids and peptides were measured: Testosterone (T), Estradiol (E2), Dehydroepiandrosterone sulphate (DHEAS), Progesterone (P), Insulin-like Growth Factor 1 (IGF1), sex hormone-binding globulin (SHBG). Samples were analysed on a DiaSorin Liaison XL automated immunoassay analyser using a one-step competitive chemiluminescence immunoassay for each hormone and two monoclonal antibodies for each peptide. The bioactive forms of testosterone and estradiol were calculated by standardising the levels according to SHBG levels. The aromatisation ratio was measured by dividing estradiol by testosterone concentrations. Expectant mothers were asked to complete the Autism Spectrum Quotient (AQ) to measure autistic traits and the Quantitative Checklist for Autism in Toddlers (Q-CHAT) online when their infant was between 18- and 20-months old. Hormone values were analysed in conjunction with autistic traits via Pearson's Correlation Coefficient. Correction of significance thresholds for multiple comparisons was performed by application of the False Discovery Rate (FDR). Latent factors driving the variance in steroid levels were calculated via the Bartlett method.

Results:

None of the analysed hormones, nor the aromatisation ratio, were significantly associated with autistic traits in the mother, in univariate analyses and following correction for multiple comparisons. However, pairwise correlations of steroid hormones revealed significant interdependence between them (e.g. estradiol to DHEAS: *Pearson's $\beta=0.629$, $p<0.0001$* & estradiol to testosterone: *Pearson's $\beta=0.466$, $p<0.0001$*). Latent factor analysis, identified three separate factors driving most of the variance in the observed steroid levels. The predicted values of the latent factor that regulated DHEAS, bioactive estradiol and bioactive testosterone were significantly correlated to maternal AQ Scores (*Pearson's $\beta=0.2515$, FDR-adjusted $q=0.026$*).

At the time of submission, Q-CHAT scores of the infants were still being collected, with their association to biomarkers to be completed and presented in May 2019.

Conclusions:

A latent steroidogenic factor affecting both androgens (DHEAS, testosterone) and estrogens (estradiol) is positively associated with autistic traits in expectant mothers.

34 **234.034** Neural Processing of Speech Sounds in Individuals with ASD and First Degree Relatives

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Background: Impairments in social communication are a core feature of autism spectrum disorder (ASD), and include atypical use of prosody, or the intonation, rhythm, and rate of speech (Mesibov, 1992; VanBourgonien & Woods, 1992). The midbrain's response to speech-evoked stimuli (i.e., the frequency following response; FFR) provides valuable information regarding an individual's ability to make sense of sound, including information about neural processing of speech prosody. Prior research using the FFR has documented delayed latencies of neural responses and poorer tracking of speech pitch in individuals with ASD (Russo et al., 2008; Russo et al., 2009). Importantly, atypicalities in social communication and prosody have also been reported in parents of individuals with ASD (Losh et al., 2012). Evidence of similar atypicalities in the FFR among parents of individuals with ASD could implicate the FFR as a genetically meaningful neurobiological marker of ASD related to prosody and broader social communication differences.
Objectives: To examine differences in the FFR to speech-evoked stimuli in individuals with ASD, their parents, and respective control groups.

Methods: Participants include 30 individuals with ASD, 36 controls (a subset of whom (n=29)) only completed FFR to the speech syllable /da/), 40 ASD parents, and 19 parent controls. FFRs to the speech syllable /da/ and the naturally spoken syllable /ya/ with an ascending pitch contour (i.e., resembling a question) were collected. FFRs to /da/ were analyzed for response latencies reflecting processing of the onset, offset, and acoustic properties of the syllable. FFRs to /ya/ were analyzed for fidelity of pitch tracking of the stimulus. Furthermore, parent-child correlations were conducted within the ASD and ASD parent groups to assess the familiality of FFRs to speech-evoked stimuli.

Results: Both the ASD and ASD parent groups differed from their respective control groups in response latencies. Specifically, in response to the /da/ syllable, individuals with ASD and ASD parents demonstrated delayed onset timing of processing the syllable /da/ compared to controls (*p*s < .01). Individuals with ASD also exhibited delayed processing of other acoustic features of the syllable /da/ compared to controls (*p*s<.05). Furthermore, individuals with ASD (*p* = .06; see Figure 1) and their parents (*p* = .02; see Figure 2) exhibited increased error in neural tracking of the ascending pitch contour of the syllable /ya/ compared to their respective control groups. Correlational analyses revealed that increased delays in processing the acoustic features of the syllable /da/ in ASD parents were associated with increased delays in individuals with ASD (*rs* > .42, *p*s < .10).

Conclusions: Findings revealed both delayed and diminished neural processing of speech-evoked stimuli in individuals with ASD and their parents. Such evidence of inefficient neural processing of the acoustic features of speech highlights the FFR as a potential neural marker of prosodic atypicalities characteristic of ASD. Parallel findings observed in individuals with ASD and their parents suggest that the FFR to speech-evoked stimuli may be a key neural marker of genetic liability to ASD.

35 **234.035** New Biomarker Discovery for Fragile X Syndrome: From Mouse Brains to Patient Blood

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Background: Recent clinical trials for treating the leading single gene cause of autism, fragile X syndrome (FXS), have failed in part due to a lack of biomarkers that can readily detect treatment–driven improvements and/or that can stratify the diverse FXS population. Using a novel brain-based proteomic approach, we identified proteins whose synthesis is dysregulated in FXS mice. Gene ontology analysis revealed that proteins related to metabolism, synaptic function, and intracellular signaling cascades are inappropriately synthesized in FXS mouse model brains.
Objectives: Many of the brain proteins we identified can be detected in more accessible tissues, such as blood. Therefore, we asked whether the blood levels of these proteins correlated with treatment response in FXS mice and whether any protein levels differed between FXS patients and healthy controls in plasma.

Methods: We measured the response of two proteins identified in our screen in the blood of FXS mice following three treatments shown previously to be effective in reversing phenotypes in FXS mice: PF-4708671, lithium and metformin. We then measured an expanded panel of seven proteins in human plasma, comparing 11 healthy volunteers to 11 FXS patients.

Results: In each treatment group for the FXS mice, we measured a difference in at least one marker in the drug-treated group compared to the vehicle group. Three of the seven proteins measured in human plasma showed a clear difference between healthy volunteers and FXS patients, with two additional proteins suggesting subpopulations within the FXS patient group.

Conclusions: Our data suggest that the markers identified in FXS model mouse brains are measureable in blood and may predict efficacy for drug treatment and could provide information for patient stratification for future clinical trials.

36 **234.036** Oxytocin's Role As a Biomarker of Early Social Cognitive Ability in Preschoolers with and without ASD

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Background: Individuals with autism spectrum disorder (ASD) show pervasive deficits in social cognition (White et al., 2007). The hormone oxytocin (OT) has been implicated in the social difficulties individuals with ASD face (Carter, 2007) which has led to the use of OT as a pharmacological intervention. However, studies to date show mixed results, which has left some questioning the efficacy and importance of OT (Young, 2015). A better understanding of basal OT concentration levels and its relationship to early social cognitive abilities in both typically developing children and those with ASD could help delineate the role of OT as a potential biomarker.
Objectives: Explore the relationship between OT salivary concentration levels between preschoolers with ASD and typically developing (TD) peers

and social cognitive ability.

Methods: Nineteen children with ASD (age = 4.27; 75% male; Mullen VR = 31.12 (9.33)) and 21 TD children (age = 4.47; 61% male; Mullen VR = 47.57 (14.39)) participated in the current study. During an in-person visit, salivary samples were collected from participants at the start of the visit and used for OT extraction (Salimetrics Salivabio children's swab; Arbor Assays DetectX Enzyme Immunoassay Kit). Then, child participants completed measures of pretend play (Affect in Play Scale – Preschool version), social cognition tasks measuring joint attention, empathy, and cooperation, emotional understanding, and a parent-child interaction task.

Results: TD and ASD preschoolers did not differ in salivary OT concentration levels (F = 2.55; p = 0.16) at baseline. Across the sample, parent involvement in play correlated with child OT levels (r = 0.38, p = 0.05). Within the TD group, OT levels significantly related to interpersonal aggression in play (r = -0.47; p = 0.04), ability to recognize negative emotions (r = 0.51; p = 0.03), and joint attention ability (r = 0.59; p = 0.01). In the ASD group, interpersonal aggression (r = 0.79; p = 0.01), transformations (r = 0.79, p = 0.01) and divergent storylines (r = 0.77, p = 0.01) in pretend play correlated with baseline OT levels as did emotional recognition (r = 0.78; p = 0.07) and the ability to express empathy (r = 0.67, p = 0.05).

Conclusions: The relationship between parental involvement and OT expression suggests that more parent involvement may relate to higher child OT concentration levels irregardless of disorder category, perhaps suggesting that increasing parental involvement may then impact child OT levels. Findings also indicate that OT may have a unique relationship with specific domains of social cognitive ability, such as pretend play, emotional understanding, joint attention and empathy, in individuals with ASD as compared to TD children. This provides support for the notion of OT as a biomarker, which may have farther reaching effects that extend to individual differences in social functioning across disorder category, including the severe social impairment evidenced in ASD. These findings may allow for better understanding of how OT can be used as a biomarker for earlier identification of social cognitive deficits and potentially as a predictor of treatment outcomes.

37 **234.037** Physiological Responses to Social and Object Fear in Children with Autism Spectrum Disorder and Fragile X Syndrome

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Background: Children with autism spectrum disorder (ASD) and children with fragile X syndrome (FXS) are often diagnosed with comorbid anxiety. Anxiety is associated with long-term impairment; however, with early intervention, anxiety symptomology can be mitigated. Increased fear during novel social situations is associated with later social anxiety, whereas heightened fear to novel or frightening objects could be linked to specific phobia or generalized anxiety later in development. Previous research has shown that children with anxiety also have atypical physiological regulation (e.g., respiratory sinus arrhythmia, RSA), exhibiting less suppression of RSA during challenge tasks. No studies have compared physiological responses to social and object fear-inducing stimuli in children with ASD and FXS.
Objectives: The current study uses RSA to evaluate group differences between children with ASD, FXS, and typically developing (TD) controls during presses meant to evoke social fear (i.e., fear in response to a novel person) and object fear (i.e., fear in response to a novel object). Additionally, the study investigates the relationship between RSA and ASD and anxiety symptom severity.

Methods: Participants included 81 males between the ages of 3 and 6 years old: 29 ASD (chronological age *M* = 45.57, *SD* = 8.92), 26 FXS (chronological age *M* = 50.93, *SD* = 11.66), and 26 TD (chronological age *M* = 47.52, *SD* = 13.29). RSA was measured during a baseline period as well as during the Stranger Approach and Scary Spider presses of the Laboratory Temperament Assessment Battery (Lab-TAB). RSA suppression was calculated by subtracting RSA during the Stranger or Spider press from RSA during the baseline period. ASD symptom severity was assessed using the Autism Diagnostic Observation Schedule (ADOS-2). Parent-reported anxiety was determined using the Anxiety Depression and Mood Scale (ADAMS). Cognitive abilities were measured using the Early Learning Composite (ELC) of the Mullen Scales of Early Learning (MSEL).

Results: Analyses of covariance (ANCOVA, covarying for chronological age) with Bonferroni-adjusted post-hoc comparisons were used to determine group differences in RSA suppression for both tasks. For the Stranger Approach press, a main effect of group emerged, $F(2,75) = 3.51$, $p = .035$, in that TD children displayed greater RSA suppression than children with ASD, $p = .045$. The effect of group was non-significant for the Scary Spider press, $F(2,76) = 0.05$, $p = .956$. RSA suppression during the Stranger Approach press was correlated with ASD severity scores on the ADOS-2, $r = -0.31$, $p = .007$. Mullen ELC scores significantly differed between TD children and children with ASD and FXS, $F(2,73) = 83.71$, $p = .00$; however, scores did not significantly differ between the children with ASD and FXS, $p = .403$.

Conclusions: Results indicate that TD children exhibit greater RSA suppression than children with ASD during challenges involving social, but not non-social fear. However, correlations suggest that blunted RSA suppression is related to ASD symptomology rather than anxiety. Future work should explore the relationship between physiological risk markers and behavior as well as investigate other biomarkers.

38 **234.038** Probing Two Novel Proxy Markers of Excitation and Inhibition within the EEG Signal

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Background: An optimum ratio of neural excitatory and inhibitory signals is necessary for coherent brain function. It has been proposed that autism is associated with an excitation: inhibition (E:I) imbalance. We investigated two novel candidate EEG markers of excitation and inhibition. Both measures tap into 'neural noise' so we expected variance in these markers to map onto adaptive functioning and intellectual disability. Inter-trial coherence (ITC) is a measure of neural consistency; higher values mean that brain activity is more temporally aligned across trials (Makeig et al., 2004). When inhibition is reduced, the brain may not be in the optimal state to process a relevant stimulus (Levin & Nelson., 2015) leading to lower ITC. The second proxy measure, 1/f, characterizes the steepness of the power spectral density (a plot of power at each frequency) distribution. Evidence from a computational model and preclinical experiments suggests that increased inhibition leads to steeper frequency decay (Gao, Peterson & Voytek., 2017).

Objectives: To carry out case-control analysis (ASD versus TD) to determine whether, on average, both metrics differ according to diagnosis. Given both measures tap into 'neural noise' we hypothesized that these measures would vary between individuals with and without intellectual disability, and correlate with adaptive functioning.

Methods: We analysed EEG data recorded during the auditory oddball task as part of the EU-AIMS LEAP consortium (age 6-30; 1/f analysis: 262 ASD and 195 TD participants; ITC analysis: 224 ASD and 182 TD). For ITC, the reduced sample size reflects removal participants who did not show an ERP (i.e. no phase locking); however, all results maintained when these participants were included. We also created a 'level of functioning' subgroup, by comparing individuals with IQ above (high-functioning; N=386) and below (low-functioning N=71) 75.

Results: There was no overall significant difference in ITC between ASD and TD groups (t= 1.484, p =0.128), and there was no difference in ITC between high-functioning and low-functioning groups (t = -1.069, p= 0.286). For children, ITC was significantly higher in the TD child group (M= 0.196) than the ASD child group (M= 0.164), (t= 2.016, p= 0.046, d=0.399). Across all participants, higher ITC scores were associated with higher adaptive functioning scores on the VABS (r= 0.354, p= <0.001; Figure 1). For 1/f, there was no significant difference between the ASD and TD group (t=1.280, p= 0.202), but there was a significant difference between the high-functioning and low-functioning groups (t = 1.010, p= 0.002, d= 0.403). Whereby, irrespective of diagnosis, the slope was flatter for the low-functioning (M= -1.165, SD= 0.406) than the high-functioning group (M= -1.317, SD= 0.345). 1/f correlated with adaptive functioning (r=-.18, p=0.002). For both the ASD and TD groups, the histograms for both 1/f and ITC were overlapping.

Conclusions: Neither ITC or 1/f slopes differed at the case-control level between autistic and non-autistic individuals. However, ITC values were associated with adaptive functioning, and 1/f slopes were on average flatter in the group with intellectual disabilities. Thus, both markers may reflect adaptive skills, but not a clinical diagnosis of autism.

39 **234.039** Relationships between Executive Function and Activity Monitoring in Children with and without ASD: Results from the ABC-CT Interim Analysis

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Background: Executive function (EF) deficits are well-documented in many children with Autism Spectrum Disorders (ASD). These EF deficits, which are critical to daily living skills such as planning and executing goals, may also contribute to the core socio-communicative deficits of ASD (Hill, 2004; Lopez et al., 2005; Faja et al., 2016). A sound understanding of the interactions between EF and social deficits, particularly at a fundamental level, may facilitate the discovery of better biomarkers and could lead to the development of more targeted therapies that address both domains. Objectives: Explore the effect of EF ability on looking percent (head, background, overall looking) during an activity monitoring paradigm in ASD and TD participants above and beyond IQ and symptom severity (ADOS calibrated severity score).

Methods: Children six to twelve years old with Autism (n = 159) and typically developing individuals (n = 64) participated. An Eyelink 1000 Plus 500 Hz was used to track participants' gaze while viewing several videos and images depicting two actresses engaged in a shared activity. Stimuli also included distractor objects placed throughout the scene and different gaze conditions (toward activity or the other actress). Trials were included if they contained valid data for more than 50% of the stimuli and if calibration error was less than 2.5 degrees. Percent time spent looking at heads (Head%), background (Background%), and the scene overall (TotalLooking%) was computed. The CASI-5 Inattentive and Hyperactive-Impulsive subscales were used as a proxy of EF.

Results: Correlations between eye-tracking outcome variables and CASI-5 EF subscales, partialling for IQ and ADOS symptom severity scores, were performed for each diagnosis group. No relationship was observed in the TD group. In contrast, Head% in ASD participants was significantly correlated with both Inattentive (r(155) = -.18, p = .024) and Hyperactive-Impulsive subscales (r(155) = -.23, p = .004), suggesting that as CASI-5 scores increased (indicating worse EF skills), time spent looking at heads decreased. A follow-up ANCOVA analysis looking at the relationship between Heads% and factorial effects of diagnosis, IQ, and CASI-5 was performed. This yielded a main effect of CASI-5 scores, F(1, 222) = 4.29, p = .039, and significant two-way interactions between CASI-5 and IQ and CASI-5 and diagnosis (F(1, 222) = 4.14, p = .043, F(1, 222) = 6.09, p = .024, respectively). The three-way interaction between diagnosis, IQ, and CASI was also significant, F(1, 222) = 5.51, p = .02.

Conclusions: Together, these analyses indicate that a complex relationship exists between CASI-5 and Head%. Although the nature of this relationship is currently unclear, the interactions suggest that CASI-5 is capturing variance in these social looking patterns that are unaccounted for by diagnosis and IQ alone. Thus, EF may play a role in social learning which may in turn impact future social skills. Interventions targeting EF domains may benefit both EF and social skills.

40 **234.040** The Electroretinogram As a Candidate Biomarker for Autism Spectrum Disorder

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Background: The b-wave of the electroretinogram (ERG) depends upon glutamate synapses between the retinal photoreceptors and bipolar cells. The b-wave has been shown to be altered in two previous studies of autism spectrum disorder (ASD) and in other central nervous system disorders.

Objectives: This three-center study tested the hypothesis that the ERG discriminates individuals with ASD and typically developing (TD) individuals.

Methods: All participants with ASD met diagnostic criteria according to DSM-IV or DSM-5. In a preliminary sample as of November 2018 (data collection is ongoing), ASD (N= 52 (38M, 14F) and TD (N= 44 26M, 13F) groups were closely matched for age (ASD: 11.8 ± 0.6, range 6.0 to 19.2 years, TD 11.9 ± 0.5, range 5.9 to 19.4 years (p = .92), gender (p = .12), and iris color (p = .54). Individuals with darker irises have lower ERG amplitudes due to the absorption of light by the ocular pigmentation. A custom Troland based, nine-step, light adapted full-field ERG series was performed on both eyes using the Ret*Eval* (LKC diagnostics, Washington DC, USA). Flashes of 0.4, 0.8, 1.3, 2.5, 4.0, 6.3, 8.9, 13 and 16 cd.s.m^{-2} were presented in random order, 2/s, on a 30 cd.m^{-2} white background. The b-wave amplitudes from the eye with the largest b-wave amplitude at 16 cd.s.m^{-2} were plotted against flash strength to establish photopic hill functions for each group. Regression analysis using a Gaussian and logistic growth function to model the photopic hill derived the peak of the function for each subject using SigmaPlot 13.0 (SysStat, San Jose, USA). Repeated measures ANOVA and non-parametric tests were used to establish the flash strength that best discriminated between groups and the peak of the photopic hill with p<0.05 as significant using SPSS ver25 software.

Results: Repeated measures ANOVA revealed a significant difference between groups (F(1,85) = 5.3, p = .025) indicating a difference in the b-wave amplitude response across the flash series. Flashes of 1.3 cd.s.m^{-2} (0.1 log cd.s.m^{-2}) were the most significant (p = .002) to discriminate b-wave amplitude differences between the groups (ASD 23.0 ± 0.9 µV; TD 28.0 ± 1.2 µV). The *fitted* peaks of regression analysis for the photopic hill occurred at significantly stronger (0.08 log units; p = 0.006) flash in the ASD group (0.50 ± 0.02 log cd.s.m^{-2}) than the TD group (0.42 ± 0.02 log cd.s.m^{-2}).

Conclusions: These preliminary findings concord with previous research indicating differences in the amplitude and sensitivity of the ERG of individuals with ASD. This indicates altered retinal signaling and/or synaptic connectivity at the level of the cone and bipolar cell complex, which may reflect some of the neurodevelopmental differences in the CNS. By six months, the light adapted cone ERG peak times are adult-like, and by five years, ERG amplitudes are adult-like. Therefore, a difference in the retina's response to a pulsed increment of light holds promise as a candidate biomarker applicable in early development of children with ASD.

41 **234.041** The Role of Metal Ion Dyshomeostasis in ASD: Evaluation of Cu, Zn and Se Levels in the North American Autism Spectrum Disorder Population

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Background: The importance of environmental factors and the extent of their role in the development of ASD are poorly understood. Zinc is a nutrient that may serve as a cofactor for 8 to 10% of currently identified autism risk genes. Previous studies have suggested that people on the autism spectrum have lower zinc and higher copper levels than control subjects. These studies also suggested a trend in which more severe symptoms of Autism were found in people with lower zinc levels. However, these studies were small and were performed in the Middle East or Asia. In addition, there are inconsistencies in the literature about the size of this effect depending on the source of the biosample (serum, hair, or nails).

Objectives: This study aims to determine whether the relationship between zinc/copper levels and ASD exists in a North American population and in a larger sample group size. Secondary aims of the study are to assess if there is a relationship between Zn/Cu/Se levels and language delay, functional level, and genotype. We also aim to determine if there is an optimal biosample to measure in this population based on effect size.

Methods: We are recruiting 100 children with ASD between ages 2 and 4 years and 50 age-matched control subjects from a tertiary care medical center. Control subjects passed standard pediatric screening for autism (the Ages and Stages Questionnaire), whereas all children with ASD were diagnosed using a multidisciplinary evaluation, including the ADOS-2. Zinc, copper, and selenium levels are measured in a CLIA-certified laboratory from serum, hair, and nail samples. All children diagnosed with ASD are offered clinical genetic testing (fragile X and chromosomal microarray). Once recruitment is complete, we will look for group differences between children with ASD and control subjects for zinc, copper, and selenium, as well as within ASD differences between metal ion levels and the severity of autism, language, and genetic diagnosis.

Results: Preliminary results indicated that there is a statistically significant difference between serum selenium levels, hair zinc levels, and the copper/zinc ratio between children with ASD and control subjects. There is not a high degree of concordance between metal ion levels across sample types for a given patient.

Conclusions: Our data suggest that there is a difference in metal ion homeostasis and absolute levels in young children with ASD and control subjects. We do not yet have sufficient power to determine whether there is a subtype of ASD or particular genetic diagnosis that accounts for most of this difference.

42 **234.042** The Urinary Metabolomic Profile Correlates with Clinical Severity of Young Autistic Children.

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Background: The identification of sensitive and specific biomarkers of Autism Spectrum Disorder (ASD) represents one of the main challenges. In this regard, metabolomics has the potential to identify a characteristic ASD metabolic fingerprint which may support the clinician for an earlier diagnosis. New evidence shows a different urinary metabolic profile in autistic children, characterized by altered levels of gut-microbial cometabolites, tryptophan, homocitrulline, quinic, xanthurenic citric and puric acid. However, to our knowledge only few studies have correlated

the urinary metabolomics findings with clinical features and the severity of autism.

Objectives: The aim of our study was to characterize the urinary metabolic signature of ASD children compared to age matched healthy controls and to investigate the correlation between the clinical phenotype severity and the urinary metabolomic profile.

Methods: 57 children (age range 2–11 years) were enrolled in the study: 31 ASD patients and 26 typically developing children without familiarity for ASD as healthy controls. Standardized clinical assessment (Autism Diagnostic Observation Schedule, Second Edition- ADOS-2; Aberrant Behaviour Checklist - ABC) was performed for ASD children. Morning urine samples were collected for all participants and urinary metabolites were analysed and quantified by Gas chromatography–mass spectrometry (GC-MS). Correlations between the ASD metabolic fingerprint and psychological tests (ADOS-2; ABC) were investigated using the Projection to Latent Structures (PLS) method.

Results: A distinct urinary metabolomics profiles emerged in the ASD children compared to healthy controls (OPLS-DA R2 = 0.766; Q2 = 0.479 $P <$ 0.001). The purine, phenylalanine and tyrosine metabolism were the most significantly altered pathways.Different levels of gut microbial metabolites, such as hippurate, phenylalanine, tyrosine, indoleacetic, aminomalonic acids, N-acetylglucosamine and a dysregulation of metabolites expression of oxidative stress (tryptophan, cystine, uric acid) were found in ASD population. Moreover, higher levels of para-cresol and adipic acid, possible indirect results of environmental exposure, were detected in children with ASD compared to healthy controls. Finally, a positive correlation emerged between the urinary levels of para-cresol, adipic acid and the clinical severity in terms of both core symptoms (ADOS: R2=0,890273) and aberrant behaviours (ABC: R2=0,970057).

Conclusions: We report a significant difference in the urinary metabolomic profile of young idiopathic autistic children compared to healthy subjects. Our findings confirm a possible associative relationship between the autistic urinary metabolomic profile, gastrointestinal dysbiosis and oxidative stress. We also found a positive clinical correlation between core symptoms, aberrant behaviours and high concentrations of p-cresol and adipic acid whose alterations can be expression of environmental exposure. Thus, a distinct metabolomic profile related with a more severe clinical outcome emerged from our study.

43 **234.043** Urinary Markers of Oxidative Stress in Children with Autism Spectrum Disorder (ASD)

J. Osredkar[1,2], *D. Gosar*[3], *J. Maček*[4], *K. Kumer*[1], *T. Fabjan*[1], *P. Finderle*[1], *S. Šterpin*[1], *M. Zupan*[5] *and M. Jekovec Vrhovšek*[4], *(1)Institute of Clinical Chemistry and Biochemistry, University Medical Centre Ljubljana, Ljubljana, Slovenia, (2)University of Ljubljana, Faculty of Pharmacy, Ljubljana, Slovenia, (3)Department of Child, Adolescent and Developmental Neurology, University Medical Centre Ljubljana, Ljubljana, Slovenia, (4)University Children's Hospital, Unit of Child Psychiatry, Center for autism, University Medical Centre Ljubljana, Ljubljana, Slovenia, (5)Blood Transfusion Centre of Slovenia,, Ljubljana, Slovenia*

Background: Autism spectrum disorder (ASD) is a developmental disorder characterized by deficit in social interaction, restricted interest and repetitive behavior. Oxidative stress in response to environmental exposure plays a role in virtually every human disease and represents a significant avenue of research into the etiology ASD.

Objectives: The aim of this study was to explore the diagnostic utility of four potential biomarkers in urine.

Methods: One hundred-thirty-nine (139) patients with ASD (89% male, average age = 10.0 years, age range = 2.1 to 18.1 years) and 21 healthy children included in a control group (52% male, average age 8.2, age range = 2.5 to 13.7 years) were recruited for this study. Urinary 8-OH-dG, 8-isoprostane, dityrosine and hexanoil-lisine were determined by the ELISA method. Urinary creatinine was determined by the kinetic Jaffee reaction and all biochemical measurements were normalized in relation to creatinine. Non-parametric tests and support vector machines (SVM) with a three different kernels (linear, radial, polynomial) were employed to explore and optimize the multivariate prediction capability of these biochemical measurements for predicting an ASD diagnosis. The SVM models were computed using bootstrapping, with additional SMOTE sampling procedures (Chawla et al., 2002) utilized because of unbalanced data.

Results: Using non-parametric test we found that children with ASD had an increased concentration of 8-isoprostane compared to the control group (unadjusted p = .046). When all four biochemical measurements were combined using SVM's with a radial kernel we could predict ASD diagnosis with a balanced accuracy of 87.9% and thereby account for an estimated 31.6% of variance (p < .001). Looking at the standardized variable importance an ASD diagnosis was best explained in terms of 8-isoprostane and 8-OH-dG.

Conclusions: Our results indicate that the examined urinary biomarkers combined together may differentiate children with ASD from healthy peers to a significant extent. However, the etiological importance of these findings is difficult to assesses, due to the high-dimensional nature of SVM's and radial kernel. In addition, our results should be interpreted with care since we did not have a sufficient large enough group of both children with ASD and healthy peers to have independent training and testing samples for our SVM's. Nonetheless, our results show that machine learning methods may provide significant insight into ASD and other disorder that could be related to oxidative stress.

44 **234.044** W-Sitting and Sociomotor Behaviors in Toddlers with Autism Spectrum Disorders: True or False?

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Background:

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by impairments in social interactions and communication, restricted interests, and stereotyped or repetitive behaviors. While abnormal motor features are not considered as diagnostic criteria, they are observed in more than 85% of individuals with ASD and are the earliest reliable predictor of a later ASD diagnosis among high-risk siblings of children with ASD. Movement variability is critical for social development and environmental exploration, affecting both autonomy and language development. The purposes of this study were to investigate the overall frequency and variety of gross motor behaviors in typically developing children (TD) and age-matched children with ASD during play with a parent and to focus on two distinctive motor behaviors: a) W-sitting position commonly reported as problematic and b) sociomotor dyadic Forced Transitions.

Objectives:

Using our pre-established reliable videocoding we tested three hypotheses: (1) compared to TD children, children with ASD will have reduced

frequency and variability of posture changes due to motor constraints and restricted social behaviors; (2) more children with ASD exhibit W-sitting based on reported clinical observations; and (3) more parents of ASD children will initiate Forced Transitions to facilitate reciprocity and responsiveness during play.

Methods:

Participants (TD=20; mean age=39.5 months; ASD=20; mean age=34.8) were videotaped during home-based play sessions with a parent as part of a longitudinal study to examine language development in children with ASD. Physical therapy students trained in videocoding and blind to ASD diagnoses independently rated the first five minutes of a 30-minute interaction using Datavyu software. Postures were categorized into "static" (sitting, standing, kneeling) and "dynamic" (locomotion involving moving from one location to another). Each posture (standing, sitting) was expanded into more specific positions (half-kneel, W-sitting). Codes for W-sitting (sitting posture where the bottom is on the ground and legs are splayed to opposite sides of the body; legs make a "W") and Forced Transition (child is physically moved by the parent) were developed, and inter-rater reliability for all codes ranged from 0.91 to 1.0 at a 95% confidence level. Data were analyzed in MATLAB R2017b, and descriptive statistics were calculated as Mean (SD), and Frequencies [%(n)].

Results:

Compared to age-matched TD children, children with ASD exhibited a similar frequency and variability of posture changes. As expected, Forced Transitions were significantly more frequent among the ASD dyads. However, no significant differences were found between the groups for W-sitting. In each group, 7 children exhibited W-sitting.

Conclusions:

The study emphasizes the benefit of developing interdisciplinary assessment between psychologists and physical therapists using standardized motor coding to evaluate best practices for children's motor autonomy and social exploration. Contrary to common beliefs about links between W-sitting and developmental delays, our results showed equal frequencies of W-sitting between groups. A survey of pediatric therapists revealed that W-sitting in children 12 to 96 months is common and often treated despite a lack of clear scientific evidence and access to longitudinal data. Our future longitudinal coding will inform on motor and related language trajectories.

45 **234.045** Associations between Clinical Features and Neural Markers of Sensory Processing in Children with Autism Spectrum Disorder

C. F. Layton[1,2], *E. Isenstein*[1,3], *S. Guillory*[1], *C. McLaughlin*[1], *M. Migo*[1], *I. Falade*[1], *B. Yao*[4], *H. Grosman*[1], *H. Voulgarakis*[1], *J. Zweifach*[1], *D. Halpern*[1], *P. M. Siper*[1], *A. Kolevzon*[1], *B. Roach*[5], *D. Mathalon*[6], *K. N. Thakkar*[4] *and J. Foss-Feig*[1], *(1)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (2)Northwestern University, Evanston, IL, (3)University of Rochester, Rochester, NY, (4)Michigain State University, Department of Psychology, East Lansing, MI, (5)Northern California Institute for Research and Education, San Francisco VA Medical Center, San Francisco, CA, (6)University of California, San Francisco, San Francisco, CA*

Background: Sensory and motor deficits are key features of the autism spectrum disorder (ASD) phenotype. Recently, we proposed that deficits in *corollary discharge (CD),* neural signals that allow actions to modulate perception, could underlie many core ASD symptoms. CD signals are copies of movement signals, which are sent to the sensory areas of the brain at the same time that the motor commands themselves are sent to lower motor regions. They allow organisms to suppress sensory consequences of self-generated action and attune more to external input. Decreased CD signaling in ASD could contribute to both hypo-responsiveness to external sensory stimuli and internal preoccupation seen in the ASD phenotype. Objectives: To test whether (i) suppression of the neural response to self-generated tones (engaging CD) versus externally-generated tones (no CD) is reduced in children with ASD, and (ii) whether these CD alterations are associated with clinical symptoms in these children.

Methods: This study used an EEG paradigm to compare neural signatures of CD between typically developing (TD) children (n=10) and children with ASD (n=15), and to relate putative CD alterations with sensory hypo-responsiveness and overall symptom severity.CD was indexed by suppression of the N1 event-related potential (ERP) between two conditions: Self-generated tones, where participants initiated a tone by pressing a button on a response pad (CD condition), and externally-generated tones, where participants passively listened to tones played back by the computer (no CD condition). Mean N1 amplitudes were extracted from central electrodes, separately for each condition**.** Correlations between N1 suppression and clinical scores on the Social Experience Questionnaire (hypo-responsiveness and sensory-seeking subscales) and Autism Diagnostic Observation Schedule, 2nd Edition (ADOS-2) total score were calculated.

Results: Typically developing participants exhibited significant suppression of N1 amplitude between externally- and self-generated conditions ($t(10)= 4.87$, $p= 0.001$). No significant N1 suppression was observed in ASD ($t(15)= 1.70$, $p= 0.11$). Participants with ASD showed attenuated suppression to self- versus externally-generated tones (1.17 μV) compared to the TD group (2.57 μV), suggesting a deficit in CD signaling ($d = 0.63$). The ASD group scored significantly higher in sensory hypo-responsiveness ($t(23)= 3.96$, $p< 0.001$) and sensory-seeking behaviors ($t(23)= 2.19$, $p= 0.04$) than the TD group. Lesser N1 suppression was associated with greater hypo-responsiveness on the SEQ across both groups ($r = -0.41$, $p= 0.04$). Though non-significant, the correlation between N1 suppression and sensory-seeking behaviors on the SEQ was of medium size across both groups ($r= -0.34$, $p= 0.09$). Lesser N1 suppression was also associated with higher ADOS-2 total scores ($r= -0.55$, $p= 0.03$).

Conclusions: These results suggest that CD signaling during self-generated action is attenuated in ASD and relates clinically to both sensory experiences and core symptom levels. If correlations between EEG measures and clinical symptoms are maintained in a larger sample, this study could lead to a breakthrough in our understanding of the neural basis of several core symptoms of ASD, in turn leading to novel, targeted treatment approaches that could be applied in the context of very early intervention.

46 **234.046** CK-BB: A Novel Biomarker in Autism Spectrum Disorders

S. Bruce, ***K. Harum****, M. Mongo and A. Walton, Clinic for Special Children, Wilmington, NC*

Background:

Creatine kinase (CK) is an enzyme that aids in the transfer of phosphate groups from ATP to creatine phosphate to meet metabolic energy demands of tissues such as brain and muscle (Sharma, Rosenberg, Bennett, Laskowitz, Acheson, 2016). Creatine kinase B type (CK-BB) is an isozyme of CK primarily found in the brain. Detection of CK-BB in serum suggests a permeable blood brain barrier and neuronal injury (Sahu, Nag,

Swain, Samaddar, 2017). The potential use of CK-BB as a biomarker for Autism Spectrum Disorders (ASD) has not yet been explored.

Objectives:

The current study sought to identify endophenotypes in autism by observing variations in a marker of neuronal injury in children diagnosed with ASD; specifically, CK-BB.

Methods:

A community population of children with neurodevelopmental disorders, meeting DSM-V criteria for autism underwent consultation for diagnostics and treatment. These children were evaluated for elevations in CK and its isozymes, including the BB fraction (CK-BB), along with a standard array of diagnostic assessments for children with autism. Patients were pulled from a community clinical population (n=435). Their laboratory data and clinical categories were tabulated in a spreadsheet in accordance with the guidelines and upon the approval of the regional IRB (SEAHEC, Study number 1711-1). Standard statistical analyses were applied. CK-BB was analyzed by Labcorp® according to their agarose gel electrophoresis with densitometry method.

Results:

There were no significant elevations in CK total in this population, yet there is significant elevation of CK-BB, a protein strongly correlated with brain injury and blood brain barrier permeability. These data suggest that a community population of children with autism have elevated CK-BB in serum regardless of their regression status and these levels are significantly higher when compared to normally developing children (Figure 1) ($p<0.001$).

Furthermore, children with regression had higher levels of total CK-BB fraction compared to children without regression (Figure 2) ($p=0.01$). In general, children over 5 years with autism tend to express lower levels of CK-BB when compared to younger children under age 5 with autism.

Conclusions:

Identifying autism with biological markers will aid in the understanding of autism's diverse etiology, and lead to more rapid biological and medical treatments. We believe that CK-BB can be used as an inexpensive and readily attainable biomarker for the detection of brain injury and/or blood brain permeability in an autistic population.

47 **234.047** Atypical Cortical Processing of Pitch Contours Predicts Social Communication Deficit in Tonal-Language-Speaking Children with Autism

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Background: Linguistic relevance shapes the neural coding of critical acoustic features pertinent to one's native phonology. Pitch contour is a defining feature of lexical tones in tonal languages such as Mandarin Chinese, and native Chinese listeners' cortical responses have been found to be more sensitive to tones with a curvilinear frequency trajectory than native English listeners (Krishnan, Gandour, & Suresh, 2014). It remains unknown to what extent whether such a language-specific neural marker of pitch encoding is developed in tonal language users with autism. Objectives: The current electrophysiological study employed nonspeech stimuli similar to those in Krishnan et al. (2014) varying in pitch trajectory to examine closely the cortical processing of linguistically relevant pitch information in Chinese children with autism. Clinical significance was explored by examining the correlations between the neural measures and autism core symptoms.

Methods: EEG was recorded from 22 native Chinese-speaking children with autism (9~13 years) and 27 age-matched TD controls. The participants were instructed to watch a self-chosen muted cartoon while ignoring any sounds. The stimuli were trains of nonspeech sounds containing either a prototypical Chinese rising tone (Tone 2 or T2) with a naturalistic curvilinear frequency trajectory or a linearly accelerated T2 that is linguistically unnatural. The linear T2 shared the same onset and offset frequencies of the prototypical T2, thus coarsely approximated the frequency trajectory of T2. The purpose of using nonspeech was to eliminate the influence from phonological and semantic contexts and thereby examine more precisely the acoustically driven cortical encoding of the pitch features. The ERP (event-related potential) responses in selected time windows were examined to see possible between-group differences. Scores from Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003) were obtained from the autism group to see if language-dependent auditory encoding could autism symptom measure.

Results: Both groups demonstrated significantly larger N250 amplitude in the processing of the prototypical curvilinear T2 relative to the linear T2. However, a group*stimulus condition interaction was observed in an earlier window of 180-230 ms. Specifically, the prototypical contour of T2 but not the linear contour produced ERP positivity in the TD group. In contrast, the ERPs for the two tones in the autism group did not differ, indicating a lack of distinction. Moreover, there was a significant correlation between ERP in this window at Pz for the linear T2 and SCQ measure. Greater ERP positivity for the linear T2 (towards reduced prototypical vs. linear distinction) was predictive of more severe autism symptoms.

Conclusions: Chinese school-age children with autism and TD controls were both sensitive to the linguistic pitch features represented by the prototypical and linear Tone 2 trajectories in later cortical processing stage. However, unlike the TD group, the autism group failed to show an early ERP distinction of the tones. The correlation between SCQ and language-dependent cortical pitch encoding suggests a potential link between low-level auditory perception and the clinical symptomology of autism. The results call for further developmental studies of atypical language-dependent perceptual reorganization and underlying mechanisms in autism.

Poster Session
235 - Communication and Language
11:30 AM - 1:30 PM - Room: 710

Relations between Production of Third-Person Pronouns and Mental State Terms in the Narratives of Children with ASD

ABSTRACT WITHDRAWN

Background:
Studies of the narrative abilities of children with autism spectrum disorder (ASD) have thus far yielded mixed results: on the one hand studies have found that children with ASD produce shorter narratives and utterances [1–3], fewer mental state terms [2,4–6], and more ambiguous pronouns [6–9] than language-matched neurotypical (NT) children. Other studies, by contrast, have found no difference in narrative length/MLU [5,9] or the use of mental state terms [10]. Furthermore it is unclear whether there is a relationship between the ability to use these different aspects of narrative language.

Objectives:

We sought to examine the relationship between production of third-person pronouns with either clear or ambiguous referents and the production of mental state terms in the narratives of children with ASD. We hypothesized that children who produced more mental state terms would also produce more 3rd-person pronouns with clear referents, since these require active monitoring of interlocutors' mental states.

Methods:

Nineteen children with ASD (3 females; *M* age = 13.68) and 20 neurotypical (NT) children (8 females; *M* age = 13.80), matched for language and nonverbal intelligence, were given a short narrative prompt which included two male characters and were asked to think about how they would end the story. Since both male characters could be referred to with the pronoun *he*, 3rd-person singular pronouns produced in the narratives could be ambiguous. Children were given three minutes to tell the ending of the story. Narratives produced by the children were analyzed for clarity of third-person pronominal reference and production of mental state terms, as well as standard measures of syntax (mean length of utterance, MLU) and semantic complexity (number of different words, NDW).

Results:

We found no difference in the length of narratives produced by the groups in terms of number of words ($t(37)=1.78$, $p=0.08$), MLU ($t(37)=-.44$, $p=.66$), or NDW ($t(37)=.1.60$, $p=.12$). However, NT children produced more 3rd-person pronouns with clear referents ($M=18.4$, SD=11.34) than children with ASD ($M=12.45$, SD=8.94), $p<.05$. Conversely, children with ASD produced more 3rd-person pronouns with ambiguous referents ($M=11.2$, SD=10.68) than NT children ($M=6.1$, SD=6.82), $p<.05$. NT children also produced more mental state terms ($M=21.65$, SD=7.78) than children with ASD ($M=15.53$, SD=7.43), $p<.05$. In both groups, greater production of mental state terms was significantly correlated with the production of clear 3rd-person pronouns ($r=0.55$, $p<.001$) as well as with age ($r=0.46$, $p<.01$); age was also significantly related to overall word count ($r=0.34$, $p<.05$) and NDW ($r=0.34$, $p<.05$).

Conclusions:

We find a moderate-to-strong relationship between children's abilities to use 3rd-person pronouns with clear referents and the production of mental state terms, suggesting that children with stronger notions of internal states are more active in monitoring their interlocutors' interpretation of pronouns. We also find that older children produce more mental state terms and longer narratives than younger children, suggesting a developmental trajectory.

48 **235.048** Benefits and Challenges of Multilingualism for Autistic Children

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Background: Despite the growing prevalence of multilingualism in the world (Grosjean, 2010), there is little research into multilingualism in children with neurodevelopmental disorders (Hampton et al., 2017). Bilingual parents of children with autism spectrum disorder (ASD) are sometimes advised to keep to a single language, often the majority language of the society (Lim et al., 2018). A handful of studies investigating whether bilingual exposure is associated with additional difficulties for the language development of children with ASD focused on receptive and expressive language (Ohashi et al, 2012), vocabulary (Petersen et al, 2012), structural and pragmatic language competence (Reetzke et al., 2015), and gestures (Valicenti-McDermott et al., 2013). A systematic review by Uljarevic et al. (2016) examined 50 studies and concluded that bilingualism has no negative effects on various aspects of functioning across a range of neurodevelopmental disorders and in the case of ASD, positive effects of bilingualism on communication and social functioning have been observed.
However, previous studies examining bilingualism in autistic children often exclusively relied on parental reports, they often excluded non-verbal children from the sample, and they sometimes did not include a general cognitive assessment of the participants to evaluate their level of general functioning. Crucially, previous studies often measured bilingual children's skills only in the language that is dominant in their society and do not report the child's development in the language used at home. This is a substantial gap in our current understanding.

Objectives: In this paper we aimed to address the gaps in previous research by avoiding the shortcomings identified above and critically, by studying children's linguistic development in all the languages spoken by a child.

Methods: Our study includes parental reports for all languages spoken by a child as well as direct data for English comprehension and production through face-to-face interactions with autistic children in England. Our data collection is still on going. To date, we collected parent-reported data from 39 children (6 females, 18 bilinguals, 5 trilinguals) and direct data from 30 children (3 females, 15 bilinguals, 3 trilinguals) aged 4;4-12;0. Our target is to present direct and parent-reported data from 60 autistic children, approximately half of whom would be bilingual.

Results: Preliminary results show that bilingual children's combined comprehension and production scores in English are significantly better than monolingual children's (M_{bil}=118.11, SD=28.19, M_{mono}=98.58, SD=18.89, F(1,28)=4.609, p=0.041). Additionally, bilingual children's production scores were significantly better than monolingual children's production scores (M_{bil}=54.50, SD=12.77, M_{mono}=43.92 SD=19.24, F(1,28)=4.282, p=0.048) in English. Finally, bilingual children also scored significantly higher than the monolinguals in the English comprehension task (M_{bil}=63.61, SD=6.94, M_{mono}=54.67, SD=17.72 F(1,28)=4.227, p=0.049). We also present qualitative data on children's linguistic performance in their second (and third) language(s).

Conclusions: These results provide empirical support for the view that multilingualism does not hamper the linguistic and communicative development in autistic children in the majority language (English). Further analyses will report on home language. This study is likely to offer the most comprehensive profile of language development in bilingual autistic children to date.

49 **235.049** Bilingually Exposed Children with Autism Spectrum Disorder: Language and Socio-Communication Outcomes

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Background: Despite concerns of many families and healthcare providers, emerging evidence suggests that bilingually exposed children with autism spectrum disorder (ASD) have similar language, behavioural, and cognitive outcomes to their monolingual counterparts. Furthermore, excluding children from exposure to the minority in favor of the majority language could lead to negative consequences, such as reducing engagement and closeness with family and community. Thus, it is important to understand the characteristics of families that maintain minority-language exposure and the associated positive or negative outcomes.
Objectives: The objectives were to (1) determine if families continue to use the minority language from ASD diagnosis until age six, (2) explore child and family characteristics associated with maintaining a minority language, and (3) compare children whose families continue to use the minority language to families who do not and to monolingually exposed children on majority-language and socio-communication outcomes at six years.

Methods: Data from 39 children with ASD exposed to a minority language by primary caregivers (*M* age =36.0 mo; *SD* =6.5; 74% males) and 17 monolingually exposed children (*M* age =35.1 mo; *SD* =5.5; 88% males) were drawn from the Canadian Pathways in ASD study. Children were assessed within four months of diagnosis (T1), one year later (T2), and at age six (T3). Children's language skills in the majority language were examined using the PLS-4 and CDI. Social and communication skills were assessed using the VABS-II Communication and Socialization subdomain scores.

Results: Only 30% of caregivers who reported primarily using a minority language with their child at T1 (*n* =21) still did so by T2. Mann-Whitney U and Chi-squared tests indicated that child age, IQ, ASD symptom severity, and language-level (minimally verbal vs. verbal) at T1, and caregiver level of education did not predict switching to the majority language. None who used a minority language as secondary at T1 (*n* =18) were using it as primary by T2. Only one of six families using a minority language as primary at T2 stopped by T3. Notably, 38% of caregivers stopped using the minority language entirely by T2: 7/21 who primarily used a minority language and 8/18 who used a minority language as secondary at T1. However, three families from each group re-introduced it by T3. Child and caregiver characteristics at T1 did not distinguish caregivers who stopped using the minority language. Importantly, at age six, ANOVAs with planned contrasts revealed no differences in expressive or receptive language, or socio-communication skills among children whose caregivers continued minority-language exposure (*n* =18), stopped minority-language exposure (*n* =14), and monolingually exposed children (*n* =17), who were matched on child and caregiver characteristics at T1 using propensity score matching.

Conclusions: Child and caregiver characteristics at ASD diagnosis did not distinguish between families who continued and families who stopped minority-language exposure during the preschool years. Further, bilingually and monolingually exposed children had similar majority-language and socio-communication outcomes. Our results add to growing evidence that bilingualism does not hinder majority-language development in ASD.

50 **235.050** Narrative Abilities in Bilingual and Monolingual Children with ASD

ABSTRACT WITHDRAWN

Background: Narrative skills are the product of the interaction of our cognitive, linguistic, and social-cultural knowledge (Losh & Capps, 2003). They allow us to examine how the mind makes sense of the self and the world, and therefore, research has been dedicated to studying narrative abilities in children with atypical cognitive development, especially children with autism (e.g., Diehl et al., 2006). Children with autism have been shown to have difficulty in organizing a coherent story and in explaining the mental states of characters (e.g., Losh & Capps, 2003). Moreover, given that narrative practices are culturally grounded, researchers are also interested in probing the effect of linguistic input and cultural context on narrative development (Heath, 1983; Wang & Leichtman, 2000). As narrative skills have been identified as strong predictors of later language and literary achievement for monolingual children (Paul & Smith, 1993), researchers have also been studying narrative development in a bilingual context (e.g., Uchikoshi, 2000). However, there has been virtually no research done on narrative abilities in bilingual children with autism.
Objectives: This study compared the narrative abilities between three groups of children-- typically developing Mandarin-English bilingual children, Mandarin-English bilingual children with autism, and English monolingual children with autism. The main objectives are: (1) to fill in the gap in current knowledge on narrative competence in bilingual children with autism, and (2) to study potential benefits or problems bilingualism can exert on the communicative competence of children with autism.

Methods: Nine typically developing bilingual children, 10 high-functioning bilingual children with autism, and 13 high-functioning English monolingual children with autism who are verbal participated in the study. The participants with autism were matched on mental age, and vocabulary size. Narratives were elicited using the wordless picture book, *Frog, Where Are You?* (Mayer, 1969), and the bilingual children were asked to generate a story in both languages. The narratives were analyzed according to their global structure, local linguistic structure, and the child's ability to provide evaluative comments.

Results: Comparisons between the monolingual children with autism and bilingual children with autism revealed no group differences. Comparisons between the two bilingual groups on the global structure revealed that bilingual children with autism included fewer story episodes and fewer types of orientations. However, both groups were able to grasp the theme of the story. With regards to the local structure, bilingual children with autism told stories of similar length, but employed less complex syntax and fewer types of conjunction, and also made more reference errors than their typically developing peers. Finally, the two groups did not differ significantly on the evaluative aspects of narratives.

Conclusions: This study was one of the first ones to investigate narrative abilities in bilingual children with autism. Results of this study demonstrated that bilingual children with autism did find certain aspects of narrative challenging, but their performance was comparable to that of monolingual children with autism, suggesting that bilingualism does not further impede language development in this population and that

verbal children with autism have the capacity to be bilingual.

51 **235.051** Language and Narrative Skills of School-Age Bilingual Children with Autism Spectrum Disorders

ABSTRACT WITHDRAWN

Background: Parents of bilingual children with Autism Spectrum Disorders (ASD) are often advised to communicate with their children using only one language (Hudry et al., 2017). Yet, the available evidence, largely from pre-school and kindergarten-age children, suggests that bilingualism does not hinder early language development in ASD (Hambly and Fombonne 2012; Kay-Raining Bird et al., 2016). Less is known about bilingual development in ASD at later ages, when language abilities become more complex and are used in academic settings. This knowledge is essential to inform childrearing and educational decisions for the growing number of families with a child with ASD living in bilingual contexts.
Objectives: The aim of the current set of studies was to compare the language skills of bilingual and monolingual school-age children with ASD without intellectual disability, using both standardized tests and a picture sequencing narrative task.

Methods: Participants were 6 to 10 year old speakers of French, English, Spanish or two of these languages. Results reported here are for their dominant language, which was always French or English, both majority languages in Montreal, Quebec. In study 1 we investigated the vocabulary and morphological skills of monolinguals (n = 14) and bilinguals (n = 13) with ASD using standardized tests. In Study 2 we analyzed the short narratives of four groups of French-speaking participants: bilingual children with and without ASD (n = 10), and monolingual children with and without ASD (n = 10). Children were given a set of three pictures depicting a scenario. They were asked to place the pictures in sequence and tell a story about it. The macrostructure (e.g., story's coherence) and microstructure (e.g., use of connectives) of the stories was assessed. In both studies groups were matched on chronological age, nonverbal IQ, symptom severity and maternal education.

Results: Study 1: both groups of children with ASD performed within the average range on the vocabulary test, but the monolinguals outperformed bilinguals. There was not a significant difference between groups on the morphology test, although there was a trend for monolinguals to perform better than bilinguals. Study 2: A main effect of diagnostic group was observed for narrative macrostructure, where typically-developing children performed better with respect to providing coherent narratives. There was no main effect of bilingualism. No significant differences were found in microstructure.

Conclusions: Similar results to those reported for typical development were found for vocabulary and morphological skills, where amount of language exposure plays an important role on language performance, and monolinguals outperform bilinguals when one language is assessed (e.g., Bialystok et al., 2010). Strikingly, however, functional language use during a brief narrative task was similar between groups, suggesting that the differences observed in Study 1 may not have a significant functional impact. For instance, children in all groups used correct grammatical gender, and connectives in their stories. These results provide new insights into the language skills of bilingual children with ASD, and are globally in line with prior work suggesting that bilingualism does not have a negative impact on language development.

52 **235.052** The Effect of Bilingualism and Verbal-Memory on Syntactic Abilities of Children with High Functioning Autism

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Background: Little is known about the influence of bilingualism and verbal memory on syntactic abilities of children with High Functioning Autism (HFA). Previous studies exploring syntactic abilities of monolingual children with HFA show large variability (e.g., Roberts, Rice, & Tager–Flusberg 2004). Some monolingual children with HFA have intact morphosyntactic abilities (Kjelgaard & Tager-Flusberg 2001, Novogrodsky 2013), while others show impaired syntax (e.g., Durrleman, Marinis & Franck 2016). Similar picture is shown for verbal memory. Some studies report lower verbal memory in children with ASD as compared to peers with Typical Language Development (TLD), others do not confirm this gap (Durrleman et al. 2017; Schaeffer, 2018). Moreover, it is not clear whether syntactic abilities of children with HFA are linked to deficiencies in verbal memory.
Objectives: The current study assessed separate and combined effects of bilingualism and HFA on verbal memory and syntactic abilities of children. Additionally, it explored to what extent syntactic abilities are associated with the capacity of verbal memory in children with HFA and TLD.

Methods: Eighty-seven monolingual Hebrew-speaking and bilingual Russian-Hebrew-speaking children aged 4;6-9;2 participated in the study: 29 children with HFA (17 monolingual and 14 bilingual) and 58 children with TLD (28 monolingual and 30 bilingual). The groups were matched for age and non-verbal IQ. Syntactic abilities were assessed using LITMUS Sentence Repetition tasks-30 (bilingual children were tested in each of their two languages) based on Armon-Lotem and Meir (2016). In both languages, the test includes 30 sentences that represent simple structures (e.g. SVO sentences with obligatory and optional prepositions) and complex structures (e.g. biclausal sentences with coordination and subordination, object *wh*-questions, relative clause sentences and conditionals). Structures that are specific to one language were included (e.g., subject relatives for Russian; oblique *wh*-questions for Hebrew). Verbal memory was evaluated based on Forward Digit Span for verbal short-term-memory and Backward Digit Span for verbal working memory.

Results: As a group, children with HFA had lower scores compared to their TLD peers on measures of syntactic abilities and verbal memory. However, some monolingual and bilingual children with HFA showed intact syntactic abilities, while others scored at risk for Language Impairment. The syntactic errors of the children at risk for Language Impairment were like those of children with Developmental Language Disorder. Importantly, syntactic abilities in children with HFA were not associated with their verbal memory skills. Furthermore, no differences in verbal memory were found between children with HFA who were at risk of Language Impairment and children with no risk. Our findings showed that bilingualism similarly affected syntactic abilities of children with TLD and HFA, demonstrating that bilingualism is not an impeding factor for language and cognitive development of children with HFA.

Conclusions: To conclude, our study demonstrates that (1) regardless of languages status (bilingual versus monolingual), children with HFA at risk for Language Impairment exhibit impaired syntax similarly to those reported in the literature for children with Developmental Language Disorder, and (2) syntactic difficulties in children with HFA are not attributed to deficient verbal memory.

53 **235.053** Pronoun Use in Monolingual and Bilingual Children with ASD

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Background:
Monolingual children with Autism Spectrum Disorder (ASD) show deficits in linguistic abilities that involve perspective-taking and pragmatic judgments[1]. For example, monolingual children with ASD have notorious problems with pronoun use[2]. In children with typical language development (TLD), pronoun use is related to syntactic knowledge, discourse-pragmatic knowledge, Theory of Mind (ToM) skills and Executive Functioning [3]. Little is known about the interface of ASD and bilingualism. Many parents of bilingual children with ASD are fearful of speaking their native language to their children, because they worried that dual-language exposure would confuse the children or exacerbate their impairments[4]. Moreover, parents receive advice from professionals to refrain from an additional language and to maintain a monolingual environment for children with ASD[5].

Objectives:

In the current study, we assessed pronoun production in monolingual and bilingual children with and without ASD and explored the relationship between pronoun use and children's ToM skills, Executive Functioning and complex syntax.

Methods:

Forty-five monolingual Hebrew-speaking children (28(18f/10m) with TLD and 17 (1f/16m) with ASD and 44 bilingual Russian-Hebrew-speaking children (30 (16f/14m) with TLD and 14 with ASD (3f/11m)) aged 4;6-9;2 participated. Bilingual children with and without ASD were raised in Russian-speaking families in Israel and spoke Russian as their Heritage Language and Hebrew as their Societal Language. Children with ASD received their diagnoses by a multidisciplinary team of specialists prior to the study, and it was verified using the Autism Diagnostic Observation Schedule (ADOS[6]) as part of the study assessment battery. All children scored within the norm on non-verbal IQ[7].

The pronoun elicitation task elicited third person pronouns in subject and object positions in Hebrew. In addition, we measured children's ToM skills; Executive Functioning (Inhibition and Verbal Working Memory), and complex syntax.

Results:

The results indicated an effect of Clinical Group, no effect of Language Status and no interaction between the two variables. The use of pronouns was lower in children with ASD as compare to their TLD peers. Children with ASD omitted pronouns more frequently in obligatory positions and/or produced more noun phrases instead of pronouns as compared to children with TLD. Importantly, bilingual children showed similar performance to their monolingual peers.

In the ASD group, pronoun use was associated with ToM skills and complex syntax, while no associations were detected between pronoun use and Executive Functioning measures. A further step-wise regression analysis showed that 39% of the variance of the pronouns use in children with ASD is explained by complex syntax, and 10% of the variance is explained by ToM skills.

Conclusions:

To conclude, the findings show that pronoun use is impaired in children with ASD, yet bilingualism is NOT an aggravating factor for children with ASD, which is reflected in the similar performance of bilingual and monolingual children with ASD. The core deficit of pronoun use in children with ASD is associated with their complex syntax and ToM difficulties.

54 **235.054** Access to Multiple Speaker Contexts Predicts Pronoun Acquisition and Use in ASD

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Background:
Children with ASD often display atypical patterns of pronoun development, including increased prevalence of pronoun reversals and avoidance relative to typically-developing peers[e.g.1]. Pronouns are difficult to acquire, in part, because of their shifting referents—*I* refers to myself only if I am the speaker. Contexts in which there are multiple speakers may thus be ideal for learning the meanings of personal pronouns: shifting referents for singulars (e.g. I, you) are more likely to be visible and easier to map[2,3]. Additionally, multiple speaker contexts are likely to provide more exposure to plural pronouns (e.g. we, us).

Objectives:

The goal of the study was to determine what role, if any, access to multiple speaker contexts play in the acquisition and proper use of personal pronouns in children with ASD.

Methods:

Participants were 119 caregivers of children with ASD (2;2 – 5;11, 102 male) who completed a survey about their child's language acquisition. Caregivers reported their child's language level (one word, phrase speech, or sentence level), pronoun use, and household environment. Pronoun questions asked about the age at which children acquired 21 personal pronouns and how well they use them now (correctly, errorful, or not at all). Household environment questions included the percentage of time they spent in the presence of two or more people, which we used as a proxy for time spent in multiple speaker contexts.

Results:

Acquisition

Principle component analysis was conducted on the age of acquisition (AoA) of all pronouns. Results yielded three components with eigenvalues >1 (75.6% of the variance explained). Components are best described as: singular first- and second-person pronouns (e.g. I, you), singular third-person pronouns (e.g. she, him), and plural pronouns (e.g. us, them). To determine the role of multiple speaker contexts on AoA, we conducted a series of linear regressions predicting component scores from multiple speaker context time and language level (see Table 1). Findings demonstrated that language level positively predicted scores on all three components (first/second: p <.001, third: p <.001, plural: p =.003). Multiple speaker contexts additionally predicted unique variance for plural pronouns (p = .018), but not first/second (p = .8) or third (p = .48).

Use

Point-biserial correlations were conducted to determine if access to multiple speaker contexts was related to current use (correct or errorful; those who had not yet acquired that pronoun were excluded from analysis). Access to multiple speaker contexts was positively related to the

correct use of first- and second- person pronouns: me (r = .343, p = .001), my (r = .222, p = .032), you (r = .244, p = .018), your (r = .227, p = .013), yours (r = .252, p = .006).

Conclusions:

Findings demonstrated that multiple speaker contexts play a positive role in the acquisition of personal pronouns for children with ASD. Specifically, multiple speaker contexts were related to the AoA of plural pronouns, and the correct use of first- and second- person pronouns. This finding has implications for pronoun-related interventions, as well as for theories of pronoun development more broadly.

55 **235.055** Refining the Scope of Language Impairment in Individuals with ASD through the Assessment of Complex Sentences

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Background: Language is developing atypically in all individuals with ASD, although there is considerable variation in exactly which aspects of language are affected and whether this results in a Language Impairment(LI, Kjelgaard & Tager-Flusberg, 2001). Recent cross-linguistic experimental work has shown that an atypical development of complex sentence comprehension emerges in individuals with ASD (Durrleman et al., 2016; Prévost et al., 2017; Riches et al., 2011), which is often related to a history of (potentially undetected) LI (Modyanova et al., 2017). Object-initial sentences, i.e., sentences that alter the subject-verb-object default word order of German, can be disambiguated by morphological (i.e., case and/or number) marking. Case-marking on nouns was shown to enhance the processing of object-initial sentences in neurotypical children before number does, but the co-occurrence of both case and number supports processing abilities in children with LI (Stegenwallner-Schütz & Adani, 2018).

Objectives: We provide a fine-grained assessment of complex sentence processing abilities in individuals with ASD and an exploration of which morphological properties may alleviate their expected processing difficulties. Towards this end, we manipulated number- and case-marking on two types of object-initial sentences in German: Object-Verb-Subject (OVS, e.g., *The dog kicks the zebra* [English translation], in which *zebra* is interpreted as the agent of the action expressed by the verb *kick*) and Object-Relative Clauses (ORC, e.g., *Where is the dog that the zebra is kicking* [English translation; notice that number- and case-marking are not reported in the English translation]).

Methods: German-speaking individuals with ASD (N=26 [2 girls]; mean age: 11;10 [y;m]; age range: 6;10-15;3) and their neurotypical age-matched controls participated in a picture-selection task (OVS-study) and in a referent identification task (ORC-study). Test and filler sentences were presented auditorily and the participant had to select the target picture/referent. Based on a detailed battery of psycholinguistic standardized tests tapping into expressive/receptive vocabulary, morphology and syntax, we identified a subgroup of individuals with ASD with co-occurring LI.

Results: The accuracy results reveal an impaired comprehension of OVS sentences (proportion correct: 0.63, SE: 0.04) and of ORC (proportion correct: 0.25, SE: 0.05) by individuals with ASD with co-occurring LI, compared to neurotypical controls. While case-marking enhanced the accuracy of ORC (both in the ASD and the neurotypical groups), number-marking revealed a facilitative effect neither on OVS nor ORC in the ASD group. The performance by the group of individuals with ASD without LI and the neurotypical controls did not differ on any of the comparisons. The reported effects are significant at the statistical significance level of $p<0.05$.

Conclusions: OVS and ORC sentences are complex linguistic structures, whose correct comprehension appears to be vulnerable in individuals with ASD, particularly when this condition co-occurs with LI. The apparent lack of deployment of number-marking during OVS processing also qualifies as a risk factor, which is not attested in neurotypical development. In contrast, the sensitivity to case can be identified as one of their strengths. Our results highlight the effectiveness of psycholinguistic investigations in the identification of risk and protective factors during language development in ASD.

56 **235.056** Cross-Modal Coordination of Face-Directed Gaze and Emotional Speech Production in Adolescents with ASD

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Background: The facial and vocal expressions of individuals with autism are often perceived as awkward (Grossman 2015, Faso et al. 2015, Sasson et al. 2017), which may be caused by atypical timing and synchrony of movements across face regions (Guha et al. 2016, Metallinou et al. 2013). Additionally, there are a range of findings for eyegaze to the face in ASD (Papagiannopoulou et al. 2014, Falck-Ytter & von Hofsten 2011). Despite an increased interest in cross-modal integration in ASD, there are no investigations to date into the relationship between speech production and emotional facial movements, nor whether face-directed gaze relates to facial-expression quality in ASD.

Objectives: In an emotional speech mimicry task, we predict that adolescents with ASD will make primarily lower-face movements to support speech production, but not make concurrent upper-face movements to express emotion. We also expect that adolescents who spend more time gazing at the face of a video model will produce more upper-face movements for emotional expressions.

Methods: Participants watched and mimicked videos of adolescents producing two-sentence combinations (a neutral sentence followed by an emotional one). We recorded acoustic measures of verbal speech (intensity, F0, etc.), facial motion capture (32 markers across the face), and eye-tracking data (dwell time to face) from 13 adolescents with ASD and 19 neurotypical (NT) adolescents. We used Granger causality to measure the strength of coordination between facial movements and acoustic measures: strong Granger causality indicates rigid speech-face dependence with few effective degrees of freedom, whereas weak Granger causality indicates independent control of the face and voice. We obtained Autism Quotient (AQ) scores as a continuous measure of autism features and used linear mixed effects models to analyze the relationship between AQ and (1) Granger causality between speech-face patterns and (2) face-directed gaze.

Results: Participants with more autistic features (i.e. high AQ scores) have greater cross-modal dependence than low-AQ adolescents ($\chi^2(7)=1541.9$, $p<0.05$). A linear mixed effects model with random slopes for AQ by motion capture marker demonstrates the effect of AQ is stronger for the lower face (lower cheek, mouth, chin) than for the upper face (eyes, eyebrows, forehead) ($U=595$, $p<0.05$).

AQ scores also interact with face-directed gaze. Specifically, the slope for net dwell time on any part of the face is steeper for children with high AQ (linear mixed effects model; all $p<0.05$): Heightened visual attention to the face results in greater speech-face dependence in high-AQ participants, but less dependence in low-AQ participants.

Conclusions: High-AQ adolescents have greater cross-modal dependence, suggesting they move all facial regions primarily for speech production

but not for additional emotional expressivity in an emotional-speech mimicry task. In contrast, low-AQ participants produce more facial feature movements not directly related to speech, particularly in the upper face (e.g. eyebrow raises), which can transmit emotional expressivity without being tied to the rhythm of lower-face speech movements. Contrary to our prediction, the difference between high- and low-AQ participants is *amplified* by greater visual attention to an emotional face.

57 **235.057** A Comparative Study of Verbal Autistic Children on Language Skills Using the CCC-2 - Brazilian Version

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Background: Social communication problems is a core group of symptoms for the diagnostic definition of autism spectrum disorders (ASD). In low or middle developed regions of the world, frequently it is difficult to find speech therapists and other speech specialists with adequate clinical experience in ASD, in order to provide screening or assessment of language problems or even for identify ASD children correctly. Consequently, caregivers self administered questionnaires or inventories for language symptoms could be an useful and practical way to perform screening for ASD in verbal competent children.

Objectives: To investigate comparatively the performance of CCC-2 on verbal ASD children in the subscales and global assessment for social communication problems and its potential for application as screening instrument for ASD

Methods: The study design was an observational, cross sectional, comparative case-control study design with two groups. The case group (N=20) was composed by verbal ASD children from four to sixteen years of age. The control group (N=20) was composed by typically developed children of the same age profile and sex distribution and free of behavioral or language problems. ASD children and their caregivers were recruited from the Child Psychiatry Outpatient Clinic of the University Hospital at the School of Medicine of Ribeirao Preto, University of Sao Paulo, Brazil. We use the Brazilian version of CCC-2 (*Children's Communicative Checklist – second edition),* originally developed by Bishop (1998) and translated from english to Brazilian portuguese by Costa and colleagues (2013). The diagnosis of ASD was performed according to the current DSM-5 (American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders – Fifth edition) criteria by a team of trained child psychiatrists, according to the standardized clinical protocol of the Child Psychiatric Outpatient Clinic.

Results: No statistically significant difference was found regarding socioeconomic variables as well regarding educational level of parents. The GCC (General Communication Composite) Standard score of the ASD group reached a lower mean value (M = 82.35; SD = 13.34) in comparison with the control group (M = 105.1; SD = 7.98). The difference of means was statistically significant (F = 42.83; p < 0.001). The ROC analysis identified a cutoff point for the GCC score of ≤ 95 with 85% sensitivity and 90% specificity (AUC = 0.936; p < 0.001). When using the GCC Percentile Rank, we found a mean score for the ASD group of 19.30 (SD = 19.63) and of 62.05 (SD = 18.50) for the control group. The difference of the mean GCC Percentile Ranks between the two groups was statistically significant (F = 50.25; p < 0.001). The ROC analysis for the GCC Percentile Rank identified a cutoff point at percentile ≤ 37, with 85% sensitivity and 90% specificity (AUC = 0.936; p < 0.001).

Conclusions: The results demonstrate a good discriminating performance of the CCC-2 Brazilian version for the screening and high suspicion for the identification of verbal ASD children.

58 **235.058** A New Approach for Assessing Social Communication in ASD: Elsa

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Background: Natural language samples can be a useful tool in the assessment of expressive language in ASD (Barokova & Tager-Flusberg, 2018; Tager-Flusberg et al., 2009). Expressive language is also central to social communication, which makes language sampling a great candidate for the evaluation of deficits in this domain – part of the core defining features of ASD. Yet, no study has examined the feasibility of using sample-derived measures in place of or as a complement to standardized assessments of communicative skills in ASD. Furthermore, sample-derived measures have been proposed to be good candidates for valid and reliable clinical outcome measures (Abbeduto, 2017; Barokova & Tager-Flusberg, 2018)

Objectives: We aimed to validate the utility of the *Eliciting Language Samples for Analysis* (ELSA) protocol for individuals with ASD as a tool for assessing social communication. We focused on the associations between ELSA-derived expressive language measures and scores on standardized assessments of communication and socialization – Vineland and SCQ.

Methods: We collected ELSA samples from 40 participants with ASD across a wide range of age, language ability, and symptom severity (Table-1). ELSAs consisted of activities with developmentally appropriate toys, eating a snack, watching a short movie, and a conversation about participants' interests (Barokova et al., 2017). All samples were coded by naïve coders in real-time using ELAN (Sloetjes & Wittenburg, 2008). Frequency of speech utterances and number of conversational turns per minute were extracted from the coded files. Participants' ASD diagnosis was confirmed with the administration of the ADOS. Vineland and SCQ questionnaires were collected from participants' parents.

Results: Frequency of utterances and number of conversational turns per minute were significantly correlated with the Vineland Communication Standard Score (for frequency: r_s **(38) = .592, *p* < .001, Figure-1;** and for turns: r_s **(38) = .595, *p* < .001**) and with the Vineland Standard Socialization Score (r_s **(38) = .514, *p* = .001** and r_s**(38) = .503, *p* = .001**). Frequency and conversational turns were strongly correlated with the SCQ Communication Subscore (r_s **(33) = .665, *p* < .001**, and r_s **(33) = .666, *p* < .001**) and moderately correlated with the SCQ Reciprocal Social Interaction Subscore, as well (r_s **(33) = .422, *p* = .011**, and r_s **(33) = .404, *p* = .016**).

Conclusions: The ELSA-derived expressive language measures were positively correlated with gold-standard measures of social communication, which provides preliminary support for the use of language sampling as an alternative method of assessment in this domain. These findings have laid the foundation for research focusing on the use of language sampling as a measure of autism symptoms that go beyond expressive language ability alone. Future work should examine the convergent and divergent validity of the frequency of utterances and conversational turn measures, as well as identify expressive language proxies for restricted interests (e.g., number of topics discussed) and repetitive behaviors (e.g., amount of verbal imitation).

59 **235.059** A Speech Generating Device Intervention with Peer Partners: Effects on Functional Communication of Preschoolers with

Autism

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Background: Communication is the most targeted outcome of AAC interventions, with positive outcomes reported in studies that incorporate speech-generating devices for individuals with ASD. There is a lack of studies reporting interventions to improve communication with peers without disabilities. Our recent studies fill this void by reporting positive outcomes of integrating peer-mediated and SGD approaches on communication of preschoolers with ASD (Thiemann-Bourque et al., 2017; 2018).
Objectives:

To describe instructional peer training and SGD strategies documented to increase communication between children with ASD and peers, including generalization and maintenance of gains.

Methods: Effects were examined using a multiple-baseline design across six dyads (i.e., one child with ASD; one peer). We taught peers to be responsive partners using *Stay-Play-Talk with SGD* strategies (Thiemann-Bourque et al., 2017). To decrease time in baseline, the six dyads were split into three groups. Following a stable rate and no upward trend in communication measures, peers in the first group started treatment while baseline continued for the other two pairs. Peer training (PT) was conducted for 90 min, then the peers joined their buddy with ASD in 15-min classroom activities. The next pair then entered PT and began the weekly sessions; this was repeated until all peers were trained. Data was collected 2-3 times/week across baseline (range 4-10), treatment (range 20-31), generalization (6), and follow up (3) phases. Dependent measures included rates of child and peer communication acts, means (gestures, SGD, speech, and speech+SGD), and functions (request objects, request actions, comments, and request attention). Social validity was assessed by naïve judge's ratings of pre- and post-treatment video clips.

Results: Positive intervention effects for the children with ASD and peers were noted, and replicated across all six dyads. Across all dyads, children with ASD improved from a baseline average of 2 acts to 22 in treatment; peers improved from an average of 4 acts to 25 in treatment. Both partners generalized improvements (16 acts for focus; 16 acts for peers) and were able to maintain progress post-treatment (23 acts for focus; 25 acts for peers). Calculation of Tau-U revealed large effect sizes, with a combined Tau-U of .99 for the focus children and .94 for the peers. Treatment fidelity was 89% (average) for school staff and 83% for peers. Three children began to use different means including greater speech and speech+SGD; and three children used more gestures and SGD. Greatest changes were observed in functions to requests objects, followed by comments, then requests for actions with minimal changes in requesting attention. Social validity outcomes were positive, showing improved social ratings for children with ASD and peers.

Conclusions: Communication rates improved markedly for both partners, and the children with ASD used varied means following treatment with half beginning to use more speech. Future research is needed to examine strategies to increase other communicative means and functions that will maximize social success of minimally verbal children with ASD in inclusive environments.

60 **235.060** Abnormal Cry in Toddlers with Autism Spectrum Disorder: A Comparative Analysis of Acoustic Features of Cry in Clinical and Non-Clinical Populations.

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Background: Preverbal vocalizations, e.g. crying and babbling, have been found to reflect characteristics of a child's target language, especially with regard to a language's prosodic (melodic) patterns (Boysson-Bardies et al. 1984; Mampe et al. 2009). Differences in prosody are one of the most common clinical features and among the earliest characteristics of Autism Spectrum Disorder (ASD) to be identified (Kanner, 1943; Dieh & Paul 2012). However, few studies have examined prosodic differences in vocalizations of toddlers with and without ASD (Sheinkopf et al., 2012; Venuti et al., 2012).
Objectives: This study was designed to investigate whether the cries of toddlers with ASD differ from the cries of their typically developing peers across four acoustic features of prosodic contours (duration, fundamental frequency (f_0), standard deviation of fundamental frequency, and peak frequency). It was hypothesized that the acoustic correlates of cry melodies of toddlers diagnosed with ASD would differ significantly from those of toddlers with typical development (TD) with the same native language.

Methods: As part of a larger study, seven toddlers with ASD (M_{age}=24.4 mo, SD=3.5) from monolingual English-speaking households were administered the ADOS-2 (Mod T) by research-reliable assessors, and the sessions were recorded and coded for crying. Previously published audio data for the TD group (n=13, M_{age}= 31 mo (SD=6)) were collected at home during tantrums with a LENA device (Green et al., 2012). Each cry was analyzed for four acoustic features (ASD, n=506 samples; TD, n=250); duration, fundamental frequency (f_0), standard deviation of fundamental frequency (SD f_0), and peak frequency.

Results: Independent sample T-Tests indicated that each of the four basic acoustic measures of cries were significantly different between groups (Table 1). Average duration was found to be shorter in the ASD group ($p=0.003$). Mean F_0 ($p<0.0001$) and SD f_0 ($p=0.01$) were found to be higher in the ASD group. Mean peak frequency was found to be lower for the ASD group ($p<0.0001$).

Conclusions: Each of the acoustic measures differed between the cries of children with ASD and the cries of children with TD in meaningful, predictable ways (Sheinkopf et al., 2012). Cries of children with ASD showed a higher mean fundamental, but also a lower peak frequency, meaning that the cries were higher in pitch overall, but were showed less modulation, which describes a flatter, less prosodically diverse cry. Higher average SD f_0 was found in the ASD group, indicating that the cries were more variable, thereby suggesting less structure. Overall, these results suggest that the ASD group did not follow the basic prosodic pattern of their native language, which can be analyzed by constructing and comparing average melody contours of cries from each group. Planned analyses include construction and comparison of average melody contours of cries from each group, which would graphically describe differences in the melodic structures of the cries.

61 **235.061** Acoustic-Perceptual and Quantitative Analysis of Grammatical Prosody in Adolescents with Autism

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Background: Published empirical research is contradictory regarding the specific characteristics of atypical prosody among individuals with Autism Spectrum Disorder (ASD). It has been suggested that individuals with ASD have atypical pragmatic and affective prosodic abilities while grammatical prosodic abilities are relatively spared (Shriberg et al., 2001). However, there is some preliminary evidence that individuals with autism exhibit acoustic or perceptual differences in grammatical prosody (e.g., Grossman et al., 2010). Research is sparse regarding the specific features of grammatical prosodic abilities among individuals with ASD. It is important to reliably and validly identify and quantify grammatical prosodic features that contribute to the perception of "unnatural" speech of some individuals with ASD.
Objectives: This research addressed the following questions: 1) Do individuals with ASD perform significantly different on perceptual and acoustic measurements of expressive lexical stress and phrase stress tasks as compared to a TD comparison group?; 2) Do individuals with ASD perform significantly different on receptive lexical stress and phrase stress tasks as compared to TD controls?; 3) Do trained listeners who are blind to stimulus item and diagnostic category judge individuals with ASD as sounding more "unnatural" than their TD counterparts using a novel acoustic-perceptual rating scale to assess lexical and phrase stress?

Methods: A between-group study was conducted to investigate grammatical prosodic abilities among individuals with ASD (n=11; ages 13;11 to 19;11 years) in comparison to typically developing (TD) controls (n=11) matched for age, gender, and receptive language. Each group consisted of 7 males (63%) and 4 females (36%). Participants with ASD and their TD counterparts were monolingual English speakers. Four tasks from the Profiling Elements of Prosody in Speech-Communication 2015 (PEPS-C 2015) were administered to assess: 1) the perception and production of lexical stress in two-syllable words; and 2) the perception and production of a noun phrase versus a compound noun within short sentences. Receptive tasks required the participant to select a picture that corresponded with the utterance they heard from a recorded standardized test battery. Expressive tasks were rated by trained listeners using a set of predefined perceptual and acoustic measurements.

Results: The group of individuals with ASD performed significantly less accurate on the expressive Lexical Stress (p= .021) and Phrase Stress (p= .0001) subtests (PEPS-C-2015). Acoustic findings revealed significantly longer duration of utterances (p< .05) among the group with ASD. The individuals with ASD performed significantly less accurate on the receptive Lexical Stress (p= .001;) and Phrase Stress (p= .009) subtests on the PEPS-C (2015). Large effect sizes were evidenced (*Cohen's d* >1). Individuals with ASD were significantly more likely to be rated as sounding "unnatural" or "atypical" as compared to TD controls.

Conclusions: The outcomes of this investigation show that there are specific differences in the production of lexical stress and phrase stress that contribute to the perception of unnatural or atypical prosody among some individuals with ASD. Atypical prosody may contribute to communication and social impairments. The impact of language on prosody, its clinical implications, and directions for future research are enumerated.

62 **235.062** An Application of Generalizability Theory to Characterize Language Learning Interactions for Young Children with Autism in Their Inclusive Classroom

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Background:
For children with autism spectrum disorder (ASD), features of the disorder can impact the nature, frequency, and length of adult-child interactions important for language learning (Carpenter & Tomasello, 2000; Landa, 2007; Wetherby et al., 2004). Given the important role that interactions play in language learning for young children, it is important to examine the means by which inferences may be made about children's language learning environments. In other words, inferences about the nature, frequency, and length of interactions that produce clinical effects are based on researchers' systematic observation and sampling of certain behaviors for certain periods of time within certain settings (Irvin, Boyd, & Odom, 2015; Irvin, Hume, Boyd, McBee, & Odom, 2013; Sanders et al., 2016; Yoder, Lloyd, & Symons, 2018). The sampling approach relative to different facets of measurement (e.g., observers, occasions, contexts) contribute variability that may have a significant, yet often overlooked, impact on the inferences that may be made by researchers when interpreting their results (Webb, Shavelson, & Haertel, 2006).

Objectives:

Guided by generalizability theory (g-theory; Cronbach, Rajaratnam, & Gleser, 1963; Shavelson & Webb, 2006), the study objectives are to (a) describe methods for characterizing language learning environments of young children with ASD based on relevant measurement facets and (b) provide empirical guidance for conditions of measurement that should guide future investigations to optimize both the reliability of inferences and efficiency of data collection.

Methods:

Using systematic observation methods, video recordings of interactions between 10 children, ages 3- to 5-years-old with ASD, and adults in their inclusive preschool classrooms during exploratory play are being examined. Consistent with g-theory, two measurement facets were identified: occasions and observers. As such, 15-minute recordings for each participant are being gathered across four occasions within a three-week timespan. After ensuring 90% agreement across observers, each observer is coding each video for frequency and type of adult language behaviors (i.e.., open-ended questions, yes/no questions, choice questions, completion prompts, imitations, comments) and child communicative acts. The generalizability study is utilizing a *person x occasion x observer* random effects Analysis of Variance (ANOVA) model. A decision study will follow with levels of occasions and observers manipulated to determine the optimal conditions of measurement that lead to stable estimates of observed frequencies and types of adult behaviors and child communicative acts.

Results:

With the investigation underway, the researchers will present results of the generalizability study, displaying estimates of magnitude with which (a) variability in the person, (b) variability in the facets (i.e., occasions and observers), and (c) variability of the interaction of the person with the facets contribute to the observed measures of adult and child behaviors. Likewise, the researchers will present the results of the decision study, such that the impact of various levels of facets on error variance can be seen.

Conclusions:

The researchers will provide guidance on measurement conditions that are most relevant for researchers in interested in sampling language behaviors in inclusive preschool environments and provide recommendations for incorporating g-theory into investigations utilizing systematic observation methods.

63 **235.063** An Automated Measure of Conversational Semantic Coherence

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Background: Complex conversational impairments in people with autism (focus on special interests or topically inappropriate responses) are well identified but their measurement requires time-consuming manual annotation of language samples. Natural Language Processing (NLP), and especially vector-based semantic methods, have shown promise to identify semantic difficulties in ASD on tasks such as semantic fluency and narrative retelling when compared to a clinician-annotated TD reference transcript. Whether or not such tools can establish language-based differences in conversational transcripts without recourse to a reference document remains to be established.
Objectives: Our goal was to develop a novel NLP measure of semantic coherence that could be employed with transcripts of conversational language in children. We hypothesized that semantic coherence, as measured by this method, would discriminate between children with or without ASD, and that more variability would be found in the group with ASD.

Methods: **Participants:** We used data from 70 subjects (38 ASD, 32 TD) age 5 to 8, all males, enrolled in a language study (ERPA). All participants were administered a battery of standardized diagnostic and neuropsychological tests, including the ADOS Module 3, the WPPSI-III, and WISC-IV. **Measures:** ADOS were recorded and subsequently transcribed verbatim using Praat software. The language output of each child during the emotion/conversation section was used in these analyses. **Analyses:** Transcripts were converted to vectors via application of a word2vec model trained on the Google News Corpus. Pairwise similarity across all subjects and a sample grand mean were first calculated. Using a leave-one-out algorithm a pseudo-value representing each subject's contribution to the grand mean was generated, and means of pseudo-values were then compared between the 2 clinical groups. Analyses were co-varied for non-verbal IQ (NVIQ), Mean length of utterance in morphemes (MLUM) and number of distinct word roots (NDR).

Results:

Statistically significant differences in mean of the pseudo-values between TD and ASD groups (Wilcoxon rank sum test, p = 0.007).

- TD subjects typically have a higher pseudo-value score suggesting that similarity scores of TD subjects are more similar to the overall group mean.
- Greater variance in the pseudo-values of the ASD group.
- Analysis of covariance suggests that none of NVIQ, MLUM, or NDR account for the difference between group means.

Conclusions:

The findings suggest that NLP methods can be effectively used to identify specific semantic difficulties that characterize children with ASD. The method is automated and does not require costly and time-consuming annotation by expert clinicians. Our results are preliminary and need to be replicated in larger samples, and older age groups. Likewise, we would need to replicate our findings in language samples collected in more natural ecological settings. Future developments of NLP methods might help to provide fine-grained differentiation of types of semantic divergence in a conversation or locate in a conversation the time and context when divergence from topics occur. Future improvements of NLP methodology may also yield new, cost-effective and sensitive outcome measures applicable to treatment research. Furthermore, more precise documentation of semantic impairments in ASD may inform new intervention strategies in language therapy.

64 **235.064** Are Variations in Narrative Language Reflected in Early Auditory Processing Via ABR?

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Background: Autism Spectrum Disorder (ASD) is a developmental disorder affecting both social interaction and verbal communication (APA, 2013). Children with ASD demonstrate differences or delays in language development compared to typically developing (TD) children (Tek et al., 2013), as well as in aspects of brain development such as auditory brainstem response (ABR, Russo et al., 2008, Pillion et al. 2018). ABR is a measure of early auditory processing characterized by five waveforms occurring in various locations of the brainstem in response to a stimulus onset. Recent research has demonstrated that children with higher ABR stability show enhanced phonological and grammatical performance on experimental tests (Tecoulesco et al., 2018). Children with ASD also demonstrate challenges with narrative language, which seems less coherent and includes fewer causal connectors compared to TD peers (Baixuali et al., 2016). The current study investigates connections between measures of narrative language and concurrent ABR processing.
Objectives: The current study investigates how disturbances in early stages of auditory processing might account for variability in the narrative language of children with ASD, including lexical, discourse, and coherence measures.

Methods: Participants included twelve children with ASD; six have been completely coded. Their average age was 12.33 years (SD=3.01), average Matrices subtest score was 19.50 (SD=8.87), CELF scores were 36.67 (SD=6.31; FS) and 30.67 (SD=5.20; WC), and ADOS scores were 8.17 (SD=4.36). Children were assessed in their home; the narratives came from the ADOS tasks, including Objects, Cartoon, Tuesday storybook. Narratives were transcribed, and coded using CLAN. The Cartoon and Objects narratives were rated by seven naïve adults on story coherence, using a Likert scale (1 (easily followed) to 7 (very difficult to follow)). ABRs were recorded from scalp electrodes with a click stimulus (31.1/sec, 2000 trials) and a 40 millisecond "da" stimulus (10.9/sec, 6000 trials) presented at 80 dB SPL to the right ear. Wave V latency plus click and /da/ response stability (Fisher transformed Pearson's r-values), served as the primary dependent measures of sound encoding.

Results: Correlations performed between the ABR stability measures and language measures (total words, noun types, utterances, conjunctions, discourse markers) revealed consistently negative relationships: children with ASD who produced *more* of each of these measures in their narratives showed *lower* click and /da/ stability (-.981 < *r*s < -.823, *p*s < .01). No significant relationships emerged between the language measures and the ABR latency measures; however, the ratings of narrative coherence correlated marginally significantly and positively with click latency (r = .731, p = .099).

Conclusions: Significant relationships emerged between children with ASD's narrative language and their early auditory processing. The directionality of most of these relationships was surprising, as children who produced more varied words in a number of categories showed less

ABR stability. However, children whose narratives were rated as less coherent tended to have longer ABR latencies. Caution is needed before drawing conclusions because of small sample size as well as a limited number of language measures. Future analyses will include twice as many participants, plus additional grammatical measures from the narratives.

65 **235.065** Assessing Audio-Visual Integration in Speech in Minimally Verbal Young Children with Autism Spectrum Disorder

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Background: Poor integration of speech sounds with the mouth mouvements likely contributes to language acquisition deficits in young children with autism spectrum disorder (ASD). However, currently existing evidence of multimodal integration deficit in autism is either limited to older high-functioning, verbal individuals or implements preferential gaze paradigms that are used in infant research, but, as we show, are not optimal to investigate pre-scholers.
Objectives: We designed a Reinforced Preferential Gaze paradigm that overcomes biaises in the previous research and allows to test multimodal integration in young, non-verbal children with ASD.

Methods: *Participants:* 31 non- or minimally verbal children with ASD (35–72 months) and 44 TD children (36–72 months)

Video stimuli are limited to the mouth region and consist of a 5 sec recording of 3 identical consonant-vowel syllables, so that three clear articulatory mouvements can be easily mapped on three salient acoustic events, associated with the consonant. In each trial, the *stimulus presentation phase* is followed by a 1 s *transition* blank screen, after which starts a visually attractive 3 s reward animation. see The position of the reward can be anticipated only based on temporal alignment between the video and the audio components of the stimuli: for half of the children in each group (TD or ASD), the reward consistently appeared on the side of the in-synch video (*Synchronous* version) and, for the other half, the reward consistently appeared on the side of the out-of-synch video (*Asynchronous* version). Consequently, anticipative gaze towards the location of the reward during the transition phase is indicative of the capacity of temporally bind the acoustic and the video signals. Each participant was exposed to 30 trials on a screen equipped with a Tobii X2-60 eye-tracker.

Two areas of interest (AOIs) were designed and kept constant across the stimuli and the transition phases: *Reward*, corresponding to the exact zone where the rewarded stimuli was displayed and *Non-reward*, corresponding to the exact zone where the non-rewarded stimuli was displayed. Together, these two AOIs corresponded to 8.86\% of the total area of the screen. A third AOI, *Other,* corresponded to the rest of the screen and was used for the analysis of the transition phase. Every 16 ms, and each AOI, we extracted eye-tracking data indicating whether this AOI was active or not.

Results: Stepwise multilevel regressions, with item-per-trial by item and by-participant random slopes were used to analyse fixation curves in the *stimuli* and *transition* phases. During stimuli presentation, children's gaze is mostly influenced by the periodic and salient mouth mouvement, independently of group or temporal alignment. Both groups demonstrated a clear preference for the Reward AOI during the first half of the transition period in both versions, viz. independently of whether the reward phase primed either the aligned or the misaligned video. Children with ASD exhibited a lower rate of fixations on the Reward AOIs, displaying lower sensitivity to audio-visual alignment.

Conclusions: Relative to traditional preferential gaze paradigms, our method offers a clearer window on young children with ASD's difficulties in audio-visual integration.

66 **235.066** Autistic Polyglots: An Analysis of the Language Experiences, Motivations, and Atypical Learning Profiles of Autistic Multilinguals

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Background: Autistic people can demonstrate skills that surpass neurotypical standards in various domains, including language. Some autistic people have difficulties with the acquisition of language, and display specific impaired linguistic processes such as mutism or pragmatic language impairments. However other autistic people successfully learn and use multiple languages. Specific enhanced linguistic skills such as hyperlexia, or learning skills such as memory and pattern recognition have been reported in autistic people. Still, the patterning of enhanced or impaired skills has not been consistently described, and a theoretical and empirical understanding of the ability of some autistic people to learn multiple languages is lacking. To date, case studies have only described savant autistic polyglots, but group studies of autistic multilinguals are scarce. Furthermore, no study has yet incorporated the accounts of autistic people describing their own experience as multilinguals.
Objectives: This study seeks to describe the factors contributing to the learning of multiple languages in multilingual autistic people. We complement quantitative data with a qualitative account of their internal motivations, and how they perceive the interplay between autism and multilingualism.

Methods: The Autism & Bilingualism Census (ABC) was an online survey designed for monolingual and multi-lingual autistic adults. The ABC included questions about demographics, language history, and open-ended questions to gather qualitative data on the way language learning and knowledge had influenced respondents' lives. A total of 297 autistic adults took part in the ABC, including 54 respondents knowing 4 languages or more. These 54 participants' answers to the demographic, language history, and open-ended questions were analyzed.

Results: Respondents (55.6% female) were aged between 18 and 64 (M=32.7 years, SD=9.8 years), 47 had a clinical diagnosis of autism and 7 were self-identified autistic. Twenty-six respondents listed 4 languages, 14 listed 5 languages, 14 listed 6 or more languages. For all their languages respondents reported a wide range of age of acquisition (AoA): for example, AoA of the 2ndlanguage (L2) ranged from 0 to 25 (M=5.9 years, SD=5.0). Respondents also reported a wide range of proficiency in all their languages: for example on the self-rating scale from 0="Not at all" to 8="Excellent", L2 proficiency ranged from 0.5 to 8 (M=5.2, SD=2.4). Autistic multilinguals' motivations include a predisposition for language acquisition and social factors, such as relationships and social skills. Respondents reported perceived benefits of multilingualism in several domains such as social skills, confidence, and opportunities. They also discussed the positive and negative effects of the atypical autistic learning processes (i.e. memory, pattern identification, increased focus) in relation to their language learning skills.

Conclusions: This is the first study reporting insights from autistic multilinguals regarding the relationship between autism and their language experiences, their motivations to learn languages, and their perceived benefits of being multilingual. This study highlights diversity in the language profiles of autistic multilinguals, and offers multiple leads to better support language learning opportunities for autistic people.

67 **235.067** Canonical Babbling in 9-Month-Old Infants Later Diagnosed with Autism Spectrum Disorder: A Naturalistic Evaluation of All-Day Recordings

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Background: Canonical Babbling (CB) may serve as an early developmental marker in differentiating neurodevelopmental disorders (e.g. Belardi et al., 2017; Oller et al., 2010). However, research on vocalizations and CB in infants at high familial risk for autism spectrum disorder (ASD) is limited and conclusions are mixed (e.g. Northrup et al., 2015; Paul et al., 2011; Talbott et al., 2016). Previous studies have used short home videos to analyze CB (Patten et al., 2014; Paul et al., 2011). This may not be representative of an infant's abilities because infant volubility fluctuates throughout the day (Warren et al., 2010). Thus, in this study we used a novel method of selecting representative segments from full-day unobtrusive naturalistic recording using the Language Environmental Analysis (LENA^{TM}) to analyze CB in infants at high familial risk (HR) for ASD.
Objectives: To compare CB in 9-month-old HR infants diagnosed with ASD at 24 months (HR-ASD), without ASD (HR-Neg) and low risk infants (LR), using naturalistic day-long recordings.

Methods: A total of 72 (11 HR-ASD, 35 HR-Neg, 26 LR) 9-month-old infants contributed data as part of a larger, ongoing longitudinal study, the Infant Brain Imaging Study. Infants wore a LENA recorder for at least 1 full day (>8 hours). A study-specific algorithm parsed through the LENA files and compiled a 5-minute sample from high vocalization periods spread across the day. Two coders blind to subject diagnostic status coded these samples for canonical syllables (CS; consonant-vowel combination); IRR – 0.75, $p<0.001$. A Canonical Babbling Ratio (CBR) was computed, dividing total CS by total child speech-like vocalizations (ChV). Infants were assessed at either 9 or 12 months of age using the Mullen Scales for Early Learning.

Results: Across groups, infants did not differ by age, sex, number of hours of LENA recording, or parental education. The groups significantly differed on Mullen Receptive Language and Fine Motor scores at 9-12 months, but not on other Mullen subscales (Table 1). Mullen Non-verbal DQ, age, sex, data collection site and maternal education were included as covariates. Group differences in CBR were not significant, although the direction of effects was consistent with previous reports (meanCBR of HR-ASD < HR-Neg < LR; $F_{(58)} = 1.85$, $p=0.16$). This direction of differences was not explained by a similar pattern in ChV (Fig-1)

Conclusions: We found no significant differences between HR-ASD, HR-Neg, and LR infant CBRs at 9-12 months of age. Previously reported large effects have come from clinically ascertained samples of children diagnosed with ASD rather than from prospectively ascertained HR infants. HR infants may demonstrate more typical patterns of CB development as compared with clinically ascertained samples. We await larger samples to more fully examine these phenomena with greater power to detect potential differences. Despite the absence of statistically significant results, this study provides a framework for studying CB in infants at risk for ASD, as well as the relationship of CB to behavioral trajectories and outcomes.

68 **235.068** Charting the Impact of Bilingualism on Social and Communicative Development in Autistic Children

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Background: There is a dearth of empirical literature addressing how bilingualism might impact upon those with autism. What limited literature exists can be summarised as follows: bilingual exposure is unlikely to lead to poorer development of language in children with ASD and could provide an advantage in social and communicative domains. However, many parents are still concerned about the potentially harmful effects of bilingualism on development. It is clear that rigorous quantitative designs capturing effects which extend beyond the linguistic domain are needed to elucidate these issues.
Objectives: The overall aim of this research is to explore how bilingualism impacts on cognitive and language development for children with autism and their families. Here, we focus on the relationship between bilingual language exposure and social cognition in children with and without autism, and the factors that mediate this relationship.

Methods: We are collecting data from autistic and neurotypical children aged 5-12 who are being raised in a bilingual environment. At the point of submission, we have enrolled 45 children in the study, of which 20 have an autism diagnosis. With a visit rate of 20 children per month, we will have complete and processed data for 50 autistic and 50 neurotypical children by the end of March 2019. These will be analysed for presentation at INSAR 2019.

At each visit, children complete a battery of social cognition tasks; The Theory of Mind Task Battery, a false-belief eye-tracking paradigm and a social preference eye-tracking task. Standardised IQ assessment and language measures are included in the test battery. Additionally, parents complete a number of relevant reports including the Theory of Mind Inventory and a Bilingual Language Experience Calculator.

Results: We anticipate that directly-observed and parent-report measures of social cognition will be highly correlated, and we will first run a principal components analysis to identify one or more latent variables representing social cognitive ability, or facets thereof.

Social cognitive ability will then be analysed as follows:

1) Mean differences between groups based on diagnostic status (autistic vs neurotypical), bilingual exposure (high versus low) and the interaction

term for these. We predict that autistic vs neurotypical group differences will be reduced when bilingual exposure is high.

2) Continuous relationship between bilingual exposure and social cognitive ability, taking account of IQ, language and diagnostic group.

Two-way ANCOVA's will be used to assess all interaction contrasts, followed by pairwise post hoc comparisons.

Conclusions: This study will elucidate the effects of bilingual exposure on social cognition in autistic and neurotypical children. This study takes a step towards exploring the question of whether bilingualism can provide a naturalistic opportunity to further develop social cognitive skills. The work has implications for future clinical practise and can contribute to an evidence base for parents to make an informed choice about bilingualism for their child.

69 **235.069** Communication Propels Growth in Early Speech Production for Young Children with Autism: A Mediation Model

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Background: Language abilities of children with autism spectrum disorders (ASD) are heterogenous (Tager-Flusberg, 2004), with delays in gesture production (Iverson & Wozniak, 2007) and joint attention (Wetherby et al., 2007) aligning with concurrent and subsequent language development deficits (Iverson & Goldin-Meadow, 2005; Luyster et al., 2008). Distinct cognitive and linguistic phenotypes have been defined in prior within-disorder comparisons of language (Wittke et al., 2017), informing anticipated patterns of later language development. However, the unique contributions of social communication elements in driving these differential patterns of language growth remain unclear.

Objectives: This study investigates the unique roles of social communication elements including emotion and eye gaze, communication, and gesture, in mediating growth in spoken language production between toddlerhood and pre-school to better inform anticipated developmental trajectories for children demonstrating specific patterns of ASD behaviors.

Methods: This study utilized a subset of secondary data originally collected through the Autism Phenome Project (APP, *N*=55, 42 male, mean age at initial visit=33.9 months, SD=5.5), a longitudinal study completed through the MIND Institute at the University of California-Davis. The APP intends to define clinically meaningful ASD subtypes based on behavioral and biological data, specifically evaluating children immediately following ASD diagnosis at age 24-40 months and again at follow-up evaluations completed approximately 3 years later. We performed simple linear regression analyses, using *Communication and Symbolic Behavior Scales, Developmental Profile* (CSBS-DP; Wetherby & Prizant, 2002) Behavior Sample Social Composite scores (see Table 1) at the age of diagnosis to predict growth in mean length of utterance (MLU) approximately 3 years later.

Results: Performance on the Social Composite partially mediated the positive relationship between MLU at toddler age and MLU at preschool age, driven by performance on the Communication scale above and beyond performance on the Gesture scale and Emotion and Eye Gaze scale (see Table 2 for detailed linear regression results). That is, total effect of MLU at toddler age on MLU three years later while controlling for Communication scale performance increased when this mediator was included in the model. When models included Gesture or Emotion and Eye Gaze scales alone, statistically significant mediation effects were not indicated.

Conclusions: These findings distinguish social communication factors including rate, behavior regulation, social interaction, and joint attention as key elements facilitating growth in MLU during the early language acquisition period from toddlerhood to preschool age. Communication behaviors may lead to increased turn-taking and engagement opportunities with peers, suggesting that MLU growth is more child-input dependent than behaviors which summon adult-input like gesture and emotion and eye gaze. Next analytic steps for this research endeavor include analyzing direct and indirect mediational pathways, and assessing changes in these pathways with this sample, as well as a larger sample, when additional social communication elements are incorporated. Further, subsequent studies should incorporate analysis of additional spontaneous speech elements and *Autism Diagnostic Observation Schedule* (ADOS-G; Lord et al., 1999) performance at both time points in order to identify unique, clinically meaningful phenotypes based on language form, language function, lexical diversity, and ASD-behavior severity.

70 **235.070** Comparing Parental Report to Standardized Assessment Scores in Communication

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Background: Parent report is an important method of gathering developmental history in the evaluation of autism spectrum disorder. Additionally, diagnosis is thought to be more reliable and valid when using both parent report and evaluation findings. However, parent report may lack objectivity which is relevant when the child is being formally assessed for a developmental disability.

Objectives: It is hypothesized that parents will rate their children as being more proficient in communication skills on a parent-report measure than results indicate on the Verbal Skills scale of a cognitive functioning assessment. This discrepancy is expected based on the unique relationship between parents and their children and the resulting difference in communication parents have with their children compared to an individual with whom the children are less familiar.

Methods: Participants included 41 children (Males n=31, Females n=10) evaluated at a community-based developmental assessment clinic. Ages of participants ranged from 30 to 72 months (μ= 51.1 months) and they were assessed using the Vineland, Second Edition, Parent/Caregiver Rating Form (Vineland-II) and the Differential Ability Scales, Second Edition, Early Years Battery (DAS-II). The sample consisted of 35.1% Caucasian, 40.5% Hispanic, 21.6% Asian Americans, and 2.7% biracial participants. All participants were at-risk for autism spectrum disorder, as determined by a phone screening method. However, not all participants were ultimately diagnosed with autism spectrum disorder.

Results: As hypothesized, there was not a correlation (r= .294, p= .073) found between the subjects on the DAS-II Verbal Skills scale and the Vineland-2 Communication domain.

Conclusions: These results suggest that parents/caregivers may unintentionally inflate Vineland-II Communication scores due to the unique relationship between parents and their children. Additionally, the resulting difference in communication parents have with their children compared to an individual with whom the child is less familiar (e.g., the examiner) may serve to inflate scores. Such findings are crucial as they can help to determine how different sources of information should be considered in the evaluation process.

71 **235.071** Content Validity Testing of the Autism Classification System of Functioning: Social Communication (ACSF:SC) with Toddlers

and School-Aged Children with Autism

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Background:

The Autism Classification System of Functioning: Social Communication (ACSF:SC) is a strengths-based system that classifies 5 levels of social communication abilities of children with ASD. To date, the ACSF:SC has been developed and used with preschoolers (3-6 years), with whom it has undergone psychometric testing, the findings of which have been published (Di Rezze et al. 2016). The current study examines applicability, clarity and utility of the ACSF:SC across the full childhood age range, by consulting with parents of children with ASD and clinicians working closely with toddlers (24-36 months) and school-aged children (>6 years) with ASD.

Objectives:

To assess the content validity of the ACSF:SC with children ages 24-36 months, and over 6 years old, in order to test the usefulness of the ACSF:SC and examine its performance across this expanded age range.

Methods:

Qualitative methods were used to test ACSF:SC age expansions from the perspectives of parents and clinicians. We developed a user guide and conducted cognitive interviews and focus groups with parents of children (both toddler and school-aged) and clinicians working with children in this age range. Transcripts from interviews and focus groups were analyzed using qualitative content analysis.

Results: Ten parents and seventeen clinicians working with toddlers or school-aged children with ASD participated, and recommendations were provided for three categories: applicability, clarity and usability of the tool. **Applicability** captured respondents' observations on developmental appropriateness of the level descriptions, and their ability to "see" (recognize) an individual child fitting into one particular ACSF:SC level. Most found the ACSF:SC relevant, but in the toddler group we learned that it was important to consider the educational and emotional needs of parents of newly diagnosed children. **Clarity** captured respondents' understanding of the ACSF:SC, its explicit and underlying constructs, level descriptions and distinctions. Feedback on **usability** helped us to identify areas that needed to be more user-friendly.

Conclusions:

Through a variety of content validation processes, these results indicated that ACSF:SC constructs are seen to be applicable to both toddlers and school-aged children with ASD, as well as being understood by most parents. Several recommendations need to be considered before proceeding with its final revisions and field testing – both of which are currently underway. Next steps will involve revising the ACSF:SC and sharing it with international stakeholders (n=50), whose perspectives are currently being collected and analysed through an online survey on ACSF:SC revisions, based on this work. This work will be completed prior to this conference and integrated into the presentation.

72 **235.072** Contextual Differences in Gesture Production in Verbally Fluent Individuals with ASD

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Background:

Impairments in nonverbal communication, including co-speech hand gestures, are required for a diagnosis of autism spectrum disorder (ASD). Co-speech gestures serve a range of communicative functions, often measured by categorizing them into discrete types, e.g., *representational* gestures ("descriptives" on the ADOS, which depict visuospatial properties of referents), *interactive* gestures (which convey social functions such as emphasis or turn-taking), and *deictic* (pointing) gestures. Several studies have now shown that individuals with ASD select gesture types differently than controls, suggesting that they rely more on certain communicative features. In addition to differences in nonverbal communication, another hallmark feature of ASD is difficulty adjusting behavior to fit the specific context at hand. Very little research has examined if, and how, nonverbal communication strategies might change based on social/communicative context.

Objectives:

The objectives of this study were (1) to replicate the finding that individuals with ASD use gesture to fulfill different communicative functions, and (2) to determine whether contextual differences are associated with a change in how individuals with ASD gesture.

Methods:

Verbally fluent children and adults with ASD (n=39) and typically developing controls (TDC; n=14, see Table) were group-matched on age, gender, and full-scale IQ. An additional n=10 participants per group will be added to the dataset by INSAR 2019. Participants completed two controlled communicative tasks, designed to evoke spontaneous gestures (participants who did not produce any codable gestures were excluded from this dataset). In the "Cartoon" task, participants described a Looney Tunes cartoon, and in the "Box" task, participants described how a shape sorter toy worked. Gestures were coded according to the types described above, with the addition of *pantomime* gestures, which are representational gestures produced in the absence of speech.

Results:

Across groups, participants relied on different gesture types depending on the task, as evidenced by a significant Task*Type interaction (p=.03, η^2=.16), with the Cartoon task eliciting relatively more gestures conveying visuospatial content (i.e., representational and pantomime gestures). Participants with ASD produced fewer gestures overall (p=.007, η^2=.13) and spontaneously selected different gesture types than controls (Group*Type: p=.003, η^2=.24), with a large effect size (see Figure). The 3-way interaction of Group*Task*Type was not significant. To probe the Group*Type interaction, post-hoc t-tests revealed marginal group differences, suggesting that autistic participants used proportionally fewer interactive gestures (p=.11, Cohen's d=.46), and proportionally *more* pantomime gestures (p=.07, Cohen's d=.58).

Conclusions:

This study replicates previous work demonstrating that autistic individuals use gesture to fulfill different communicative functions than controls. Counter to our predictions, however, we found that participants with ASD *were* equally sensitive to the change in communicative context, and modified their gesture selection accordingly. Finally, we found that, across tasks, individuals with ASD were *more* likely to use "pantomime" gestures, in which they enacted their gesture in the absence of speech. On one hand, this finding reflects a weakness: reduced integration across verbal and nonverbal modalities. However, we also see this as a strength, in that participants identified an effective way to transmit information about the world.

73 **235.073** Creaky Voice in Adolescents with Autism Spectrum Disorder: An Acoustic, Quantitative Analysis

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Background: People with Autism Spectrum Disorder (ASD) have often been described as having unusual prosodic (e.g., "robotic", "flat", "monotone"), and vocal (e.g., "harsh", "nasal" and "hoarse") qualities to their speech, but there is little consensus on exactly how their speech differs from typical speech (McCann & Peppé, 2003). There is growing interest in using acoustic measures of speech to quantify these subjective impressions (Fusaroli et al., 2016), but nearly all studies to date examine traditional aspects of prosody, such as pitch and rhythm, and ignore voice quality.

Objectives: To investigate the accuracy, sensitivity, and specificity of acoustic measures of prosody in combination with measures of voice quality for diagnostic classification.

Methods: We analyzed speech data (8 sentences per participant) from 15 adolescents diagnosed with ASD (mean age = 14.4 years, SD = 1.48) with IQ scores in the typical range, and 15 adolescents with typical development (TD; mean age = 14.1 years, SD = 1.91); groups did not differ on chronological age or full-scale IQ. Participants in both the ASD and the TD groups demonstrated average to high average performance on standardized language measures (see Mayo, 2015, for details). We extracted acoustic features from the audio files using the *Covarep*(Degottex et al., 2014) toolbox for Matlab and custom Praat (Boersma & Weenink, 2001) scripts, and computed RQA (recurrence quantification analysis, a measure of temporal dynamics) features for voice creak using the R *nonlinearTSeries*package (Garcia, 2015). We built two logistic regression models. Model 1 incorporated acoustic measures of prosody previously employed in the literature (Fusaroli et al., 2016), as predictors of diagnosis: mean F0, standard deviation of F0, pause duration, and speech rate. Model 2 included the above, as well as measures of voice creak: mean creak, SD of creak, and a recurrence measure of creak (RATIO). All models were 10-fold cross-validated, and reported statistics are averaged over 1000 iterations.

Results: Model 1 (prosodic measures only) had an accuracy of 0.61 (CI: 0.60, 0.62), sensitivity of 0.57 (CI: 0.55, 0.59), and specificity of 0.66 (CI: 0.64, 0.67). Model 2 (prosodic and voice measures) had an accuracy of 0.71 (0.70, 0.72), sensitivity of 0.68 (CI: 0.66, 0.70) and specificity of 0.74 (CI: 0.72, 0.75). Adding the voice measures improved the model, even when taking the increased complexity of the model into consideration.

Conclusions: Qualitative descriptions of the speech of people with ASD often allude to characteristics that include both prosodic and voice-quality aspects, but quantitative studies to date focus on measures of prosody. Human raters are still substantially more effective at diagnostic classification on the basis of speech: expert clinicians displayed sensitivity of .86 and specificity of .86 in classifying these samples (Eigsti, Mayo and Simmons, INSAR 2016). However, it remains unclear which acoustic features clinicians base their judgments on. Our results extend previous findings, showing that measures of voice creak improve acoustic diagnostic models. In future work, we aim to systematically combine voice quality and prosody measures with the aim of informing speech language therapy and intervention.

74 **235.074** Evidence for Pronoun-Mapping Confusion in Children with ASD

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Background:

"Pronoun reversals" – confusions between *you* and *I* – are believed to be produced more frequently by children with autism spectrum disorder (ASD)[1–3] than by typically developing (TD) children. This prevalence has been connected to social impairments in ASD, specifically to problems with self-other awareness[4] and perspective-taking[5]. However, a recent review of language-acquisition literature reveals that children with ASD show relative deficits in assigning meaning for nouns and relative strengths in morpho-syntax[7]. The authors conclude that "form is easy, [but] meaning is hard" for children with ASD.

If children with ASD struggle to assign meaning for even concrete nouns, reference for pronouns should be particularly baffling, since pronoun reference shifts between entities based on social and linguistic context. This should lead to pronoun-mapping errors beyond confusing *you* and *I*. For instance, a child might confuse *you* and *he*. And, if form is easier than meaning, children with ASD should make relatively fewer morpho-syntactic errors (e.g., "This is hims").

Objectives:

Using a caregiver survey, we tested whether children with ASD make more pronoun-mapping errors but fewer pronoun-form errors than their TD peers.

Methods:

We ask caregivers whether their child uses each of 16 pronouns, and if so, whether s/he always uses it correctly. If the child uses pronouns incorrectly, caregivers provide example errors. Caregivers of children with (N=119) and without (N=112) ASD participated. In the ASD group, children were significantly older (ASD *M*=53mos; TD *M*=31mos, $p<0.001$), and there was a higher proportion of males (86% vs. 71%, $c^2=6.21$, $p=0.02$). Proportions of children at different language levels (single-word-, phrase-, vs. sentence-level) did not differ significantly between groups ($c^2=2.33$, $p=0.31$).

Results:

We focused on children who use at least phrase-level speech, use at least two pronouns but do not always use them correctly (ASD N=67; TD N=62). We categorized caregivers' example errors as "mapping errors" (person, gender, number) and/or "form errors" (e.g. "Her is funny."). We used Fisher's Exact Tests to compare proportions of children who made each error type and found a significant difference in proportions of mapping errors (ASD 63%, TD 35%; p=0.003), but not form errors (ASD 19%, TD 29%; p=0.15). We then compared person, gender, number errors, separately. Children with ASD made more person errors (ASD 25%, TD 14%), but this difference was not significant (p=0.19). Of these, reversal errors made up a smaller proportion for the ASD group (ASD 76%, TD 89%). The ASD group made significantly more gender errors (ASD 42%, 23%; p=0.02). Only three children were reported making number errors; all were ASD.

Conclusions:

In accordance with the "form/meaning" hypothesis, a higher proportion of children with ASD make mapping errors than form errors, and significantly more of them make mapping errors than TD children do. The fact that gender and number errors are more prevalent in the ASD group shows that their erroneous use of pronouns is not limited to confusing features that distinguish self from other. Instead, children with ASD seem to have a hard time determining the appropriate meaning for all pronouns.

75 **235.075** Deficits in Understanding Perspective-Dependent Spatial Language By Older Children with ASD

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Background:

The earliest reports on autism spectrum disorder (ASD) describe pronoun reversal errors, where individuals confuse *you* with *I*[1]. Subsequent research has suggested that such errors result from underlying deficits in perspective-taking in ASD[2–4]: specifically, that individuals do not understand others' perspectives and therefore cannot understand that the person referred to by *you* or *I* depends on who is speaking. If so, the same perspective-shifting deficit should then apply to spatial terms, like prepositions, since they can also be perspective dependent. For example, when two people are facing one another, the position "to the left" of one person is the opposite of "to the left" of the other.

Despite these parallels, there is limited research on spatial-language use in ASD[5], and, as far as we are aware, there is *no* research on their *interpretation* of such terms. If there is an underlying deficit in perspective-taking in ASD, it should affect both expressive and receptive spatial language.

Objectives:

We aim to determine whether children with ASD show relative weaknesses understanding perspective-dependent spatial language.

Methods:

Sixteen (16) older children and adolescents with ASD participated, along with 18 neurotypical (NT) peers. Groups were not significantly different in age (M ASD=13;5, M NT=13;7 p=0.86), sex (4 F ASD, 5 F NT, p=1), IQ (K-BIT 2[6], *M* ASD = 111, *M* NT = 111, p=0.95), and language (CELF-4[7] Core Language, *M* ASD = 106, *M* NT = 109, p = 0.68).

We presented 128 spatial arrays on a computer screen. In each, a doll is pictured in the middle of the screen, with four black shapes surrounding her (Figure 1). From trial to trial, the doll's position changes, so that she is facing different directions, but the shapes' positions are fixed.

At the beginning of each trial, participants hear a command in the "doll's voice", e.g. "Click on the shape above me". For half of the trials, the position of the object is described from the doll's perspective (e.g., "...on my left"), and for the other half, the shape's position is described from the participant's perspective (e.g., "...on your left").

Participants use a mouse to highlight and select the shape described.

Results:

We used a 2x2 repeated-measures ANOVA to measure the effect of Group (ASD vs. NT) and Perspective (Doll vs. Child) on shape-selection accuracy.

There was a significant interaction between Group and Perspective ($F_{(1,32)}$= 4.53, p=0.04), where children with ASD were less accurate at selecting a shape when the shape's position was described from the doll's perspective.

Conclusions:

Results show that older children and adolescents with ASD – even those with normal language scores – struggle to accurately interpret prepositions when they reflect another's perspective. Because prepositions are some of the most frequently used words in English, this presents a persistent problem during reciprocal conversation. Thus, we believe that language deficits in perspective-taking should be intervention targets for children with ASD, even for those who score within normal ranges on standardized language tests.

76 **235.076** Low-Verbal Investigatory Survey for Autism (LVIS) – an Initial Validation

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Background: Approximately 30% of children with autism spectrum disorder (ASD) will be considered minimally verbal (MV) throughout their lifetime. However, we are unable to predict who is *preverbal* and who will *remain MV*. A tool for assessing communicative competence in MV children would allow us to increase our understanding of communicative trajectories. The current study explored the Low Verbal Investigatory Survey (LVIS), a 36-item parent-report measure designed to assess communicative capacity in MV children with ASD. The LVIS is easy to complete, and based specifically on language trajectories in ASD.

Objectives: To assess convergent and divergent validity of the LVIS in relation to gold-standard measures of language ability, and to assess the dimensionality and item characteristics of the LVIS.

Methods: Parents of 147 children (1 to 8 years) completed the LVIS. Sixty-four children had diagnoses of ASD [12 female; *M*(*SD*) age = 4.45(1.68) years], 28 had language or developmental delays [11 female; *M*(*SD*) age = 1.91(1.08)), and 55 were typically developing [21 female; *M*(*SD*) = 3.10(1.53)]. Scores were available on the Preschool Language Scales (PLS-5; Zimmerman et al., 2011) for 86 participants and on the Vineland Adaptive Behavior Scales (VABS-II; Sparrow, 2011) for 122 participants. Principal components analysis (PCA) with oblique rotation was used for data reduction. Pearson correlations assessed convergent and divergent validity with the PLS and VABS. Item Response Theory (IRT) was used to determine item characteristics.

Results: PCA analyses identified five factors (as indicated by scree plots and parallel analysis), which mapped onto: Language, Nonverbal Communication, Atypical Language, Loss of Skills, and Atypical Nonverbal Communication. A Communication Composite score was calculated as the sum of the Language and Nonverbal Communication scores. Convergent validity was demonstrated with significant correlations between the LVIS Communication Composite and PLS Receptive ($r(86) = .71$, $p < .01$) and Expressive Scores ($r(86) = .71$, $p < .01$), as well as VABS Communication Scores ($r(122) = .64$, $p < .01$). Divergent validity was demonstrated with significantly stronger correlations between the LVIS Communication Composite and Vineland Communication scores than with Socialization ($z = 2.38$, $p = .02$), Motor ($z = 4.33$, $p < .01$), or Daily Living Scores ($z = 2.66$, $p < .01$) (Figure 1). IRT models of the subscales indicated that these constructs were unidimensional and yielded informative item characteristic curves demonstrating the importance of joint attention for language development (Figure 2).

Conclusions: Results provide initial validation of the LVIS as a specific measure of communicative competence that captures multiple dimensions of communicative skills in the understudied population of MV children. Joint attention was demonstrated to be one of the most basic of nonverbal abilities, lending support to interventions targeting joint engagement as a critical skill for language development. The LVIS is designed to be short (< 10 minutes for completion); it requires no special equipment, and scoring requires no expertise. These data demonstrate that the LVIS is efficient and informative, and will be useful in research on early language development in ASD.

Poster Session
236 - Diagnostic, Behavioral, Sensory and Intellectual Screening and Assessment
11:30 AM - 1:30 PM - Room: 710

77 **236.077** The Abridged Version of the Autism-Spectrum Quotient in Chinese People with Autism

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Background: The Autism-Spectrum Quotient (AQ: Baron-Cohen et al. 2001) is among the most widely used scales assessing autistic traits in the general population. Hoekstra et al. (2011) reported that the 28-item abridged Version of the Autism-Spectrum Quotient (AQ-28) had high sensitivity and specificity which made the AQ-28 a useful alternative to the full 50-item version of AQ. Few studies have examined the psychometric properties of the 28 items among Chinese population.
Objectives: This study measured the distribution of autistic traits using AQ-28 in a big sample from Chinese people with autism spectrum disorders (ASD) and examined the measurement ability and convergent validity.

Methods: Total AQ-28 scores were collected from 6223 children and adults with ASD from all over China (except Tibet, Taiwan, Macau and Hong Kong), including 5073 ASD children (younger than 16 years old) (4255 males, M_{age}=8.7418,*SD*=3.4093, and 818 females, M_{age}=8.7083,*SD*=3.4567, Male: Female = 5:1) and 1150 ASD adults (older than 16 years old) (958 males, M_{age}=20.0120, *SD*=3.8738, and 192 females, M_{age}=20.4761,*SD*=4.6734, Male: Female = 5:1). 64.04% of the participants were recruited from urban areas, while 16.73% were living in suburbs and 19.22 % in rural areas. We examined the effects of groups (child and adult) and home areas (urban, suburb, rural) on AQ-28 total scores. The item severity and item discrimination was assessed using item response theory. In addition, we tested for sex differences in both groups. Besides, the caregivers of all the participants also filled a questionnaire about the characteristics of the people with ASD, comorbidities, service encounters, monthly cost for intervention/education and caregiver perceptions.

Results: The results showed that there was no gender difference in the ASD individuals on the AQ-28 scores but a correlation between age and AQ score was found (ASD children: M_{male}=77.9457,SD_{male}=10.6048, M_{female}=79.0880,SD_{female}=11.4374; ASD adults: M_{male}=76.1033, SD_{male}=11.0202, M_{female}=77.8750, SD_{female}=11.9456). In this study, 87.43% of the participants had received or were receiving various therapies/interventions, while 37.33% of people with ASD were in service centers, 42.68% were attending typical or special schools and 19.31% were staying at home, but only 41 participants (0.67%) got a job. It was found that participants' current status had significant correlation with AQ-28 scores.

Conclusions: This study confirms that AQ-28 has adequate validity to be used in health surveys as a measure of autistic traits.

78 **236.078** The Association between Parent-Reported Emotional/Behavioral Problems and the Modified Checklist for Autism in Toddlers

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Background: Children with Autism Spectrum Disorders (ASD) have difficulties in the areas of social-communication and other restricted and repetitive behaviors. The assessment of these core symptoms may be complicated by the presence of other co-occurring emotional and behavior problems (EBPs), which can make differential diagnosis challenging. EBPs may include externalizing symptoms such as overactivity and aggression, as well as internalizing symptoms such as mood problems and anxiety. Studies have shown the presence of EBPs decrease the specificity of ASD screening and diagnostic instruments.
Objectives: This study assessed the impact of parent-reported EBPs on an often used autism screener, the Modified Checklist for Autism in Toddlers, Revised (MCHAT R/f). In addition, the study examined the potential benefit of combining EBP data with the MCHAT R/f data to improve screening accuracy.

Methods: Participants included 473 children, 1.5-5 years of age, referred to one of three sites for ASD-related concerns. EBPs were assessed via the Child Behavior Checklist (CBCL) and autism symptoms were screened with the parent-report MCHAT R/f in a subset (N = 290). Children were also

administered a full battery of diagnostic measures including the ADOS-2, with a final diagnosis assigned by a senior clinician.

Results: Overall, participants who were diagnosed with ASD had significantly lower externalizing EBPs compared to those who were not diagnosed with ASD (i.e., CBCL T scores - Externalizing [62.6 vs. 68.1]). Internalizing symptoms were not significantly different. Higher MCHAT-R/f scores (e.g., more ASD symptoms) and fewer CBCL- Externalizing symptoms were significantly predictive of an ASD diagnosis. MCHAT-R/f specificity was reduced if CBCL- Externalizing behaviors were present (i.e., from 44% to 27%). In addition, MCHAT-R/f Positive Predictive Value (PPV) was reduced from 86% to 71% if externalizing behaviors were present.

Conclusions: For toddlers referred for an ASD evaluation, parental report of significant EBPs, and in particular externalizing problems, often result in higher scores on an autism screening measure that may not be directly related to core autism symptoms (i.e., a false positive). Therefore, a combination of measures that assess EBPs and autism core symptoms will improve screening in this population. More specifically, results suggest that combining EBP findings from the CBCL with those of the M-CHAT R/f may improve the specificity of this instrument.

79 **236.079** The Brazilian Version of the ADOS: Translation, Cross-Cultural Adaptation and Semantic Equivalence for Brazilian Portuguese

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Background: Autism Spectrum Disorder (ASD) is a condition comprised of genetic and biological markers, but its diagnosis remains primarily clinical, based on behavioural measures which ideally rely on gold standard instruments, such as the ADOS. The ADOS has been translated, culturally adapted and standardized in numerous countries, but few of them in Latin America. After several years of work, the Brazilian version of the ADOS was recently concluded.

Objectives: In this study, our group researchers and clinicians aimed at translating and back-translating the ADOS to Brazilian Portuguese; to assess its cross-cultural semantic equivalence and to validate indicators of quality for the final version by analysing the inter-rater reliability of the ADOS scores.

Methods: This study had four stages: 1) Translation and back-translation; 2) Analysis of semantic equivalence; and 3) Pre-test to verify the agreement regarding the scoring procedure, between mental health specialists and a clinical specialist on the application and research with the ADOS. Permission to translate and conduct the cultural adaptation of the ADOS was obtained from the publishers of the instrument, Western Psychological Services.

Results: Results show good equivalence between the original ADOS version in English and the final version. A few semantic differences were found between the original version and the back-translation into English, although it did not interfere with the first translation into Portuguese or the final version. Limitations of this study include a small sample size, and related to that, the inter-rater reliability of the ADOS scores between the specialists and the ADOS clinician using the Kappa coefficient was equivalent for 7 out 10 areas.

Conclusions: The official Brazilian version of the ADOS will strengthen clinical and scientific research in ASD, preventing the use of unauthorized versions of the ADOS in Brazil.

80 **236.080** The Clinical Feasibility of Deconstructing Autism into a Pathogenetic Triad: Classification Results from a Case-Control Cohort

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Background:

Several mechanisms have been shown to influence the risk and severity of autism. Autism can be understood as resulting from a triad of contributing factors: genetic vulnerability from common susceptibility variants influences the pervasive and normally distributed broader autism phenotype (BAP; operationalized as the Autism-Spectrum Quotient (AQ)); cognitive compensatory ability (operationalized as the working memory subscale (WMIQ) of the Wechsler Adult Intelligence Scale (WAIS)) alleviates social difficulties and allows for adaptive behaviors and learning; environmental risk factors (operationalized as Heart Rate Variability (HRV)) negatively influence brain development and cognitive compensatory ability. While the sheer number, heterogeneity, and variety of environmental factors make quantification difficult, we propose HRV as a candidate surrogate variable that may capture enough of an individual's history to be useful for diagnostic purposes.

Objectives:

Risk factors for autism have previously been theoretically discussed. However, a concrete and clinically relevant framework that can guide clinical reasoning has not been outlined. The objective of this study was to empirically validate the clinical feasibility of a pathogenetic triad by investigating its ability to classify a case-control cohort.

Methods:

20 neurotypical controls and 21 high-functioning individuals with autism (all adult males, age- and total IQ-matched) underwent neuropsychological testing using the WAIS and AQ, as well as ECG recording during a face-processing experimental paradigm of a magnetoencephalographic session. The inter-beat intervals from the ECG recordings were extracted and used to calculate the logarithm of the Cardiac Vagal Index (CVI), a measure of HRV. The AQ, WMIQ and CVI were plotted in 3D using Python Matplotlib to identify the plane of maximal separation between the groups. The principal component of the WMIQ and CVI for that orientation was found, and plotted against the AQ. A second-degree polynomial regressor was applied and the residual for each individual was calculated. Sensitivity, specificity, diagnostic odds ratio (DOR), and prevalence-corrected (at 1%) positive and negative predictive values were calculated. The residuals for each individual were used in a

Receiver Operator Characteristic, and the Area Under the Curve (AUC) was calculated.

Results:

It was found that classification of autism following deconstruction into a purported pathogenetic triad yielded high accuracy with a sensitivity of 90.5% and specificity of 90.0%. The DOR was 85.5 (lnDOR = 4.45, 95% CI [2.39-6.51]). The positive and negative predictive values were 0.084 and 0.999 respectively. The AUC was statistically significant at 0.963 ($p < 0.0005$, 95% CI [0.913-1.000], SE = 0.026).

Conclusions:

These results show the promise of deconstructing and operationalizing autism as a pathogenetic triad and its clinical feasibility in discriminating individuals with autism from neurotypical controls. A population-based study, with larger sample size, will be instrumental in proving the validity and clinical utility of the framework, as well as its specificity, as autism was the only patient group included. Strengths of the method include the simplicity, ubiquity and cheapness of the tests, as well as the short time needed for administration. If the high diagnostic accuracy were to be replicated, the method could easily be introduced into clinical work.

81 **236.081** The Effectiveness of Gold-Standard ASD Diagnostic Tools in Phelan-Mcdermid Syndrome

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Background: Phelan-McDermid syndrome (PMS), also known as 22q13 deletion syndrome, is a rare neurodevelopmental disorder caused by loss of one functional copy of SHANK3 on the terminal end of chromosome 22q. Individuals diagnosed with PMS frequently demonstrate global development delay, intellectual disability of varying degrees, hypotonia, significant speech and language delays (including absent speech), and behaviors characteristic of autism spectrum disorder (ASD) (De Rubeis et al., 2018; Kolevzon et al., 2014; Soorya et al., 2013). Recent studies using gold-standard diagnostic instruments have revealed high rates of clinical ASD diagnoses in individuals with PMS, ranging from 69-84% (De Rubeis et al., 2018; Laura et al., 2018; Soorya et al., 2013). However, due to severe intellectual impairments, language delays, and repetitive behaviors seen in many individuals with PMS, a greater proportion of patients within this population exceed the cut-off scores on gold-standard diagnostic tools (i.e., Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview-Revised (ADI-R)) than actually go on to receive a diagnosis of the disorder (De Rubeis et al., 2018; Laura et al., 2018). Thus, due to complex developmental and behavioral profiles, careful integration of standardized assessment, caregiver report, and structured observations are necessary components of diagnostic evaluations of individuals with PMS.

Objectives: This study aimed to investigate the sensitivity and specificity of the ADOS-2 and ADI-R with regard to detecting ASD in a sample of children and adolescents with PMS who have intellectual disability and limited language abilities.

Methods: Thirty-six participants between 2 and 18 years old (mean age=8 years, 2 months, SD=53.4 months; 58% male) with PMS underwent comprehensive diagnostic evaluations. Participants were administered the ADOS-2 (Toddler Module: 6%; Module 1: 78%; Module 2: 17%) by a research-reliable clinician as well as a developmentally-appropriate assessment of cognitive functioning (Mullen Scales of Early Learning: 78%; Differential Ability Scales-II: 8%; Stanford-Binet-5: 14%). Developmental quotients (DQs) were calculated based on Mullen age equivalents. Participants' caregivers completed the Vineland Adaptive Behavior Scales-II (VABS-II) and the ADI-R with a research-reliable clinician. Consensus diagnoses of ASD accounted for test results, expert clinical judgment, and DSM-5 criteria.

Results: Cognitive assessment results revealed intellectual disability in all participants. Both the ADOS-2 and ADI-R (total scores) demonstrated high sensitivity in this population (100.0% and 82.8%, respectively); however, the specificity rate of both measures was poor (ADOS-2 specificity=28.6%; ADI-R specificity=57.1%). False positives on both measures had significantly higher IQs/DQs and VABS-II adaptive behavior composite scores than true positives ($p<.05$).

Conclusions: In a sample of children and adolescents with PMS, the ADOS-2 and ADI-R correctly identified ASD in most participants who ultimately received a clinical diagnosis. However, the rate at which the measures produced negative results for participants who did not receive clinical diagnoses was significantly lower than the specificity rates found in past studies of the measures with participants with idiopathic ASD (Lord et al., 1997; McCrimmon & Rostad, 2014). Thus, these tools must be used in conjunction with expert clinical judgement during diagnostic evaluations of individuals within this population.

82 **236.082** The Effects of Severity of Autism Symptoms on Developmental Trajectories

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Background:

Children under the age of 3 years old who are experiencing developmental delays or disabilities are legally entitled to receipt of early intervention services, as mandated by Part C of the Individuals with Disabilities Education Act. Although little research has examined publicly available (Part C) early intervention services specifically, several studies have focused on efficacy of a variety of early-delivered programs for children with disabilities. This research suggests that a variety of outcomes (such as cognitive level, early nonverbal communication skills, and early social interaction skills) may relate to developmental growth over time in children receiving these services (Ben-Itzchak & Zachor 2007, Calandrella & Wilcox 2000, Harris & Handleman 2000). However, many potentially important factors that might predict developmental growth, such as symptoms of autism spectrum disorder, have not been explored in detail within a population of children receiving early intervention services.

Objectives:

This study aims to examine the effects of severity of autism symptoms, as measured by the parent rated Modified Checklist for Autism in Toddlers (M-CHAT) in the developmental trajectory of social skills, social communication, and adaptive behavior as measured by the Assessment, Evaluation, and Programming System (AEPS). Although it is anticipated that individuals with higher M-CHAT scores will have lower scores on the social communication, social, and adaptive behavior areas of the AEPS, little is known about the effect of M-CHAT scores on developmental

trajectory in these areas.

Methods:

Our sample includes 45 children ages 0-3 years enrolled in a center-based early intervention program between 2010 and 2017. Data was collected from review of children's educational records. We examined the relationship between scores on the M-CHAT (completed by the parent) and two time points (initial and a second time point between 2-9 months after initial) of the AEPS measures (completed by the teacher). We used regression models to predict growth on each AEPS domain using M-CHAT as a predictor variable and initial AEPS score, child age and gender, and time between AEPS assessments as covariates.

Results:

The overall regression models were not able to significantly predict growth on the social and social communication domains of the AEPS. However, there was a significant relationship between severity scores on the M-CHAT and the trajectory of adaptive behavior scores (β=-0.652, p=0.016).

Conclusions:

Surprisingly, M-CHAT scores did not predict gains over time in the social or social communication domains. We theorize that immersion of socialization within a group setting, as well as the emphasis on improving social and social communication skills for children who show heightened symptoms of autism, may buffer these areas of weakness for children with heightened ASD symptoms. However, adaptive skills that require more independence and complexity may not be focused on in group early intervention settings. It is our hope that this research will help improve early intervention services by increasing the understanding of the developmental trajectory of individuals receiving early intervention services, with specific implications on the need for adaptive skills intervention.

83 **236.083** The Experience of Getting a Neurodevelopmental Disorder Diagnosis: A Survey of Stakeholders

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Background: Neurodevelopmental disorders (NDD) affect the brain and nervous system during early development. These disorders include attention deficit hyperactivity disorder, autism, fetal alcohol spectrum disorders and intellectual disability. The transdiagnostic approach suggests NDDs should be considered together, not in isolation. A transdiagnostic approach can make significant difference in understanding these disorders due to frequent overlap of signs, symptoms and diagnostic labels. Although the assessment and diagnostic experience has been studied individually for some NDDs, it is unclear if the assessment and diagnostic experiences of stakeholders (individuals diagnosed with a NDD, along with caregivers / family members and health professionals involved in their care) are similar or different across NDDs.
Objectives: This research project aimed to explore the NDD assessment and diagnostic experiences, from the stakeholder perspectives of individuals diagnosed with a NDD, their caregivers / family members and their health professionals.

Methods: An online survey designed specifically for this research project captured the assessment and diagnostic experiences of stakeholders across Australia. The survey included a general demographic section and tailored background questions for each of the three stakeholders groups: (1) individuals diagnosed with a NDD (n = 5); (2) caregivers / family members of an individual diagnosed with a NDD (n = 68); and (3) professionals involved in the assessment, diagnosis or care of individuals diagnosed with a NDD (n = 50). The survey concluded with an open-ended question seeking the stakeholders' view on how the process of assessing and diagnosing NDDs can be improved. A qualitative thematic data analysis approach, with the assistance of NVivo software, was used to identify themes from the qualitative survey responses from 113 stakeholders.

Results: The four main themes that emerged from the qualitative survey responses were process, support, health professionals and resources. Processes and clear pathways are needed where health professionals work collaboratively with one another, individuals undergoing assessment and caregivers / family members. Support during the assessment and diagnosis process was an expressed need to help individuals undergoing assessment and their caregivers / family members to navigate this very stressful time, in particular in relation to appraisal, emotional, informational and instrumental support. Health professionals with a lack of knowledge about some NDDs, or who miss early signs and symptoms, misdiagnose and do not identify comorbidities, were raised as concerns, all of which would be improved through the provision of more specialized training for health professionals in relation to the full range of NDDs. Finally, additional resources were deemed necessary to provide adequate trained health professionals to meet service requirements, integrate appropriate assessment tools into practice and provide financial support to allow individuals and caregivers / families to access assessment and diagnostic services within acceptable wait times.

Conclusions: The perspective of individuals, caregivers / families and health professionals, showed that across all NDDs the assessment and diagnosis process is often associated with a wide range of positive and negative emotions. Health professionals have the opportunity to implement solutions that may improve the diagnostic experience through addressing processes, supports, health professional training and resources.

84 **236.084** The Impact of Alexithymia on Autism Diagnostic Assessments

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Background: Alexithymia, a difficulty identifying and communicating one's own emotions, affects socio-emotional processes, such as emotion recognition and empathy. Indeed, research has highlighted several behavioural characteristics traditionally attributed to autism that have been demonstrated to be related to alexithymia. Given that many of these behaviours are assessed during autism assessments such as the Autism

Diagnostic Observation Schedule (ADOS), it is pertinent to examine the relationship between alexithymia and scores on autism diagnostic assessments.
Objectives: Our objective was to examine the association between alexithymia and ADOS scores. We examined 1) the impact of alexithymia on meeting the criteria for autism/ASD, 2) correlations between alexithymia and ADOS subscales, and 3) whether alexithymia predicted scores on specific ADOS items, selected a priori based on the literature.

Methods: We utilised two previous datasets for which both ADOS and alexithymia data were available. Participants included 96 women with anorexia, and 147 adolescents who were either high in autistic symptoms, or whose twin had high autistic symptoms. Both samples of participants completed the Toronto Alexithymia Scale (TAS-20), a self-report alexithymia measure. For the adolescent sample, parent-report alexithymia scores were also available (the Observer Alexithymia Scale). Current depression/anxiety symptoms were also measured: for the anorexia sample this was via the Hospital Anxiety and Depression Scale or the Moods and Feelings Questionnaire (depending on participant age), and for the adolescent sample this was via the Strengths and Difficulties Questionnaire.

Results: In the adolescent group, parent-reported (but not self-reported) alexithymia predicted autism/ASD diagnosis, correlated with both social affect and restricted and repetitive interests sub-scales, and predicted scores on a priori selected ADOS items. Fewer associations were observed in the anorexic sample, and most associations were removed once depression/anxiety symptoms were controlled for. Nonetheless, the presence of alexithymia predicted a near fourfold increase in the likelihood of meeting diagnostic criteria for autism/ASD in this sample.

Conclusions: Alexithymia does appear to show an association to ADOS scores, at the level of meeting the diagnostic threshold, ADOS subscales, and scores on specific items. The reduced associations in the anorexia sample could have arisen for a number of reasons. This includes the high level of depression and anxiety in this group potentially impacting on self-report alexithymia measures. Alternatively, this could be related to the gender and age of this group, as compared to the mostly male and younger adolescent group. This and future research have important implications for diagnostic practices, but also research practices in which ADOS assessments are considered the gold standard for inclusion in autism research.

85 **236.085** The Impact of DSM-5 Social Communication Disorder Diagnosis on Autism: Results from Two Systematic Literature Reviews and Meta-Analyses

ABSTRACT WITHDRAWN

Background: Social Communication Disorder (SCD) is a new behaviorally-defined developmental communication disorder diagnosis in the Fifth Edition of the Diagnostic and Statistical Manual (DSM-5). It was initially described as potentially capturing individuals with a DSM-IV, Text-Revised (DSM-IV-TR) diagnosis of autism, perhaps those with pervasive developmental disorder-not otherwise specified (PDD-NOS), who would no longer meet the more stringent DSM-5 ASD criteria. To date, limited studies have examined SCD, and its impact remains unknown.
Objectives: As part of two systematic literature reviews and meta-analyses, the first conducted prior to DSM-5 implementation and a recently completed five-year follow-up, we assessed the potential of an alternative diagnosis of SCD for individuals who met DSM-IV-TR but not DSM-5 autism spectrum disorder (ASD) diagnostic criteria.

Methods: We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines in conducting these reviews. We searched the literature for studies published between January 2011 and March 2013 (first review) and April 2013 and July 2018 (second review) that applied DSM-IV-TR and DSM-5 ASD criteria to study samples and, for those who did not meet DSM-5 ASD criteria, applied SCD criteria. Scientific rigor was rated using the Quality Appraisal of Reliability Studies. We pooled study data by extracting the number of individuals who met DSM-IV-TR ASD criteria but no longer met criteria for an ASD diagnosis under DSM-5 and, of those, the number who would alternatively meet SCD criteria. We estimated a pooled effect for the proportion of individuals meeting SCD criteria, and we investigated model heterogeneity and publication bias.

Results: Nine studies (four from the first review and five from the second review) representing data from 555 individuals assessed for SCD were included. Of these, 5 studies specifically examined ASD subtypes. There was no evidence of publication bias. While statistical significance was not achieved, the pooled effect suggests that less than one-third [28.8%; (95%CI 13.9-50.5), p=0.06] of those who met DSM-IV-TR but not DSM-5 ASD diagnosis would meet criteria for SCD. Heterogeneity was greater than expected by chance alone (Cochran's Q = 57.5, $p<0.001$, $I^2 = 86.1$). In studies which examined ASD subtypes, those with PDD-NOS (23 of 47 individuals; 49%) were less frequently captured by SCD compared to either Autistic Disorder or Asperger's Disorder.

Conclusions: Overall, SCD does not appear to capture the majority of those with ASD diagnosis using DSM-IV-TR but who no longer maintain their diagnosis under DSM-5. While subtype data are limited, SCD appears least likely to capture those with DSM-IV-TR PDD-NOS who do not meet DSM-5 ASD diagnostic criteria. The impact of SCD as a new, independent diagnosis from ASD, and its potential to serve as a gateway for services, are important areas for future research.

86 **236.086** The Misnomer of "High Functioning Autism": IQ Is a Weak Predictor of Functional Abilities at the Time of Diagnosis of Autism Spectrum Disorder

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Background:
'High functioning autism' is a term often used interchangeably for individuals with autism spectrum disorder (ASD) without an intellectual impairment (or Intellectual Disability, ID). Over time, this term has become synonymous with expectations of greater functional skills and long-term positive outcomes, despite contradictory clinical observations. Because an adaptive functioning assessment is not required for a diagnostic evaluation in many settings, it is often assumed that an individual's cognitive estimate (intelligence quotient, IQ), particularly those IQs that are

>70, approximate functional adaptive ability. While there has been some research investigating the relationship between IQ and adaptive functioning in ASD, very little has focused on individuals at the time of diagnosis. Understanding whether IQ is an appropriate proxy for adaptive functioning has important clinical implications for service provision and funding allocated for supports.

Objectives: This objective of this study was to investigate the relationship between adaptive behavior, IQ and age at diagnosis in ASD.

Methods: Participants part of an ongoing prospective register in Australia (The Western Australian Register for Autism Spectrum Disorder), notified by their diagnosing clinician(s) at the time of diagnosis. Established in 1999, the register currently contains details of more than 6000 cases, with information collected about diagnostic criteria met, co-occurring conditions, basic demographic data, and details of any diagnostic, cognitive, language and adaptive functioning assessments conducted. Cases were selected if they were ≤ 18 years at diagnosis, had a cognitive estimate and adaptive functioning scores recorded. This left a sample of n = 2222, which were then grouped by presence (n = 1039) or absence (n = 1183) of ID. Adaptive functioning was reported using the Vineland Adaptive Behavior Scales (VABS).

Results: As expected, VABS scores were significantly lower in the ID group, and IQ estimates significantly correlated with adaptive functioning scores across the whole sample. However, weaker sized correlation coefficients were observed between IQ and VABS in the group without ID, particularly for the Socialization subscale which fell below the threshold for statistical significance. Regression models suggested that IQ was a weak predictor of VABS composite and subscale scores after controlling for sex for children without ID. When comparing difference scores between IQ and VABS scores, the ID group's adaptive behavior estimates were close to reported IQs, while VABS scores fell significantly below IQs for children without ID. The gap between IQ and VABS scores increased with increasing age at diagnosis for all children.

Conclusions: These data indicate that estimates from IQ alone are an imprecise proxy for functional abilities when diagnosing ASD, particularly for those without ID. We argue that 'high functioning autism' is an inaccurate clinical descriptor when based solely on IQ and this term should be abandoned in research and clinical practice. We also recommend functional adaptive assessments be considered a key component of a comprehensive diagnostic evaluation, to facilitate more targeted service delivery and provision of adequate funding for the level of support and needs required on an individual basis.

87 **236.087** The Overlap of Autism Symptoms in Children with Williams Syndrome

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Background: Williams syndrome (WS) is a neurodevelopmental disorder caused by a deletion of approximately 26 genes on chromosome 7 (7q11.23) (Peoples et al., 2000), and is commonly associated with hyper-sociability. However, despite this pattern of extreme friendliness, individuals with WS display an increased prevalence of autism spectrum disorder (ASD). Previous research investigating the presence of ASD symptoms in WS suggests that individuals with WS display elevations both on assessments measuring symptoms of autism (Lough et al., 2015) as well as gold-standard autism diagnostic assessments (Klein-Tasman, Phillips, Lord, Mervis, & Gallo, 2009).

Objectives: The objective of this study is to investigate the presence of behaviors associated with autism across different symptoms areas (as measured by the treatment scales of the Autism Spectrum Rating Scales; ASRS). Additionally, this study aims to investigate symptoms at the item level, to make recommendations as to which symptoms may best differentiate those with WS who have ASD from those who do not.

Methods**:** Parents (n=167) of children between 6 and 18 years of age completed survey data online as part of a larger study on ASD, Down syndrome, and WS. This poster aims to focus on the data from the ASD (n=39) and WS (n=45) groups. For this study, parents were asked to report child diagnoses and demographic information as well as complete an autism screener (Social Communication Questionnaire; SCQ) and a dimensional measure of autism symptoms (ASRS). An overall analysis was done to examine autism symptom elevation on the total score of the ASRS. Following this, children in the WS group were then divided into screen positive (n=20) and screen negative groups (n=25) based on whether or not they met the SCQ cut off score of 15.

Results: Overall, the WS group had an ASRS total score significantly higher than the mean score of 50 (M=65.24,SD=6.03), although this was significantly lower than the mean of the ASD group (M= 71.74, SD=5.04; ps<.001). Results comparing ASRS total scores showed that both the WS-screen negative and autism groups, and the WS-screen negative and WS-screen positive groups (ps<.001) were significantly different from one another. However, there was no difference between the autism and WS-screen positive groups. Further analyses using the eight treatment subscales of the ASRS revealed a similar pattern. Analyses at the item level revealed that questions relating to complex social skills (displaying interests in other's ideas, noticing social cues, understanding the point of view of others), as well as over-reactivity to loud noises may best differentiate these groups.

Conclusions: Results of this study further support previous research suggesting that individuals with WS exhibit elevated symptoms of autism. Although individuals with WS in this sample displayed significantly higher symptoms of autism (as demonstrated by the significantly higher ASRS total score), results suggest that measures such as the ASRS can differentiate between individuals with high vs. low symptoms of autism. Additionally, analyses at the item level suggest potential targets for symptom areas that may best differentiate those with WS who have ASD from those who do not.

88 **236.088** The Relationship of Intellectual Disability to Traditional and Distinct Anxiety Presentations in Children with ASD

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Background:

Research suggests that children with ASD present with "traditional," anxiety disorders (e.g., specific phobia, generalized, separation, and social anxiety) as well as distinct forms of anxiety, such as fears of change and idiosyncratic phobias (e.g., fear of gloves). A prior study found that traditional and distinct anxieties can be reliably differentiated and that traditional, but not distinct, anxiety symptoms are positively associated with language ability in verbal children on the spectrum. Yet, rates of traditional and distinct symptoms have not been compared in children with

ASD with and without intellectual disability (ID).

Objectives:

Research suggests that children with ASD present with "traditional," anxiety (e.g., specific phobia, generalized, separation, and social anxiety) as well as distinct forms of anxiety, such as fears of change and idiosyncratic phobias (e.g., fear of gloves). A prior study found that traditional and distinct anxieties can be reliably differentiated, and that traditional, but not distinct, anxiety symptoms are positively associated with language ability in verbal children on the spectrum (Kerns et al., 2014). Yet, rates of traditional and distinct symptoms have not been compared in children with ASD with and without intellectual disability (ID).

Methods:

63 youth with ASD (ages 9–13 years: *M*=11.08, SD=1.82; 78% male; 44% with ID) were part of the middle childhood follow-up of a rigorous longitudinal study of biological and behavioral correlates of ASD known as the Autism Phenome Project (APP). Anxiety symptoms were assessed via the Anxiety Disorders Interview Schedule–Parent/Autism Spectrum Addendum (ADIS/ASA), a semi-structured interview validated to assess 10 types of traditional and distinct anxiety in ASD. The highest traditional and distinct clinical severity ratings (CSR; Range 0-8, 4 = cut-off for impairment) were used to categorize each child's anxiety presentation and assess concordance with the report of anxiety symptoms exceeding clinical cut-offs on brief parent-report measures, including the CBCL, MASC, and SCARED.

Results: Per the ADIS/ASA, 68% of total children presented with impairing anxiety (CSR ≥ 4), including: 22% traditional anxiety only, 19% distinct anxiety only, and 27% with both. Rates of impairing distinct anxiety (ID 45% v. No ID 46%) and traditional anxiety (ID 39% v. No ID 60%) were not significantly different in children with, versus without, ID. Yet, though children without ID presented with varied traditional anxiety disorders (phobia 49%, generalized anxiety 26%, social anxiety 14%, separation anxiety 11%), those with ID had only phobia (36%) and OCD (4%). In contrast, both children with and without ID presented with distinct anxieties, including social confusion fears (10%, 9%), idiosyncratic phobia (14%, 14%), fears of change (14%, 23%), and worries about special interests (3%, 11%). Brief parent-report measures had limited sensitivity in the sample, particularly amongst those with ID (Table 1).

Conclusions: This study provides further evidence of both traditional and distinct presentations of impairing anxiety in youth with ASD and suggests that brief parent measures lack sensitivity. Anxiety may be missed in youth with ASD when the content of their worries/fears varies from traditional conceptualizations or when their cognitive and their language abilities are impaired.

89 **236.089** The Reliability and Validity of the Social Responsiveness Scale to Screen for Autism Spectrum Disorder in Vietnamese Children

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Background:

The Social Responsiveness Scale (SRS) has been validated in high income countries, but not yet in low and middle-income countries.

Objectives:

We assessed the reliability and validity of a Vietnamese-translated SRS to screen for autism spectrum disorder (ASD).

Methods:

We used a 3-phase study in 173 Vietnamese caretakers and their children (ages 4-9 years) that piloted, reliability tested, and validated the translated SRS.

Results:

We found that the translated and culturally adapted Vietnamese SRS demonstrates high reliability (0.82–0.83), validity (0.88–0.89), sensitivity (93%) and specificity (98%) for identification of children with ASD in Vietnam. The optimal cutoff was 60 for both total raw scores and T-scores. Both SRS long and short forms performed adequately in screening for children with ASD.

Conclusions:

Access to validated screening measures is limited in low and middle-income countries. The translated and culturally adapted Vietnamese SRS showed good reliability, validity, and sensitivity for identification of children with ASD in Vietnam. Future studies should examine the utility of culture-specific norms.

90 **236.090** The Systematic Observation of Red Flags for Autism in the First Year of Life for Infants at Risk

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Background: Studies focused on high-risk (HR) siblings of children with ASD demonstrate that core ASD symptoms can be detected as early as 12 months (Bryson, et. al, 2008; Watson et. al, 2013; Zwaigenbaum et. al, 2005), highlighting the opportunity for earlier screening. The Systematic Observation for Red Flags (SORF/Cite) is an observational screening tool based on DSM-5 diagnostic criteria designed to quantify presence of ASD symptoms. The SORF has been validated to differentiate 16-24 month-olds with ASD from those with developmental delay and typical development (Dow et al., 2017). Given the pressing need for earlier detection, the current study examined utility of the SORF among 12-month-old HR infants.

Objectives: In a prospective, longitudinal study of infant siblings, we examined: 1) sensitivity and specificity of the SORF at 12-months for predicting ASD at 24-months, and 2) associations between 12-month SORF performance and 24-month phenotypic outcome

Methods: Participants included 122 infants seen for communication, developmental and social-behavioral assessment at 12 and 24-months of age. Participants were either HR (N=45,) or low-risk infants (LR; N=77). The Communication and Symbolic Behavior Scales-DP Behavior Sample (Wetherby & Prizant, 2002) and the Mullen Scales of Early Learning (Mullen, 1995) were administered at 12-months. The SORF was coded via video

review of the CSBS and provides a measure of ASD symptoms (represented as a score and total number of red flags) across two domains: Social Communication and Social Interaction (SC) and Restricted Repetitive Behaviors (RRB). At 24-months, participants received a diagnostic evaluation that included the CSBS, Mullen, ADOS-2, and clinician best estimate diagnosis.

Results: See results in Table 1 and 2. 12-month-olds later diagnosed with ASD scored significantly higher than TD infants on the SORF SC domain, RRB domain, and overall composite. Infants with ASD also had significantly more SC and total red flags (RFs), with the difference in RRB RFs approaching significance. Highest sensitivity and specificity was observed for the SORF Composite with a cutoff of 18, which correctly identified 24 of 31 ASD infants, yielding a sensitivity of .77 and specificity of .76. Optimal cutoff for SORF Total RFs was 7, with 20 of 31 infants having 7 or more RFs at 12 months, yielding a sensitivity of.65 and specificity of.75. The SORF composite score and SC domain score at 12-months were both highly correlated with ADOS-2 CSS and verbal and nonverbal skills at 24-months.

Conclusions: Our results show that 12-month-olds later diagnosed with ASD exhibited significantly greater SORF total and SC domain scores compared to TD-infants. Additionally, SORF Composite cutoff of 18 resulted in higher sensitivity and specificity than SORF red flags cutoff of 7. SORF RRB scores were less associated with ASD when considered in isolation, in line with other research showing RRBs unfold over time and are quite subtle in the first year (Zwaigenbaum et. al, 2015, Bryson et. al 2008). The high sensitivity and specificity of the SORF at 12-months highlights the need for 12-month screening studies that include larger samples of both high-risk and community-based infants.

91 **236.091** Toddlers with Tuberous Sclerosis Complex with Comorbid Autism Spectrum Disorder at High Risk for Adaptive Behavior Delay By 36 Months.

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Background:
Infants born with TSC have a 40-50% risk for developing Autism Spectrum Disorder (ASD), a condition strongly associated with deficits in adaptive behavior development. Previous investigations have noted that children with TSC are at high risk for intellectual and adaptive deficits (e.g., Kopp et al., 2008), and that significant declines in adaptive function occur over time in individuals with TSC (van Eeghen et al, 2011). Although concerns with adaptive behavior dysfunction has been noted in TSC, little is known about the relationship between adaptive function and ASD in very young children (e.g., toddlers) with TSC

Objectives:

In this study, we compare developmental trajectories in adaptive behavior between age 18 and 36 months in toddlers with TSC, to determine if a diagnosis of ASD is associated with a higher risk over time for adaptive deficits.

Methods:

Sample was composed of toddlers who had completed their 36-month TACERN project evaluation. The ASD group consisted of 19 toddlers (15 boys, mean age= 36.5 mo., mean MSEL=53.3). The non-ASD group consisted of 60 toddlers (30 boys, mean age= 36.5 mo., mean MSEL= 85.3). Adaptive function was assessed using the Vineland Adaptive Behavior Scales, 2nd Ed., with parents serving as informants. Time-series analysis techniques (in which each child's development is tracked over time) were used to compare the developmental trajectories in VABS-II domains standard scores between 18 and 36 months in the two groups.

Results:

At 18 months, the VABS-II scores were lower in TSC+ASD compared to non-ASD (p<0.001). From 18 months to 24 months, the trajectories of adaptive development remained steady in both groups (p>0.05). However, between 24 and 36 months, significant group differences emerged in developmental trajectories (p<0.01). Toddlers with TSC+ASD demonstrated significant standard score decreases in Communication (-8.5), Daily Living Skills (-15.9), Socialization (-13.5), and the Adaptive Behavior Composite (-13.2) (p<0.05 for all). In contrast, for non-ASD group, standard scores decreased by 2.1, 4.4, 2.7 and 7.9--none of which was significant. Examination of subdomain raw scores suggested that while both groups gained new skills between 24 and 36 months, the rate of acquisition of new adaptive skills was much slower in the TSC+ASD group.

Conclusions:

Given that adaptive deficits are associated with suboptimal developmental outcomes, the declining trajectories of adaptive skill development in TSC+ASD suggests that by 36 months, toddlers with TSC+ASD are at significantly higher risk for suboptimal outcomes—similar to ASD-related adaptive concerns seen in the general pediatric population.

92 **236.092** Training Pediatricians to Implement Autism-Specific Screening Tools: A Review of the Literature

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Background: The American Academy of Pediatrics recommends using an autism-specific screening tool for all young children at primary care well visits. Screening can detect risk of Autism Spectrum Disorder (ASD) in young children whose parents and pediatrician may not have developmental concerns. The identification of children with or at-risk for ASD increases their access to early intervention services, which helps ameliorate skill deficits associated with Autism. Recent studies indicate pediatricians use autism-specific screening tools infrequently. Some research has been conducted to determine whether providing training to primary care providers increases screening practices; however, evidence-based practices for training pediatricians to conduct ASD-screenings have not been identified. We conducted a review of the research on training primary care providers (e.g., pediatricians) to conduct ASD-screenings with young children and their families. This information can be used to advance research, policy, and practice.
Objectives: The purpose of this review was to systematically review the research on training primary care providers to conduct ASD screenings including challenges related to their use and describe the findings.

Methods: Our literature search included terms for participants (pediatrician* OR doctor* OR physician* OR clinic* OR primary care), intervention

(professional development OR training* OR workshop* OR course OR teaching), and outcome (screen* OR diagnos* OR intervention* OR ADOS* OR M-CHAT* OR Autis*). Article screening was conducted in three steps: title screening, abstract screening, and full-text screening. Two coders extracted data related to population, design, independent variable characteristics, and study outcomes. All studies were evaluated using Cochrane's Risk of Bias tool.

Results: Few studies reported characteristics of participants. Five of the 12 studies reported inclusion criteria for providers. Most studies reported the setting; all reported on-site training. >50% of the studies reported objectives; they included goals related to knowledge/education and practice improvement. A variety of screening tools were used across studies. 75% of the studies reported an increase in the use of the screening tools following training. 66% included surveys, which reported increases in provider confidence and likelihood to use the tool. Knowledge consistently increased while the resulting referral rates varied by study and age group. All studies were rated as having a high risk of bias.

Conclusions: Overall, there is a lack of high-quality research in this area. Few research groups have conducted studies examining the effect of training primary care providers to implement Autism-specific screening tools. Methodological details in several studies were insufficient for replication. Furthermore, several studies included more than one training method, making it difficult to determine which parts of the training package were effective. Several directions for future research are suggested. Component analyses should be conducted to determine the most effective parts of training. Future studies should be held to higher rigor standards and work to decrease bias. Additionally, given changes in provider confidence, knowledge, and practice were observed, future research should investigate the cause of the increase in screenings. Finally, given the limited availability of resources for evaluations and early intervention, future research should investigate the costs and benefits associated with universal screening for Autism.

93 **236.093** Understanding the Diagnostic Process of Autism Spectrum Disorder in Females: The Role of Initial Diagnosis and Comorbidities

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Background: To ensure early intervention, it is important that children with autism spectrum disorder (ASD) receive a diagnosis as early as possible, as identifying and diagnosing ASD early can improve an individual's quality of life and reduce social, emotional, and behavioural problems (Bargiela, Steward, & Mandy, 2016). ASD can be diagnosed as young as two years of age; however, there are many children that do not receive a diagnosis until school age, defined here as five years of age and older (Pringle et al., 2012; Hiller, Young, & Weber, 2015). It has been suggested that the heterogeneity of symptoms and the presence of comorbid mental and physical health disorders can contribute to a late diagnosis (McMorris et al., 2013). Sex also contributes to late diagnosis, as females typically receive a diagnosis later than males (Duvekot et al., 2017; Hiller, Young, & Weber, 2016). Inconsistencies in the current literature have lead to equivocal conclusions related to the role of sex in children receiving a late diagnosis of ASD. Thus, it is unclear if females experience more instability in their diagnostic process than males.
Objectives: Given the inconsistencies in the existing literature, the primary objective of this study is to determine how sex impacts the diagnostic process of females with ASD. In particular, the study will first investigate if females, compared to males, have *more* instability in their diagnostic process, as indicated by a) taking longer to receive their ASD diagnosis; and b) receiving numerous initial diagnoses prior to their ASD diagnosis. A secondary aim of the study is to determine whether the existence of co-occurring mental health disorders may impact these sex differences in the diagnostic process.

Methods: Caregivers of children 18 years of age or younger, and who have a primary diagnosis of ASD are asked to complete a questionnaire that collects information about: 1) demographic information (i.e. age and sex); 2) initial diagnosis; and 3) multiple diagnoses and comorbid psychiatric or health conditions. Participants are recruited through: 1) autism-specific community agencies in Calgary, Alberta, who support children; 2) the University of Calgary external research page; 3) Facebook ASD support groups; and 4) the ASD Diagnostic Clinic at Alberta Health Services.

Results: We currently have 18 male and 14 female participants, and anticipate 35 males and 35 females by Spring 2019. Descriptive statistics will be conducted for all variables, including frequencies, means, standard deviations, and ranges. To answer the aforementioned research questions/aims, multiple regression models will be used.

Conclusions: Understanding whether sex impacts the process of receiving an ASD diagnosis can inform diagnostic tools for clinicians to determine early signs for diagnosis, particularly in females. The importance of determining sex differences in the first diagnosis a child receives can provide information as to whether clinicians are misdiagnosing females at a higher rate than males. These findings will aid health practitioners in their awareness of early ASD symptoms in both sexes, developing community outreach and intervention programs, and ultimately improve outcomes for these children and their families.

94 **236.094** Use of the CHILD Behavior Checklist 11/2–5 As a Screening Tool to Identify High-Risk Siblings Who Require Clinical Assessment

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Background:
Younger siblings of children with autism spectrum disorder (ASD) are at higher risk of developing ASD themselves, therefore their surveillance by community health providers is pivotal in order to determine whether they need referral for further assessments. A variety of standardized tools and screening instruments have been developed to inform clinical decision-making. However, early identification is complex, especially in children who may show sub-clinical ASD symptoms or other developmental problems due to a familial genetic risk.

Objectives:

This study aimed to investigate the utility of a parent completed questionnaire - the Child Behavior Checklist (CBCL 11/2–5) - in identifying toddlers who require further specialist assessment, in a population of siblings at genetic risk for ASD.

Methods:

CBCL profiles of 40 toddlers (18 mos.) at genetic risk for ASD, recruited through a surveillance programme, were compared with those of 40 toddlers with no familiarity for ASD (18-24 mos.) recruited through local kindergartens. Toddlers in the high-risk group underwent clinical assessment with the Autism Diagnostic Observation Schedule -ADOS and a best estimate diagnosis was obtained, in accordance with DSM-5 criteria (Outcomes: 9 ASD; 31 no-ASD). Scores on the CBCL questionnaire were compared within the sibling group, to evaluate possible differences between siblings with and without an ASD diagnosis and correlated with the ADOS clinical assessment (ADOS total score).

Results:

As a group, siblings at risk for ASD did not present significant differences in their CBCL profiles in comparison with the TD group. Subtyping the sibling group on the basis of the clinical diagnosis enabled us to observe that 5 of the CBCL scales significantly differentiated siblings with an ASD outcome from siblings with a familial risk but no ASD outcome ($p < .05$): Somatic Complaints, Withdrawn, Attention Problems, Internalizing Problems and Autism Spectrum Problems. Indeed, higher scores on these scales were positively correlated with higher ADOS total scores ($p < .05$) and an outcome of ASD as estimated by clinical judgement ($p < .05$).

Conclusions:

These preliminary findings suggest the utility of the CBCL scales, in particular, of 5 scales (Somatic Complaints, Withdrawn, Internalizing, Attention problems, and Autism Spectrum Problems) in identifying siblings at genetic risk for ASD who need further specialist assessment for ASD, as early as 18 months of life.

95 **236.095** Using a Portable Eye-Tracking Device to Measure Social Impairment in Children with Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental condition affecting 1 in 68 children and carrying a public health burden of $69 billion per year. Available ASD treatments are reliant on early and accurate identification. Expert clinicians can reliably diagnosed ASD by age two; nonetheless, research has found that a diagnosis of ASD for underserved and minority populations can be delayed several years despite parental concerns. Using eye-tracking measures, visual attention in ASD has been the focus of extensive research as an early and quantifiable marker of the disease. Indeed, diminished visual social attention and atypical non-social engagement have been correlated with increased ASD symptomatology.

Objectives: The overall objective of this study is to evaluate the utility of a tablet-based eye tracking paradigm to asses social and non-social engagement in children with ASD as a diagnostic aid in community settings. We will also examine the relationship between gaze preference to social and non-social scenes with measures of social impairment, cognitive and adaptive functioning.

Methods: Twelve children with ASD, and 11 age-matched typically developing (TD) controls were included in this study. Children with ASD were diagnosed based on psychiatric evaluation, DSM-5 criteria, and the ADOS-2. All participants received measures of cognitive function. In addition, children with ASD were administered the Vineland Adaptive Behavior Scale- 2nd edition (VABS-2). All participants completed the eye-tracking paradigm, which consists of a 50 second video in which a social scene and a non-social scene are displayed side-by-side. The algorithm measures time spent looking at: (1) social scene, (2) non-social scene, (3) distraction (i.e. middle of the screen, outside screen frame). A subset of TD and ASD participants (n=11) completed the Social Responsiveness Scale 2nd Edition (SRS-2).

Results: Gaze preference for the *social scene* was significantly higher for the TD group as compared to ASD participants (ASD: M=16.58, SD=12.2; TD: M=33.55, SD=16.36; p=0.01). There was no difference in time spent looking at the *non-social scene* (ASD: M=18.63, SD=13.01; TD: M=13.01, SD=11.27; p=0.317) or the *distraction* condition (ASD: M=64.75 SD=19.72; TD: M=52.88, SD=21.94; p=0.223). Gaze preference towards the *social scene* was not correlated with the adaptive behavior composite on the VABS-2 ($r = 0.108$, $p = 0.505$) or with full IQ scores ($r = 0.293$, $p=0.197$). SRS-2 total scores and time spent looking at the *social scene* had a negative relationship approaching significance ($r=-0.592$, $p = 0.055$).

Conclusions: Consistent with the existing literature, we found that children with ASD spent significantly less time looking at the *social scene* as compared to their TD peers. Importantly, gaze preference was not impacted by measures of cognitive or adaptive functioning. Interestingly, our results suggest that social impairment as measured by the SRS-2 is inversely correlated with gaze preference towards the social scene, suggesting that the eye-tracking paradigm might be sensitive social functioning in children with ASD and, as such, useful as a measure of treatment response. Overall, these results highlight the utility of the application and warrant continued larger-scale investigation.

96 **236.096** Using the Social Responsiveness Scale–Short Form to Assess ASD Characteristics in Children with Dup15q Syndrome

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Background: The Social Responsiveness Scale (SRS) is a quantitative measure of autism symptoms, which is widely used in studies of autism risk and phenotypic characterization of associated genetic syndromes. Due to concerns over the vulnerability of the SRS to non-ASD traits such as cognitive and language abilities, Sturm and colleagues (2017) developed a short form SRS, using item response theory to identify the least vulnerable items. The resultant 16-item short form was unidimensional and un-biased by language or non-verbal cognitive ability. In order to further evaluate the performance of the SRS short form in children with cognitive and language impairment, we examined the SRS scores of children with duplications of 15q11.2-q13.1 (dup15q syndrome), which is one of the most common copy number variants associated with ASD and intellectual disability (ID). Dup15q syndrome is characterized social communication deficits, cognitive and language impairment, hypotonia, motor impairment, and epilepsy (Battaglia etal., 2010). These widespread and significant impairments present a challenge to accurate measurement of ASD characteristics.

Objectives: 1) Examine the association of short-form SRS scores with verbal and non-verbal cognitive ability, and other measures of ASD characteristics (SCQ, ADOS) in children with dup15q syndrome, 2) compare these associations in children with dup15q syndrome and age and IQ-matched children with idiopathic ASD and ID.

Methods: Participants included 31 children with dup15q syndrome (3-14 years; IQ *M(SD)* 35(22)), and an age and IQ-matched group of children with

idiopathic ASD (*N*=18). Participants were assessed using the Autism Diagnostic Observation Schedule (ADOS) and cognitive/developmental assessment (Mullen Scales of Early Learning or Differential Ability Scales). Parents completed the SRS and Social Communication Questionnaire (SCQ). The SRS was scored with original long form T-scores and revised short form totals.

Results: In children with dup15q syndrome, both long and short form SRS scores were negatively associated with verbal IQ (*r*=-.61, *p*<.001; *r*=-.42, *p*=.02, respectively), and non-verbal IQ (*r*=-.7, *p*<.001; *r*=-.46, *p*=.009). Long and short form SRS scores showed moderate positive association with ADOS severity scores (*r*=.62, *p*=.004; *r*=.56, *p*.01) and SCQ scores (*r*=.69, *p*=.003; *r*=.57, *p*=.02). In contrast, neither long nor short form SRS scores were associated with verbal or non-verbal IQ in the ASD+ID group, but did show the expected positive association with SCQ and ADOS scores (*r*-values .65-.7, *p*-values .008-.02).

Conclusions: SRS short form scores did not show an association with language or cognitive abilities in children with ASD+ID, consistent with the results from Sturm and colleagues. However, in children with dup15q syndrome, SRS short form scores were negatively correlated with language and cognitive scores, albeit with reduced correlations strength. Encouragingly, SRS short form did show the expected positive association with other measures of ASD characteristics in the dup15q sample. In children with dup15q, the short form SRS represents an improvement over the long form in terms of reduced relationship to non-ASD characteristics, but was not independent of those characteristics as in the ASD+ID sample. The SRS short form should be interpreted with caution when used in genetic syndromes with a high degree of impairment across domains.

97 **236.097** Utility of the M-CHAT-R for Identifying Autism and/or Developmental Disorder in a Representative Community Sample at the 18-Month Pediatric Visit

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Background:
Autism screening is recommended by the AAP at both 18 and 24-month check-up visits (2006) and M-CHAT-R/F is the most popular screen. However, a USPSTF report (2015) did not recommend universal autism screening, citing inadequate data about current screening tool accuracy, specifically lack of information on children screened negative. Studies suggest that the Positive Predictive Validity of the M-CHAT is lower at 18 months than at 24 months, even with the required follow-up interview (Pandey, 2008) (Sturner, 2017). However, it has been argued that almost all false positive M-CHAT-R/F screens have alternative clinical value in detecting children with developmental disorder (Robins, 2013).

Objectives:

To determine the predictive utility of the M-CHAT-R with Follow Up Interview (M-CHAT-R/F) for concurrent autism and developmental diagnoses in a community pediatric sample at 18 months, including children screening negative.

Methods:

Parents of 11,878 children completed the M-CHAT-R at 18-month pediatric visits (16-20 mo.) via an online system (CHADIS). Children with positive screens (96) and age and practice matched controls (314) were recruited. All children had diagnostic evaluations using the ADOS-2 Toddler Version and Mullen tests with clinical impression of autism considered to be a positive for autism. Developmental disorder was defined as the typical criteria for early intervention services (score >1 ½ SD below the mean on two or more subscales or > 2SD on a single subscale).

Results:

The M-CHAT-R/F had significantly lower sensitivity (0.35 vs 0.73) compared to M-CHAT-R with significantly higher specificity (0.89 vs 0.64) but positive predictive value (PPV) tended to be low (0.37) and not significantly different than M-CHAT-R (0.27), and negative predictive value did not differ (0.88 vs 0.93). 51% of the MCHAT-R/F false positives were developmental delay (DD) positives. However, MCHAT-R/F correctly identified only 19% of the developmental screen (ASQ-3) false negatives as true positives for delay. When the entire group of autism +/or DD (Table 2) is considered slightly more than half are identified by the combination of MCHAT-R/F + ASQ (sensitivity 0.53). Addition of the Follow Up to M-CHAT-R+ ASQ lowers sensitivity (0.75 to 0.53) and NPV (0.80 to 0.74) but increases specificity (0.63 to 0.81) and PPV (0.55 to 0.61).

Conclusions:

We cannot assume that children 16-20 months old passing the M-CHAT-R/F are unlikely to have an autism diagnosis. The low sensitivity to the presence of autism was without the intended balancing benefit of increase in positive predictive value, the rationale for requiring a follow-up interview. If referral for developmental delay in addition to referral for autism is considered desirable, false positives are infrequent. However, the clinical utility of the recommended procedure (M-CHAT-R/F) false positives is considerably less if only children missed by a developmental screen are considered.

98 **236.098** Utility of the Screening Tool for Autism in Two-Year-Olds (STAT) to Detect Autism in Toddlers before 24 Months of Age in Taiwan: A Longitudinal Study

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Background:
Autism spectrum disorder (ASD) is thought as an innate developmental disorder. Over past decade, some studies reported that prevalence of ASD has increased markedly. However, compared to Western countries, the prevalence of ASD in Taiwan is lower. There are a few reasons that cause the differences of the prevalence, such as stigma in Chinese culture, policy of government etc. Previous studies reported that early intervention improved outcomes for toddlers with ASD. The benefits of early intervention highlighted the importance of earlier identification of toddlers with ASD. Knowing the importance of early identification, the American Academy of Pediatrics (AAP) has recommended that all infants receive universal screening for autism less than 24 months old (Johnson et al., 2007).

Objectives:

The purpose of the longitudinal study is to examine the predictive validity of the Screening Tool for Autism in Two-Year-Olds (STAT; Stone et al.,

2008) as a screening tool for detecting ASD in toddlers before 24 months of age in hospital-based clinical sample. The STAT is a 12 items interactive autism-specific screening tool, including four behavioral domains: play (2 items), requesting (2 items), joint attention (4 items) and imitation (4 items).

Methods:

There were 139 toddlers between 16 to 24 months (Time 1) participated the study and all toddlers were recruited from the teaching hospital in Chia-Yi area. 18 months after the assessment at Time 1, participants were invited for re-assessment and finally diagnosis. There were 119 children between 35 to 46 months (Time 2) received follow-up assessment. The average length of time between the initial and follow-up assessment s was 18.64 months (SD = 1.09). Finally, there are 57 children with ASD and 62 children with developmental delay (DD).

Results:

Using receiver operating characteristics (ROC), 2.25-2.75 was the optimal range of the total of the STAT as cut-off at Time 1. Using cutoff score of 2.25, the sensitivity was .88, and the specificity was .73. In addition, the positive predictive value (PPV) was 74.6%, while the negative predictive value (NPV) was 86.5%. Using cutoff score of 2.50, the sensitivity was .86, and the specificity was.81, the PPV was 80.3%, and the NPV was 86.2%. Using cutoff score of 2.75, the sensitivity was .74, and the specificity was.88, the PPV was 85.7%, and the NPV was 78.6%. The AUC was .87 at Time 1. Using ROC, 1.25-1.50 was the optimal range of the total of the STAT as cut-off at Time 2. Using cutoff score of 1.25, the sensitivity was .86, and the specificity was .71, the PPV was 73.1%, and the NPV was 84.6%. Using cutoff score of 1.50, the sensitivity was .70, and the specificity was.79, the PPV was 75.5%, and the NPV was 74.2%. The AUC was .82 at Time 2.

Conclusions:

The results of this study revealed that STAT showed high predicative validity for detecting ASD in toddlers before 24 months of age. This study indicated that the STAT is a promising good tool to differentiate the toddlers with ASD and toddlers with DD.

99 **236.099** Validation of a CBCL/6-18 ASD-Scale: Differentiation of Youths with ASD from Comparison Groups

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Background: Broadband measures have been used to identify youth at risk for Autism Spectrum Disorder (ASD), including the *Childhood Behavior Checklist/6-18 (CBCL/6-18).* Only one study has created a 9-item ASD-scale utilizing items from *CBCL/6-18* to differentiate children with ASD from comparison groups (Ooi et al., 2010). However, its validity has not been examined

Objectives: This study investigated differences among children with ASD, Social Anxiety Disorder (SAD), Specific Phobia (SP), and those having no diagnoses (NODX) on the eight *CBCL/6-18* syndrome scales. The 9-item ASD-scale was examined to determine its ability to differentiate the ASD group from the other groups.

Methods: Nine youths with ASD (8 male; *M=9.66* years-old), 9 with SAD (4 male; *M=10.22* years-old), 9 with SP (5 male; *M=9.22* years-old), and 9 with NODX (7 male; *M=12.78* years-old) were included as part of a larger IRB-approved study. Diagnoses were confirmed by the *Childhood Autism Rating Scale, Second Edition (CARS-2)* and the *Anxiety Disorders Interview Schedule (ADIS-IV-C/P).* Full-Scale IQ was measured using the *WISC-V* (ASD *M*=94.00, *SD*=13.83; SAD *M*=99.67, *SD*=10.61; SP *M*=101.67, *SD*=7.97; NODX *M*=103.44, *SD*=8.03). The *CBCL/6-18* was completed by the primary caretaker. Consent/assent was obtained.

Results: A one-way MANOVA was run to determine the effect of diagnosis on the eight *CBCL/6-18* syndrome scales. The differences between diagnosis on the combined dependent variables was significant, $F(24, 73)=2.05$, $p=.01$; Wilks' $\Lambda=.23$. Follow-up univariate ANOVAs showed that Anxious/Depressed ($F(3, 32)=3.30$, $p=.03$), Social Problems ($F(3, 32)=5.82$, $p<.001$), and Aggressive Behavior ($F(3, 32)=6.17$, $p<.001$), scales were statistically significantly different between groups. Games-Howell post-hoc tests showed that the ASD group had significantly higher mean scores on Anxious/Depressed ($p=.04$), Social Problems ($p=.03$) and Aggressive Behavior ($p=.03$) than the NODX group and higher Social Problems ($p=.04$) than the SAD group. Cronbach's alpha was computed for the ASD-scale, for each group separately and the full sample. Surprisingly, ASD group had poor internal consistency (.43); when one item was removed (*#66. Repeats acts over and over*) it improved to .61. Acceptable internal consistency was found for the SP (.91), NODX (.77) groups and the full sample (.79). Three logistic regressions were used to test the ability of the ASD-scale to differentiate the ASD group from the comparison groups. All logistic regression analyses yielded significant results ($p<.05$), with variance accounted for by the ASD-scale ranging from 28.3% (ASD vs. SP) to 84% (ASD vs. NODX). Overall prediction success rates at 83.3% (sensitivity 88.9%, specificity 77.8%) for the ASD vs. SAD and SP groups, and an overall predication success rate of 88.9% for ASD vs. NODX.

Conclusions: The *CBCL/6-18* may be used in differentiating children with ASD from those with other disorders. High scores on the ASD-scale identified the majority of children in the ASD group, especially compared to the SAD and SP groups; low scores identified the majority of children being contrasted with the ASD group. Future research should address the limitations of the current study specifically, the small sample size, in order to determine if the internal consistency and predictive utility of the scale can be improved.

100 **236.100** Validity of the Autism Diagnostic Observation Schedule-2 (ADOS-2) in South Korean Toddlers and Preschoolers with ASD from 12-47 Months of Age

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Background: The gold-standard diagnostic measure, the Autism Diagnostic Observation Schedule-2 (ADOS-2; Lord et al., 2014), has shown strong diagnostic validity in individuals with ASD, including young children from 12 to 47 months of age (Luyster et al., 2009; Gotham et al., 2007). However, the studies of the diagnostic validity of the ADOS have been limited to samples obtained from the Western countries, limiting the evidence for the valid use of the ADOS in the Eastern countries, although initial attempts have been made recently to examine its validity in Chinese (Sun et al., 2015) and Indian (Rudra et al., 2014) children with ASD. A recent translation of the ADOS-2 in Korean (2017) has increased the use of the ADOS in South Korea significantly for both research and clinical purposes, which highlights the urgent need to examine the validity of the ADOS for South Korean children.

Objectives: To provide the initial validity of the ADOS Toddler Module and Module 1-2 in South Korean toddlers and preschoolers.

Methods: The ADOS-2 was administered by a research team led by a research reliable clinician to 143 children clinically referred for ASD (68 children with ASD, 39 with non-spectrum (NS) disorders [e.g., developmental delays]), and 36 typically developing (TD) children recruited as a comparison group in a metropolitan area of South Korea. The mean age was 33.1 months (SD=9.1) and a mean nonverbal IQ, 81.5 (SD=25.1). Fifty-six children received the Toddler Module, 67 children, Module 1, and 20 children, Module 2. Algorithm and item scores were compared based on the ANOVAs for the ASD vs. NS/TD groups. Sensitivity and specificity using the ADOS algorithm cutoffs ("ASD cutoffs"; Lord et al., 2014) for each Module and age/language group were computed for the ASD vs. NS/TD diagnostic comparisons. Correlations (Pearson's *r*) between algorithm totals and developmental factors (e.g., nonverbal mental age, chronological age) were computed to examine the effects of these factors on the measurement of autism symptom severity.

Results: The ASD group showed significantly higher ADOS algorithm totals, and social affect and repetitive and restricted behavior (RRB) domain scores across all Modules ($p<0.05$) compared to the NS/TD groups. Likewise, the ASD group scored significantly higher on the majority of item scores on the diagnostic algorithms across all Modules, with the greatest variability in Toddler Module ($p<0.05$). Sensitivities were excellent, ranging from 94% to 100% across different Modules. Specificities varied more, ranging from 75% (Module 1, Few to No Words algorithm) to 100% (Module 2). Algorithm totals had mild-to-moderate correlations with NVMA and age (range=r=0.1 to 0.5).

Conclusions: The current study demonstrates promising, initial evidence for the diagnostic validity of the ADOS-2 for clinically ascertained, South Korean toddlers and preschoolers with ASD from 1-4 years of age. Results suggest that the ADOS-2 could be validly implemented as a diagnostic tool by highly trained clinicians, with minimal cultural adaptations, in research and clinical settings for South Korean children. This study is one of the first steps in current efforts for the cross-cultural validation of the ADOS-2 in non-Western countries.

101 **236.101** Variation between Clinician and Parent Report Outcomes Following a Trial of Pivotal Response Treatment

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Background:
Assessment of autism spectrum disorder (ASD) symptom severity is an area of great clinical importance. Reliable measures of ASD symptom severity and change in symptom severity over time are necessary to quantify treatment response, yet there is no strong consensus in the literature of the best way to measure change in symptom severity (Bolte & Diehl, 2013). Two common methods of assessing change in symptom severity are parent-reported questionnaires and clinician-administered assessments. However, the literature is mixed as to the relationship between parent and clinician reports of ASD symptom severity as measures of treatment response (Stone, Hoffman, Levis & Ousley, 1994; Murray, Mayes & Smith, 2011).

Objectives:

The present study aimed to explore agreement between parent and clinician report of ASD symptom severity before and after Pivotal Response Treatment (PRT).

Methods:

The study sample consisted of 41 children ages 4-9 who were diagnosed with ASD. Participants received 16 weeks of PRT. All participants received a diagnostic and clinical characterization battery before and after treatment. Measures administered at pre-PRT and post-PRT included the Autism Diagnostic Observation Schedule (ADOS) and Social Responsiveness Scale – II Parent Report Form (SRS-II). Paired-samples t-tests were used to examine change in measures of ASD symptom severity. Pearson correlations were then used to examine the association between parent-rated and clinician-rated measures of symptom severity.

Results:

Paired-samples t-tests confirmed our previous findings of improvement in ASD symptom severity as reported by parents on the SRS-II (pre-PRT t-score M=73.95, post-PRT t-score M=68.32,$p<.001$) and as reported by clinicians on the ADOS Calibrated Severity Score (CSS; pre-PRT M=7.65, post-PRT M=6.90, $p=.037$). Pearson correlations between the change in SRS-II and the change in ADOS CSS revealed no correlation in symptom change on the two measures ($r=-.115$,$p=.503$). Furthermore, there was no significant correlation between the SRS-II and the ADOS CSS at pre-treatment or post-treatment time points (pre-PRT $r=-.220$,$p=.185$, post-PRT $r=.109$, $p=.505$). Additional Pearson correlations were run between all ADOS and SRS-II subscales, and no significant correlations were found. When controlling for gender, age, and IQ, partial correlations between the change in SRS-II and ADOS CSS remained insignificant.

Conclusions:

As a group, children improved in social communication skills following PRT; however, there was heterogeneity in treatment response. Improvement as measured by the ADOS did not relate to improvement as reported by parents on the SRS-II. This indicates that although PRT facilitated social communication skills in the sample as a whole, it may have an effect in heterogenous ways at the individual level. The ADOS tends to assess core social communication skills as well as understanding and insight, whereas the SRS-II measures skills related to social communication in naturalistic contexts. These results underscore the need for collecting outcome information from multiple informants across a variety of settings to obtain an accurate understanding of treatment response. Future studies should examine the relationship between other measures of treatment response and consider additional methods of quantifying social communication change.

102 **236.102** Visual Scanning Preferences of Low-Birth-Weight Preterm

ABSTRACT WITHDRAWN

Background: Visual scanning studies of preterm infants are still limited and contributions are relevant to establish their typical eye gaze pattern, aiming for the identification of early impairments, and ASD screening
Objectives: to evaluate time fixation in social and non-social figures and percentage of preterm that looked to the images.

Methods: cross-sectional study, with 31 preterm, eye gaze evaluated at 6 months of corrected age.Inclusion criteria: toddlers of six months of corrected age, of both sexs, born before 37 weeks of gestation and birth-weight equal or below 20000g, followed up at a multidisciplinary outpatient clinic for preterm infants.Exclusion criteria: genetic syndrome and/or presence of a major motor, visual or hearing deficiency, according

to the diagnosis recorded in the children's histories by the multiprofessional team that accompanied the children after their discharge from the neonatal unit. Preterm were evaluated with eye-tracking Mirametrix S2 Eye Tracker (version 2.0.0.057, Mirametrix Research Inc., 2011) with Mirametrix Viewer software (made in Canada) and 17 inches monitor. Six boards with social and non-social figures were projected in a screen computer each one for 5 seconds, successively, evaluating time and percentage of preterm that looked to each board. Socioeconomic data, clinical evolution during the hospitalization period in the neonatal intensive care unit and perinatal clinical data were collected from the charts .M-CHAT questionnaire was answered at 18 months of corrected age by the sample. This study complies with the guiding policies and principles for experimental procedures endorsed by the National Institutes of Health.

Results: The study sample was composed of 31 preterm with birth-weight equal to or below 2000g, 12 (38.7%) male. The mean gestational age at birth was 30.7 ± 2.7 weeks (24 to 35 weeks), the mean birth weight was 1362 ± 363 g (655 to 2000 g), Mother's age at birth was 28.2 ± 6.0 years and 73.9% belonged to socioeconomic class C (average income between U$500 and U$2000). None of the preterm had siblings with ASD diagnosis. Preterm showed bigger visual fixation time in social figures, if compared to non-social ones, regardless to the social figure position in the board. Similar percentage of preterm looked either to social or non-social figures, to social figures with direct or indirect look, and to the eyes or mouth of the social figure. No preterm was screened positively with M-CHAT

Conclusions: At 6 months of corrected age, preterm show capacity of eye gaze in eye-tracking test, preferring social figures, suggesting that this tool can be useful as another screening ASD instrument.

103 **236.103** What Are the Differences between Parent-Reported Autism Concerns on the M-CHAT-R/F and Clinical ADOS-2 Results?: Findings from a Sample of Ethnically Diverse, Low Income Families

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Background: To detect autism spectrum disorder (ASD) in as many cases and as early as possible, the American Academy of Pediatrics recommends universal ASD-specific screening at 18- and 24-months. Pediatricians widely screen for ASD with the Modified Checklist for Autism in Toddlers Revised with Follow-Up (M-CHAT-R/F), a parent questionnaire with 20 binary items. Some research indicates sensitivity of the M-CHAT-R/F at rates up to 91%; however, in other studies the validity has been questioned for children who have: (a) families with lower socio-economic status, (b) varying symptom expression, such as females, and (c) ethnic minority group status. Understanding the areas of discrepancy and agreement on parent-report and gold-standard assessment (i.e., ADOS-2) is critical for informed recommendations on the M-CHAT-R/F's practical utility.

Objectives: To explore the relationship between parent-indicated concerns for ASD on the M-CHAT-R/F and corresponding gold standard assessment within a sample of ethnically diverse, low-income families.

Methods: Data were collected about 148 toddlers who had positive MCHAT-R/F screens in primary care and diagnostic assessment including ADOS-2 administration in specialty care. Participating parents, toddlers, and clinical sites were from a larger randomized controlled trial of Family Navigation across three U.S. cities. Two trained clinicians independently mapped M-CHAT-R/F items onto the ADOS-2 scoring system, based on measured ASD symptoms that corresponded across both assessments. Inter-rater agreement was 85%. The M-CHAT-R/F positive predictive value (PPV) in relation to ASD diagnostic resolution was calculated. Across toddlers with and without ASD, parent-indicated M-CHAT-R/F and clinician indicated ADOS-2 results were tabulated. Proportions of clinicians and parents with concordant present or absent concerns (i.e., positive predictive and negative predictive values) and with disagreement across corresponding items (i.e., false positive and false negative rates) were calculated.

Results: The participating toddlers were 73% male, 59.4% born in the U.S., and primarily from ethnic minority groups. The majority of parents had graduated high school, enrolled in social service programs, and received public insurance. Eighty-two of 148 toddlers met ASD diagnostic criteria, yielding an M-CHAT-R/F PPV of 0.55, which is within the range of its published performance characteristics. When a skill was indicated as a concern on the ADOS-2, the highest rate of M-CHAT-R/F-ADOS-2 agreement was on pretend play, pointing to ask for help, and imitating. In contrast, low agreement was identified on ratings of children's shared enjoyment and intonation. High false negative rates (i.e., absent M-CHAT-R/F item concern and present corresponding ADOS-2 item concern) occurred on pointing, imitation, response to name, and unusual finger movements. High false positive rates (i.e., present M-CHAT-R/F item concern and absent corresponding ADOS-2 item concern) occurred on responding to pointing and not requesting parents' attention.

Conclusions: In the context of research indicating poor M-CHAT-R validity for samples of ethnic minority and low SES children, this study identified specific areas that may contribute to a high level of inaccurate screens. Further exploration of parent-related factors (e.g., expectations of children, interpretation of items) and assessment-related factors (e.g., specificity of skill, wording of item, cultural bias) is recommended to explain the underlying causes of these findings.

104 **236.104** What Is the Optimal Structure of the Autism Phenotype: A Comprehensive Comparison of Dimensional, Categorical, and Hybrid Models

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Background:

While initially conceptualized as a categorical construct, recent years have seen an emergence in clinical, research, and popular discourse about a continuous (dimensional) "autism spectrum." More recently, a compelling new possibility has emerged that integrates both categorical and dimensional representations of ASD symptoms (i.e., hybrid model). Nevertheless, there was still a debate about how to best conceptualize ASD phenotypic symptom structure, with multiple categorical, dimensional, and categorical-dimensional hybrid models showing varying degrees of support (Frazier et al., 2012; Georgiades et al., 2007; James et al., 2016). Given this, adjudicating between these proposed structures of ASD symptoms is essential for effective diagnostic classification in the context of research as well as clinical practice.

Objectives:

We sought to delineate the optimal structure of the observable ASD symptom phenotype by comprehensively comparing categorical, dimensional,

and categorical-dimensional hybrid models in two large, diverse samples of youth with and without ASD.

Methods:

The primary study sample comprised 3,825 youth, who were consecutive referrals to a university developmental disabilities clinic or a child psychiatric outpatient clinic. We analyzed the ASD symptom rating scale from the parent-report version of the Child and Adolescent Symptom Inventory-4R. A series of latent class analyses (LCA), exploratory and confirmatory factor analyses (EFA and CFA, respectively), and factor mixture analyses (FMA) were compared. Further, including only individuals whose ASD diagnoses were available, we conducted another subset of analyses where we further specified the three following category-based models: (a) diagnostically-driven categorization, (b) empirically-driven categorization, and (c) *DSM-5*-based-categorization. We also conducted a full replication analysis using a separate large heterogeneous and geographically diverse sample of clinic referrals (*N*=2,503).

Results:

Overall results indicated that the ASD symptom phenotype was best conceptualized as multi-dimensional rather than categorical (either diagnostically-based categories or empirically-based categories) or as a categorical-dimensional hybrid (Figure 1). ASD symptoms were best characterized as falling along three dimensions (i.e., social interaction, communication, and repetitive behavior). The results of the replication analysis were virtually identical to those of the analyses conducted using the primary dataset, supporting: (a) the superiority of the 3-factor dimensional model of ASD symptoms (Table 1-1), (b) the same top five models (Table 1-1), and (c) that the best fitting models for each approach were almost identical across the two subsets (i.e., the primary and replication analyses) of analyses (Table 1-2).

Conclusions:

In sum, our findings are consistent with the notions that ASD traits are widely distributed among the general population of clinic referrals; there are three core domains of symptoms (social, communication, repetitive behavior); and diagnostic models including their associated symptom clusters are better conceptualized as dimensional. Clinically, these results challenge traditional conceptualizations of *autism*, *spectrum*, and *disorder*, and have important implications for differential diagnosis and trans-diagnostic models of pathogenesis.

105 **236.105** A Paradigm for Engaging Underrepresented Communities in Autism Research

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Background: Racial/ethnic minorities, individuals of low socioeconomic status (SES), and individuals with extensive special education needs are underrepresented in autism research. Community-based methods, as well as proactive and reactive recruitment methods, have been shown to be effective at engaging racial/ethnic minorities in research. To our knowledge, these methods have not been used for engaging minority adolescents and young adults of low SES with extensive special education needs in behavioral autism research.

Objectives: This pilot study tested the efficacy of a community- and participant-centered paradigm for recruiting and retaining minority adolescents and young adults of low SES with extensive special education needs in behavioral autism research.

Methods: The NYC Department of Education and the University of Kansas IRBs approved this study. A community- and participant-centered paradigm was implemented over a four-month period. The first author partnered with a community organization to recruit participants. Participants attended a Title I school requiring a diagnosis of ASD. Most students are racial/ethnic minorities and qualify for free lunch. The school consists of self-contained classes with a maximum class size of 6 - 12 students.

Recruitment included proactive and reactive strategies. In addition to disseminating information on a flyer, the first author made repeated visits to the recruitment site to distribute/collect flyers and provided individual consultation on the research process to participants and their families.

Formal recruitment and assessment happened in a single session at a time and place selected by participants' families outside of school. Each session required 10 minutes for assent and informed consent, and 60 minutes for assessment. Participants and their families were compensated $20 and $40, respectively.

Results: The paradigm was effective. 12 of 80 (15%) potential participants returned consent-to-contact forms, 10 of 12 (83%) were successfully contacted, and 10 of 10 (100%) were formally recruited and retained. All participants were male, racial and/or ethnic minorities, and adolescents or young adults (100%). The paradigm was costly in terms of time. Assessment and recruitment required 30 hours and 20 hours respectively, or 5 hours per participant. Most of this time was spent traveling to the research sites.

Conclusions: This study demonstrated the efficacy of a community- and participant-centered paradigm to engage racial/ethnic minority adolescents and young adults of low SES with extensive special education needs in behavioral autism research. Findings suggest when barriers to participation are removed, it is feasible to engage underrepresented communities in autism research. Further work is needed to learn how to make this paradigm efficient, sustainable, and scalable.

Additional references available upon request.

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Poster Session
237 - Early Development (< 48 months)
11:30 AM - 1:30 PM - Room: 710

106 **237.106** Parent Behavior Associated with the Development of Emotional Self Regulation for Children with Autism in a Diverse

Sample

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Background: Emotional self-regulation (ESR) challenges are well documented in the developmental profiles of children with autism (Samson, et al, 2014). The development of child ESR is influenced by parent behaviors during daily interactions. Children diagnosed with autism have significant social communicative and sensory processing differences which potentially impact parent behaviors (Laurent & Gorman, 2018). Limited evidence suggests that children of color may be diagnosed later than their white peers, and that parents of color may engage in different parenting behaviors (ADDM, 2012). As such, exploring the relationship between autism specific child behavioral characteristics and parents behaviors among a diverse sample associated with supporting ESR is warranted.

Objectives: To examine the association between behavior of young children diagnosed with autism and their parents' behaviors as a function of race/ethnicity.

Methods: Participants were 37 children diagnosed with autism and a parent. Child age ranged between 30-48 months (*M*=40.86, *SD*=5.75). Participants were diverse: 32.4% identified as families of color; 19% of the children were female. Employing a cross sectional design, we observed parent-child dyads in their homes during naturalistic routines: free play, social communication (SC) assessment, and snack. Observations were video recorded for subsequent coding using combined event/time sampling procedures. Parent behaviors included physical engaging and helping, language-based engaging and helping, redirection/distraction, vocal comfort, physical comfort, language-based comfort, emotional following, and active ignoring. Children's SC abilities were assessed using the Communication Symbolic Behavior Scales- Developmental Profile (Wetherby & Prizant, 2002)and their sensory processing (SP) abilities were assessed using the Sensory Processing Measure – Preschool Home form (Ecker & Parham, 2010). Parents completed a demographic questionnaire.

Results: Compared to children of color, White children scored higher on SC ($t(35)=2.06$, $p<.05$) and lower on the SP measure ($t(35) =-2.62$, $p<.05$) indicating overall fewer SC and SP challenges. Parents engaged in all of the behaviors associated with ESR development during the observations but to varying degrees (Laurent & Gorman, 2018). Parents of color used redirection/distraction significantly more often than White parents during the combined observation ($t(35)=-2.547$, $p<.05$) and the CSBS DP assessment condition ($t(35)=-2.382$, $p<.05$). Additionally, parents of color used language and helping behavior significantly less often than White parents during free play ($t(35)=2.425$, $p<.05$). However, after controlling for child SC ability, differences were no longer significant (Tables 1 & 2). No other differences were observed.

Conclusions: In this sample, children of color demonstrated more significant delays in SC and SP than the White children in our study. When the child SC delays were controlled for, differences in parenting behaviors were no longer significant. This suggests that parents engage in responsive parenting practices based on their child's developmental level rather than factors related to race and ethnicity. No differences based on sex of the child were noted.Future research within culturally diverse populations is warranted to further understand racial/ethnic group differences that we observed in relation to both child characteristics and parent behavior. These findings have potential implications for informing parent coaching interventions aimed at supporting the development of child ESR.

107 **237.107** Physiological Responses to the Emotions of Others in Infants with a Family History of ASD

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Background: Although symptoms associated with Autism Spectrum Disorder (ASD) do not emerge until the second year of life, differences in attention regulation have been observed in infancy. Additionally, studies have reported differences in physiological measures, such as heart rate (HR). During a calm state, some studies report higher HR and smaller HR responses to social stimuli in ASD compared to typically developing children.

Objectives: In this study HR is compared between infants with an older sibling with ASD (ASD-sib) and those without a family history of ASD (control-sib) in response to non-social stimuli and social, emotional stimuli. Additionally, groups are compared on the amount of HR deceleration during the videos, as an indicator of attentional engagement.

Methods: Data is from the 5, 10 and 14-month visits of the longitudinal British Autism Study of Infant Siblings (BASIS; www.basisnetwork.org). Ninety-three ASD-sibs (52 males) and 28 control-sibs (17 males) had HR data available for at least one visit. HR was measured continuously during an eye-tracking paradigm including a non-social wildlife video (N-S), Happy video and Sad video. At the end of the paradigm, infants either saw the N-S video (5 months) or a neutral social video. 'Baseline HR was the median of 5 pre-stimulus beats. Average HR during deceleration was calculated as: HR during video when lower than baseline - baseline. Multilevel mixed models were compared using log-likelihood test. Variables were added in the order age, condition, group, condition-by-group interaction.

Results: There was an effect of age (B = -.05, p <.001) and condition on HR (p <.001), but no group (p =.373) or interaction (p =.112) effect. Data at each visit showed that HR was lowest during N-S at 5 months, but during Happy at 14 months. For HR deceleration, there was an effect of age (B =.002, p =.008) and condition (p <.001), but not of group (p =.358) or the interaction (p =.680). HR deceleration was largest during Happy and last N-S video at 5 months, but during Sad at 14 months. Looking more specifically at the change in HR deceleration over development showed that with age, children increased their HR deceleration to the Sad video only. Additionally, cross-lagged models showed bidirectional associations between parent-reported language skills and HR/HR deceleration.

Conclusions: Despite previously reported differences in physiological activity at baseline or in response to social stimuli in children with ASD, ASD-sibs do not show differences in HR during infancy compared to the control-sib group. Moreover, groups did not differ in HR deceleration, suggesting similar amounts of attention allocation in both groups. With age, infants show increased HR deceleration to the sad stimulus. This finding contributes to the literature suggesting that infants can discriminate between emotions around 5 months, although emotion recognition and regulation are still developing. Moreover, early language skills play a role in physiological adaption to social information and vice versa. Following-up which children in the ASD-sib group go on to have ASD can further elucidate whether children with ASD already show differences in autonomic activity in infancy.

108 **237.108** Potential Gender Differences in Non-Verbal and Verbal Communication Among High-Risk and Low-Risk Infant Groups

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Background:

Throughout their lifetime, females may master non-verbal communication more adeptly than males (Briton & Hall, 1995), such that high-functioning females may "camouflage" their social deficits and receive a late ASD diagnosis (Lai et al., 2017). While gender differences in ASD have been examined in older children, adolescents, and adults (Hull et al., 2017), little research has explored potential gender differences in non-verbal and verbal communication in the context of high-risk (HR) versus low-risk (LR) infant development.

Objectives:

The objective of this study was to examine within risk status gender differences and within gender risk status differences in non-verbal and verbal communication at 12, 15, and 18 months in infants who are at HR and LR for ASD.

Methods:

These analyses used secondary data from two cohorts of LR (n=43) and HR (n=39) infant participants from two longitudinal studies. Nonverbal communication skills were measured using the Early Social Communication Scales (ESCS; Mundy et. al, 2013) at 12, 15, and 18 months, yielding frequency information on initiating joint attention (IJA), initiating behavioral regulation (IBR), and percent correct scores for responding to joint attention (RJA; number of trials in which a child correctly follows the examiner's point). Verbal communication was measured using the MacArthur-Bates Communicative Development Inventory (MCDI; Fenson et al., 2007) at 12 and 15 months. Descriptive statistics and One-Way ANOVAS were calculated.

Results:

The results of the ANOVAs comparing gender differences within each risk group yielded no significant differences for IJA, IBR, or MCDI scores between LR males and females at any age or for IJA, RJA, IBR, or MCDI scores between HR males and females at any age. However, a significant difference was found for RJA at 15 months between LR males and females, with LR females outscoring LR males. Comparing risk status group differences within each gender, no significant differences were found for IJA or IBR between LR and HR females or IJA between LR and HR males. However, significant differences were found for RJA at 18 months and MCDI Phrase Speech Comprehension (Percentile Score) at 15 months between HR and LR females, with LR females outscoring HR females. Furthermore, significant differences were found for IBR at 12 months, RJA at 18 months, and MCDI Vocabulary Comprehension at 15 months between HR and LR males, with LR males outscoring HR males.

Conclusions:

These analyses suggest that, within the context of a particular risk group, gender differences in non-verbal and verbal communication may not be observable at 12 and 15 months; they may not emerge until later in development when communication skills are more advanced. These analyses show that within the same gender, HR individuals scored lower in some realms of non-verbal and verbal communication than their LR counterparts, starting as early as 12 months of age. Thus, infants who are at HR for ASD, but not yet diagnosed with ASD, may be distinguishable from LR infants of the same gender, implicating a potential for future diagnosis or possession of a broader autism phenotype.

109 **237.109** Predictors of Initiation of Early Intervention Services Prior to Positive Screen for Autism Spectrum Disorder in Young Children

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Background: Early intervention (EI) for autism spectrum disorder (ASD) can lead to improved outcomes.[1-3] To improve early identification of and treatment for ASD, the American Academy of Pediatrics recommends developmental surveillance and ASD-specific screening in primary care. Referrals to EI can be initiated before final diagnoses are made, and the EI system can facilitate diagnosis and access to targeted ASD interventions, if indicated. However, minority children are less likely to be represented in EI,[4] and are more likely to be diagnosed with ASD at a later age.[5] We examined whether disparities in early initiation of EI exist, even before a child screens positive for ASD, which may contribute to disparities in ASD identification.

Objectives: To examine whether socio-demographic factors are related to early initiation of EI before a child screens positive for ASD.

Methods: Universal ASD screening was implemented in a large, academic primary care network using the Modified CHecklist of Autism in Toddlers (M-CHAT).[6] We identified all children aged 16-30 months who screened positive on the M-CHAT between 2013 and 2016 during a well-child visit, and who had also completed a general developmental screen (n=2,884). Data were extracted directly from the electronic health record, including results of screening, socio-demographic characteristics, documented diagnoses, and prior EI initiation. Prior EI initiation was defined as patient having been previously referred to EI (regardless of outcome of evaluation) or already receiving EI, according to provider documentation during the visit in which M-CHAT was positive. Manual chart review for a random subsample of 10% of charts was conducted to confirm data accuracy, with >90% agreement for manually and digitally extracted data. A priori hypotheses stated that socio-demographic factors would predict early EI initiation. Therefore, multivariable logistic regression models included all socio-demographic factors (child age, ethnicity, race, sex, insurance, and language spoken at home) simultaneously to assess factors associated with prior EI initiation. Diagnoses made prior to visit with positive M-CHAT were enumerated.

Results: Among children who screened positive on the M-CHAT (n=2884), 26.4% of children (n=762) had prior EI initiation, with a median age of 19 months. Children with prior EI initiation were more likely to be white race (p<.001), older (p= .002), Hispanic ethnicity (p<.01), and have only English spoken at home (p=.02). Insurance status and child sex were not statistically significantly associated with prior EI enrollment. Diagnoses given prior to positive M-CHAT among those with early EI initiation are presented in table 2.

Conclusions: For some children who later go on to screen positive for ASD, developmental surveillance results in successful early initiation of EI. However, prior to a first positive M-CHAT, racial and socio-economic disparities already exist in initiating EI services, demonstrating that not all children uniformly benefit from early developmental surveillance and EI initiation. This may preclude them from ASD diagnostic and intervention

services accessible through EI. Recognizing the early clinical and socio-demographic factors that drive early EI initiation may help providers equitably perform developmental surveillance and initiate EI, with the ultimate goal of improving ASD identification and outcomes.

110 **237.110** Prospective Associations between Anger and Later Internalizing Symptoms in Young Children with ASD

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Background: Early negative emotionality is a risk factor for later difficulties in the general population, including internalizing symptoms and anxiety (Dougherty et al., 2015; Hernandez et al., 2015). Although intensity of anger in response to real-world challenges in toddlers with ASD was found to be greater than that of TD and DD peers (Macari et al., 2018), little is known about prospective relationships between anger and later internalizing symptoms including anxiety, which affect a large proportion of preschool- and school-age children with ASD (Gadow et al., 2004; Simonoff et al., 2008). The present study aims to address these gaps in knowledge.
Objectives: To examine the association between directly-observed and parent-reported anger in the second year and internalizing symptoms including anxiety at age 3.

Methods: Participants included 94 toddlers (Time1: M_{age}=22mo, range: 13-30mo; Time2: M_{age}=39mo, range: 33-47mo): 53 ASD and 41 typically-developing (TD). At Time1, anger was assessed both via parent report (ECBQ-Frustration) and directly (Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1999). Intensity of emotional expression of anger (iEE-Anger) across facial and vocal channels was coded during three Lab-TAB episodes designed to elicit anger. At Time2, parents completed the Early Childhood Inventory (ECI-4; Internalizing composite) and the Preschool Anxiety Scales-Revised (PAS-R; Generalized Anxiety score).

Results: In the ASD group, Time1 iEE-Anger was correlated with the PAS-R Generalized Anxiety score at Time2 (r(30)=.377, p=.04), while iEE-Anger did not predict either Time2 measure in the TD group. Parent-reported ECBQ Frustration at Time1 in the ASD group was significantly and positively associated with PAS-R Generalized Anxiety (r(53)=.401, p=.003). In contrast, parent-reported ECBQ Frustration in the TD group was significantly associated with the ECI-Internalizing composite (r(41)=.550, p<.0001) but not with anxiety.

Conclusions:

This study suggests a significant role for anger in the development of anxiety and internalizing symptoms. Results indicated that expression of anger at age 2 measured both directly and via parent report predicted psychopathology a year later. In the ASD group, both directly-assessed and parent-reported anger at age 2 were associated with later generalized anxiety symptoms. This contrasted with TD toddlers, for whom parent-reported anger predicted later internalizing symptoms. Taken together, these preliminary results indicate that anger in toddlerhood is related to later anxiety in toddlers with ASD, but for TD children anger predicts a range of internalizing symptoms. Furthermore, prospective relationships suggested that pathways to these vulnerabilities may not be the same in children with TD and ASD. The data highlight the importance of a multi-method approach in understanding the development of internalizing symptoms and anxiety in young children with ASD.

111 **237.111** Prospective Associations between Anger and Later Internalizing Symptoms in Young Children with ASD.

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Background: Early negative emotionality is a risk factor for later difficulties in the general population, including internalizing symptoms and anxiety (Dougherty et al., 2015; Hernandez et al., 2015). Although intensity of anger in response to real-world challenges in toddlers with ASD was found to be greater than that of typically-developing (TD) and DD peers (Macari et al., 2018), little is known about prospective relationships between anger and later internalizing symptoms including anxiety, which affect a large proportion of preschool- and school-age children with ASD (Gadow et al., 2004; Simonoff et al., 2008). The present study aims to address these gaps in knowledge.
Objectives: To examine the association between directly-observed and parent-reported anger in the second year and internalizing symptoms including anxiety at age 3 in children with and without ASD.

Methods: Participants included 94 toddlers (Time1: M_{age}=22mo, range: 13-30mo; Time2: $M_{age=}$39mo, range: 33-47mo): 53 ASD and 41 TD. At Time1, frequency of anger was assessed via parent report (Early Childhood Behavior Questionnaire (ECBQ), Frustration scale) and intensity of anger was assessed directly (Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1999). Intensity of emotional expression of anger (iEE-Anger) across facial and vocal channels was coded during three Lab-TAB episodes designed to elicit anger. At Time2, parents completed the Early Childhood Inventory (ECI-4; Internalizing composite) and the Preschool Anxiety Scales-Revised (PAS-R; Generalized Anxiety score).

Results: In the ASD group, Time1 iEE-Anger was correlated with the PAS-R Generalized Anxiety score at Time2 (r(30)=.377, p=.040), while iEE-Anger did not predict either Time2 measure in the TD group. Parent-reported ECBQ Frustration at Time1 in the ASD group was positively associated with PAS-R Generalized Anxiety (r(53)=.401, p=.003). In contrast, parent-reported ECBQ Frustration in the TD group predicted ECI-Internalizing composite scores (r(41)=.550, p<.0001) but did not predict anxiety.

Conclusions: This study suggests a significant role for anger in the development of anxiety and internalizing symptoms. Results indicated that expression of anger at age 2 measured both directly and via parent report predicted psychopathology a year later. In the ASD group, both directly-assessed intensity and parent-reported frequency of anger at age 2 were associated with later generalized anxiety symptoms. This contrasted with TD toddlers, for whom parent-reported frequency of anger predicted later internalizing symptoms. Taken together, these preliminary results indicate that frequency and intensity of anger in toddlerhood is related to later anxiety in toddlers with ASD, but for TD children, frequency of anger instead predicts a range of internalizing symptoms. Thus, prospective relationships indicate that pathways to these affective and behavioral vulnerabilities may not be the same in children with TD and ASD. The data highlight the importance of a multi-method approach in understanding the development of internalizing symptoms and anxiety in young children with ASD.

112 **237.112** Reciprocal Associations between Language Ability and Social Functioning Development over a Two-Year Period in Young Pre-Verbal Children with Autism Spectrum Disorder

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Background: Extant research involving young children with ASD has examined developmental trajectories of language ability and social functioning separately, with little focus on relations between these domains across early childhood (Bennett et al., 2015). Pre-verbal young children with ASD are of particular clinical relevance, given that greater language abilities at school entry have been shown to predict positive long-term adjustment in language and social functioning (Tager-Flusberg & Kasari, 2013). Since attention to and engagement with social contexts is necessary for language development, and growing language skills can facilitate further social engagement, examining reciprocal relations between social and language functioning in early development among pre-verbal children with ASD could inform intervention efforts. Further, more optimal nonverbal cognitive functioning, autism symptom severity, and joint attention skills have been associated with gains in both language ability and social functioning (Anderson et al., 2007, 2009; Thurm et al., 2007).
Objectives: We examined reciprocal associations between language ability and social functioning in a sample of young pre-verbal children with ASD over a two-year period. Moderating effects of baseline nonverbal cognitive functioning, initiation of and response to joint attention, and autism symptom severity on these associations were explored.

Methods: Participants were 90 pre-verbal children (21 girls) with ASD confirmed at two assessments: 1) 18 to 33 months of age (T1: M = 28 ± 4 months) and 2) 29 to 51 months (T2: M = 41 ± 4 months). Fifty-six children were assessed one year after T2 (T3: 43 to 66 months; M = 52 ± 5 months). Missing T3 data was imputed for 34 children. Pre-verbal status was defined at T1 by *t*-scores below 30 on the Mullen Scales of Early Learning (Mullen) expressive language scale, corresponding to the "Very Low" descriptive category. Nonverbal cognitive functioning was derived from T1 Mullen Visual Reception and Fine Motor subscales. Social functioning was assessed with the original parent-report Vineland Adaptive Behavior Socialization scale. Autism symptom severity was measured with T1 Autism Diagnostic Observation Schedule algorithm total score. Initiation and response to joint attention was assessed with T1 Early Social Communication Scales. Multi-group cross-lagged panel analyses examined reciprocal associations between language ability and social functioning and potential moderators.

Results: Cross-lagged panel analyses revealed significant within-time correlations and within-domain autoregressive paths over time. All added reciprocal paths were significant (Fig. 1). Nonverbal cognitive functioning moderated T1 to T2 and T2 to T3 autoregressive language paths (Fig. 2a). Autism symptom severity moderated T2 to T3 autoregressive language and social functioning paths (Fig. 2b). Joint attention indices did not moderate.

Conclusions: For young pre-verbal children with ASD, language ability and social functioning appear to exert concurrent and cascading reciprocal developmental influences. Nonverbal cognitive functioning and autism symptom severity change the magnitude of these relations (Ellis Weismer & Kover, 2015). Findings support potential amplification of intervention effects from simultaneous targeting of language and social domains for this population. Increased attention to nonverbal cognitive functioning and autism symptom severity in intervention research may also inform targeted intervention approaches for young pre-verbal children with ASD.

113 **237.113** Relationship between Child Dysregulation and Parenting Stress Scores in Toddlers with ASD

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Background:
Parents of children with ASD are known to experience levels of stress significantly higher than those experienced by parents of children with other disabilities (Osborne, McHugh, Saunders, & Reed, 2008). Child challenging behaviors are also shown to be correlated with these parent stress levels, wherein more challenging behaviors are associated with greater parent stress (Lecavalier, Leone, & Wiltz, 2005). However, it is unclear what specific aspects of child behavior are most predictive of parent stress among a sample of parents who have a toddler at risk for ASD or recently-diagnosed with ASD.

Objectives:

The present study aimed to: (1) establish whether there is an association between parent perceptions of discrete child behaviors (as measured by the Infant-Toddler Social and Emotional Assessment (ITSEA)) and parenting stress (as measured by the Parenting Stress Index (PSI)) (2) to determine the relationship between significant ITSEA subdomain scores and PSI subdomain scores controlling for demographic characteristics.

Methods:

This study is a secondary analysis of an RCT of toddlers at-risk for ASD (N=86 parent-child dyads; Kasari, et al., 2015). Parents completed the ITSEA and the PSI prior to beginning a caregiver mediated intervention study. This study reports on baseline associations only. The ITSEA has four subdomains including: Externalizing problems, Internalizing problems, Dysregulation and Competence. The PSI assesses stress in the parent-child system based on three categories: child-related, parent-related, and total stress. Analyses first included, bivariate correlations to determine the associations between ITSEA and PSI subdomain raw scores at baseline. Significant correlations between subdomain scores informed the subsequent predictors within the multiple regression models. Next, three regression analyses determined which ITSEA subdomains significantly predicted each PSI subdomain. This analysis controlled for autism severity (as measured by ADOS Clinical Severity Scores), IQ (Mullen developmental quotient), treatment assignment, age, and gender. Insignificant predictors were excluded from presented analyses.

Results:

All four ITSEA subscale scores externalizing, internalizing, dysregulation, and competence significantly correlated with the PSI child subdomain scores as well as the PSI total stress subdomain scores. The ITSEA dysregulation and externalizing subscale scores significantly correlated with the PSI parent subdomain scores (see table 1 for full matrix). In pursuit of the second objective, PSI total stress and parent domain scores were each uniquely predicted by ITSEA dysregulation scores (β=0.44, *p*=.002; β=0.39, *p*=.001). Additionally, PSI child domain was significantly predicted by both ITSEA dysregulation (β=0.33, *p*=.01) and competence (β=-0.32, *p*=.006) subscale scores.

Conclusions:

Child dysregulation is a behavior that strongly predicts parents' stress across all domains of the PSI, highlighting the need to address these behaviors in behavioral intervention studies. Consistent with previous findings (see Davis & Carter, 2008), impairments in child social relatedness (as measured by competence domain of ITSEA) also produced high-levels of parent stress in this sample. These findings suggest that intervention studies may find it useful to explicitly target parent stress and integrate tools to help manage child dysregulation.

114 **237.114** Respiratory Sinus Arrhythmia Predicts Fear Longitudinally in Infants and Children with FXS, ASD, and Typical Development

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Background:

Fragile X syndrome (FXS) is a neurodevelopmental disorder characterized by intellectual disability, inattention, and increased likelihood of maladaptive behaviors (Bailey et al., 2008). Further, it is the most common genetic cause of autism spectrum disorder (ASD; Cohen et al., 2005). Both FXS and ASD have high rates of comorbid anxiety disorders which often are not diagnosed until later in life (Cordeiro et al., 2010; Kessler et al., 2005). However, prodromal signs of anxiety can be observed in infants and young children across typical and atypical development. In typically developing (TD) children, atypical respiratory sinus arrhythmia (RSA), an index of parasympathetic nervous system function, and elevated fear are known to predict later anxiety (Viana et al., 2017). The relationship between early RSA and fear has not been examined in young children with FXS or ASD despite the high risk for anxiety in both groups.

Objectives:

The objective of the current study is to examine whether baseline RSA predicts fear across infancy and early childhood in FXS and ASD as well as TD controls. Further, we aim to determine whether the relationship between RSA and fear is different across groups.

Methods:

Participants included 36 children with FXS (10 [27.8%] female), 28 children with ASD (2 [6.9%] female), and 37 TD children (7 [18.9%] female). Participants were tested several times between 4 and 117 months of age, for a total of 276 observations (FXS *n*=116; ASD *n*=29; TD*n*=131). Baseline RSA was extracted using CardioBatch (University of Illinois at Chicago). Fear was measured via parent-report temperament questionnaires; specifically, the Fear subscales from the Infant Behavior Questionnaire-Revised (<18 months), Early Childhood Behavior Questionnaire (18-36 months), and the Childhood Behavior Questionnaire (>36 months) (Gartstein & Rothbart, 2003; Putnam, Gartstein, & Rothbart, 2006; Rothbart, et al., 2001; respectively).

Results: Univariate analysis of covariance controlling for age and sex revealed no difference between groups for fear ($F(1,276) = 0.249$, $p = .780$) and baseline RSA ($F(1,276) = 2.187$, $p = .114$). To examine the relationship between RSA and fear across early childhood, a linear mixed model was employed with baseline RSA, age, group, and an RSA by group interaction entered as predictors of fear. There were significant main effects of age ($F(1,271) = 14.386$, $B = -0.014$, $p < .001$) and baseline RSA ($F(1,271) = 7.975$, $B = -0.23$, $p = .005$). The main effect of group ($F(1,271) = 3.516$, $B = -0.839$, $p = .062$) and the interaction of group by RSA ($F(1,171) = 2.888$, $B = 0.137$, $p = .090$) were both non-significant.

Conclusions: Results indicate that higher baseline RSA is related to lower fear across all groups, suggesting that the physiological mechanisms associated with fear may be similar across typical and atypical development. Early physiological dysregulation and temperamental fear are risk markers for later anxiety in TD children, so interventions targeting the physiological dysregulation and/or temperamental fear may be effective in prevention. Given similar relationships between physiology and fear across groups, interventions known to be effective in TD groups could potentially be applied to both FXS and ASD.

115 **237.115** Sexual Dimorphism of Social-Emotional Development in Toddlers

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Background: The increasing prevalence of developmental disorders such as autism spectrum disorder (ASD) and the effectiveness of early intervention services in improving long-term outcomes for affected individuals highlights the necessity in identifying early risk factors and biological markers for atypical neurodevelopment. In children without neurodevelopmental concerns, there is a developmental increase in high-frequency neural oscillations (Beta and Gamma) and a developmental decrease in low-frequency neural oscillations (Delta and Theta). Although there is significant heterogeneity in prior studies, relative to neurotypical populations, infants at-risk for developmental disorders often exhibit lower levels of high-frequency oscillations and higher levels of low-frequency oscillations. Specifically, EEG studies of *awake* infants at-risk for autism have found: reduced frontal power and higher alpha power at 3 months and lower spectral power across all frequencies at 6 months whereas other studies suggest high-risk infants demonstrate different developmental trajectories in neural oscillations than their low-risk peers. Objectives: To identify associations between electrocortical spectral power during infant natural sleep and subsequent social-emotional development in toddlers.

Methods: Participants included in the present analysis consisted of infants initially enrolled in the Safe Passage Study with follow-up assessments currently underway. The sample consisted of 203 infants (116 males/87 females; gestational age at birth *M*: 39.4 weeks, SD: 1.1 weeks) from the Western Cape Province of South Africa who had both neonatal EEG and developmental assessments at ~3 years of age. Neonatal EEG was recorded during sleep in the supine position using EGI's (GEM) 28-lead net for approximately thirty minutes. Average electrocortical power was computed in 10 frequency bands (Delta 1-3 Hz; Theta 4-6 & 7-9 Hz; Alpha: 10-12 Hz, Beta: 13-15, 16-18, & 19-21 Hz, Low-Gamma: 22-24 & 25-36 Hz, Gamma: 37-48 Hz) and 12 brain regions (left and right: frontal-polar, frontal, central, parietal, temporal, & occipital) separately within active (REM) and quiet (slow wave) sleep. The Brief Infant-Toddler Social and Emotional Assessment (BITSEA) was administered at 3 years of age (*M*: 37.0 months, SD: 2.6 months). Multiple regressions were run to predict social-emotional development from neonatal EEG power with prenatal exposures, gestational age at birth, and hours of life as covariates. Secondary sex specific analyses were also computed.

Results: In active sleep, increased Alpha, Beta, and Low-Gamma EEG power in the left temporal, right temporal, and left-frontal regions were associated with *increased* socioemotional problems on the BITSEA, ($F(1, 196) = 2.33 - 2.92$, p's = .000 - .01. Sex specific analyses revealed increased Delta, Theta, and Alpha EEG power during quiet sleep in the left temporal, frontal, and frontal polar regions were associated with *increased* socioemotional problems in males only, ($F(1, 111) = 4.49 – 6.37$, p's = .000 - .01. Conversely for females, increased Delta, Theta, and Alpha EEG power in the right frontal and central regions were associated with *increased* socioemotional competence scores, ($F(1, 82) = 1.18$, p's = .000 - .01 (Figure 1).

Conclusions: Our results demonstrate sexual dimorphism of EEG brain markers at birth associated with subsequent socioemotional development in toddlers.

116 **237.116** Temperament Variability Among Socio-Demographic and Clinical Subgroups of Children with Autism Spectrum Disorder in the Study to Explore Early Development

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Background: The proposed factor structure of the Behavioral Style Questionnaire (BSQ) is not supported in children with autism spectrum disorder (ASD), for whom a 10-factor solution may be best. It is unknown whether socio-demographic and clinical variables are associated with expression of these 10 factors among children with ASD.

Objectives: To compare socio-demographic and clinical subgroups of children with ASD on alternative BSQ temperament factors.

Methods: Data were collected in the Study to Explore Early Development-Phase I (SEED1). SEED1 is a case-control study funded by the Centers for Disease Control and Prevention and conducted at multiple sites throughout the U.S. (catchment areas in CA, CO, GA, MD, NC and PA). Children with ASD were recruited through developmental disability service organizations and were aged 2-5 years at time of enrollment. Clinicians confirmed ASD status with the Autism Diagnostic Observation Schedule and Autism Diagnostic Interview Revised. BSQ data were obtained via caregiver self-administered questionnaire.

Revised BSQ (BSQ–R) Bartlett factor scores were developed via exploratory factor analysis (*M*=0; *SD*=1): (1) *Maladaptivity* (e.g., "bothered by changes"), (2) *Environmental Sensitivity* (e.g., "sensitive to noises"), *(3) Quiet Persistence* ("practices [to mastery]"), *(4) Social Inattention* (e.g., "does not acknowledge [when called]"), *(5) Social Approach* (e.g., "approaches [unknown children]"), (6) *Activity* (e.g., "[frequently] runs"), (7) *Crying, (8) Rhythmicity* (e.g., "hungry at dinner"), (9) *Food Openness* (e.g., "tries new foods"), and (10) *Negative Social* (e.g., "complains about friends").

Maladaptivity, Quiet Persistence, Social Approach, Crying, Rhythmicity, *Food Openness,* and *Negative Social* were non-parametrically distributed. ANOVA and T-tests compared groups for parametric factors; Friedman ANOVAs and Wilcoxon Rank Sums compared groups for non-parametric factors.

Socio-demographic subgroups were sex (male/female), maternal race (White/Black/Other), maternal ethnicity (Hispanic/non-Hispanic), and maternal education (high school or less /some college or college degree/advanced degree). Clinical subgroups were intellectual disability (ID; no/yes) defined as a Mullen Scales of Early Learning Early Language Composite Score < 70, and nonverbal status (no/yes) measured by the Social Communication Questionnaire.

Results: White mothers reported more problems with *Maladaptivity, Social Inattention,* and *Food Openness* in their child with ASD than did Black or Other race mothers; Black mothers reported more problems with *Crying* than did White or Other race mothers. Hispanic mothers reported more problems with *Food Openness* than did non-Hispanic mothers. Mothers with HS education reported more problems with *Quiet Persistence* but fewer problems with *Crying* than did those with more education. Children with ASD and ID had more problems with *Environmental Sensitivity, Quiet Persistence, Rhythmicity, Food Openness,* and *Activity* and fewer problems with *Negative Social* than those without ID. Non-verbal children with ASD had more problems with *Negative Social* and fewer problems with *Environmental Sensitivity, Quiet Persistence, Social Approach,* and *Rhythmicity* than did verbal children with ASD. All reported differences are significant at $p < .05$.

Conclusions: Socio-demographic and clinical variables are associated with BSQ-R scores for children with ASD. Future research is needed to better understand these associations and the resultant impact on family functioning.

117 **237.117** Testability in Young Autistic Children: A Descriptive Longitudinal Study Comparing Conventional and Strength-Based Assessment.

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Background: DSM-5 autism spectrum (AS) disorder diagnosis is often done early in childhood and must specify whether there is an accompanying intellectual disability (APA, 2013). However, conventional intellectual assessment at such an early age bears many challenges and may not accurately represent the potential of young autistic children, whose developmental paths are highly atypical. For example, many autistic children are considered as having intellectual delay at preschool age when assessed with conventional tests. However, many of them will no longer exhibit an intellectual delay or disability at school age.

Objectives: We first wanted to describe testability at the age of diagnosis (T0) and a year later (T1) in a group of young AS and typically developing (TD) children using WPPSI-IV as conventional assessment and Raven Coloured Progressive Matrices (RCPM) as strength-based assessment. Second, we wanted to determine the proportion of AS and TD children with scores in the intellectual delay range (QI<70 or percentile rank<=2%) when assessed with WPPSI-IV compared with RCPM.

Methods: At T0, 100 children (50AS; 50 NT) aged 30-70 months (mean 54 months) were tested with both WPPSI-IV and RCPM. Data collection for T1(one year after T0) is still ongoing, but 46 children (20AS; 26NT) have already completed T1 with the same two tests. Of these, 38 children (12AS; 26 NT) were able to complete all tests at both time points. Both groups are matched on age at both time points (ps>.05).

Results: At T0, all 50 TD children who attempted to complete WPPSI-IV and RCPM were able to complete both tests. The 26 TD children who were called back a year later were also all able to complete both tests. Out of the 50 AS children who were tested at baseline (T0), 58% (29/50) were able to complete WPPSI-IV whereas 66% (33/50) were able to complete RCPM. A year later (T1) testability of AS increases for both tests as 75% (15/20) were able to complete WPPSI-IV and RCPM. Also, the proportion of AS children with scores in the intellectual delay range (IQ<70 or percentile rank<=2%) is higher when using WPPSI-IV [14% (7/50)] compared to RCPM [2% (1/50)] at T0. A year later, this percentage decreases to 10% (2/20) using WPPSI-IV and to 0% (0/20) using RCPM in the AS group. Linear regression analyses are planned to determine whether performance on WPPSI-IV and on RCPM could predict the evolution of cognitive potential, operationalised as change between WPPSI-IV standard score at T0 and T1.

Conclusions: In the AS group, the performance and ability to complete WPPSI-IV increases a year after baseline, as children get older. Also, administration conditions specific to RCPM seem to favour AS children in their comprehension and compliance to the test relative to WPPSI-IV. Thus, a strength-based approach could help bypass some challenges of assessing young AS children at the age of diagnosis. Our results also suggest that assessing AS children at such an early age is difficult and that waiting until school age to assess their cognitive potential could help

increase their testability.

118 **237.118** The Broader Autism Phenotype in the First Two Years: Maternal Reports and Play Behaviors

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Background: In families raising a child with an autism spectrum disorder (ASD), younger siblings are at elevated risks for ASD, and other developmental concerns including subclinical ASD features, often called the Broader Autism Phenotype (BAP). In adults and children aged 3 years or older, self- or parent-report questionnaires are often used to characterize the BAP. For children under 3, clinical judgments and standardized developmental assessments typically inform impressions of the BAP. Recent work has expanded our understanding of the BAP in early childhood by documenting observed dyadic social difficulties as early as 15 months of age. However, less is known about maternal reports of BAP-aligned social difficulties in young children and how that may inform their play interactions.

Objectives: Within this study we expand our developmental understanding of the BAP in early childhood by examining (1) maternal reports of social communication difficulties in their children, compared to typically developing peers, and (2) if reported social difficulties inform mothers' approaches to play, within a social context.

Methods: As part of a prospective study, dyads were recruited from families with at least one older child with ASD (high-risk group, n = 36), and families with no history of ASD (low-risk group, n = 38). During laboratory visits at 12, 15, 18, and 24 months of age children completed a series of standardized assessments and a mother-child play interaction. At each visit, child socialization and communication skills were mother-reported via the Vineland Adaptive Behavior Scales (VABS). Play interactions were rated with the Joint Engagement Rating Inventory (JERI). Between 24 and 36 months, children completed an outcome visit and, following previously established criteria, children were assigned to BAP (n = 22) and TYP (n = 52) groups.

Results: A series of ANCOVAS were conducted, with terms for infant sex and maternal education as covariates, and revealed significant group differences on select standardized measures and indices of play from 12 to 24 months of age. Group comparisons revealed differences between the BAP and TYP outcome groups by 24 months in mother-reported socialization, $F(1, 68) = 4.22$, $p = .04$, partial $\eta 2 = .06$, and communication $F(1, 68) = 5.71$, $p = .02$, partial $\eta 2 = .08$. By 15 months, mothers in the BAP group exhibited less symbol highlighting, $F(1, 30) = 5.71$, $p = .02$, partial $\eta 2 = .17$, and following-in, $F(1, 30) = 5.33$, $p = .03$, partial $\eta 2 = .17$. Mothers in the BAP group also exhibited more affective communication by 12 months, $F(1, 24) = 5.85$, $p = .03$, partial $\eta 2 = .23$. These results were not consistent across visits (Figure 1).

Conclusions: Overall, this study provides detailed information on early social interactions in the BAP, which may inform intervention and differential diagnosis efforts. By examining group differences across four time-points, the current study demonstrates that distinct patterns exist between BAP and TYP. Recognizing the increasing demand for parent-mediated elevated-risk interventions, these findings highlight several social constructs through which interventions may promote optimal development in children developing at risk.

119 **237.119** The Development of Pretend Play in Very Young Children with Autism Spectrum Disorder (ASD)

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Background: Our ability to identify and diagnose ASD in toddlerhood allows study of critical developmental phenomenon such as the emergence of pretend play. However, there remains little understanding of the very early development of pretence abilities in ASD compared to children without ASD, and whether individual differences make some children with ASD more likely to have intact pretend play. Longitudinal studies are needed to examine causal factors in the early emergence and development of pretence. While it is well established that pretence and cognition are interrelated, there remains no evidence on whether this relationship is bidirectional or unidirectional in children with ASD.

Objectives: We examined the development of spontaneous pretend play in children with ASD compared to children with Developmental and/or Language Delay (DD/LD) from 24- to 48-months of age. A further aim was to investigate whether the relationship between pretend play and cognition (verbal and non-verbal) was bidirectional within the ASD group using longitudinal data.

Methods: The participants comprised 48 children with ASD and 20 children with DD/LD who were assessed at both 24- and 48-months. All children were assessed with the Mullen Scales of Early Learning (MSEL) at each age, with the target group being significantly lower on Verbal Mental age (VMA), Non-VMA and overall Developmental Quotient compared to the DD/LD group at both 24- and 48-months. Spontaneous pretend play was coded continuously (frequency and duration) off videotapes by a coder blind to group status when participants were 24- and 48-months of age.

Results: Very little pretence was observed at 24-months in both groups. A two way repeated measures ANOVA indicated a significant increase in spontaneous pretend play in both groups over time, with no group differences at either 24- or 48-months.

Significant concurrent and cross-lag correlations were found between cognition (age equivalent scores on visual reception, fine motor, expressive language and receptive language) and spontaneous pretend play at 24-and 48-months in the ASD group. Hierarchical multiple regression showed that pretend play at 24-months did not significantly predict pretend play at 48-months. With the addition of the cognitive variables, the model significantly predicted pretend play at 48-months, accounting for 27.4 % of the variance. The cognitive variables, on their own, predicted 20.6% of the variance. However, pretend play at 24-months was not a significant predictor of verbal or non-verbal cognition at 48-months, indicating a unidirectional relationship between cognition and pretend play in young children with ASD.

Conclusions: Our findings indicate that young mixed ability children with ASD engaged in equivalent levels of spontaneous pretend play at 24- and 48-months compared to DD/LD children, despite having significantly lower cognitive abilities overall. The findings support previous work with older and more able children with ASD indicating they can engage in pretend play even when it is not elicited; these findings, together, support neither a competence nor performance deficit in pretence in ASD. The findings also suggest that cognitive abilities facilitate the development of early pretend play in children with ASD and that this relationship is unidirectional.

120 **237.120** The Emergence of Early Signs for Autism Spectrum Disorder in Babies at High Risk and Its Relationship with Later Trajectories of Symptom Severity

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Background:
How early signs for autism spectrum disorder (ASD) emerge is currently unknown. The Autism Observation Scale for Infant (AOSI) represents an elegant solution to the prospective observation of the emergence of ASD symptoms in high risk infants. Within this study, we longitudinally assessed infant siblings of children with ASD from 6 to 18 months of age using the AOSI. We followed up the expression of their symptomology using the Autism Diagnostic Observation Schedule (ADOS), collected from 18 months to 5-7 years in the same children. We derived distinctive trajectories of early signs of ASD in infancy, and we observed the conditional probability that those trajectories had on the later trajectories of symptom severity.

Objectives:

The primary goal of the current research was to define, in children at high risk, the relationship between how early signs for ASD emerge and the expression of symptom severity later in life.

Methods:

The sample was composed of 499 high risk siblings (281 males), of whom 128 received an ASD diagnosis in a blinded assessment at 36 months. We used group-based trajectory models (GBTM) to derive trajectories of early signs for ASD measured at 6, 9, 12, 15 and 18 months of age using the AOSI. Using the same statistical model, we derived symptom severity trajectory groups from the ADOS at 18, 24, 36-42, and 60-84 months. We examined the proportions of children within each trajectory group, and analyzed the conditional probability of switching from a distinctive AOSI trajectory to a later ADOS trajectory.

Results:

Analysis revealed three distinctive trajectory groups for early signs measured with the AOSI and three distinctive trajectories for symptom severity measured with the ADOS (Low, Intermediate and Increasing trajectory groups for each). Pairwise comparisons between trajectory groups for quadratic slope and intercept estimates revealed significant differences for all comparisons (all $p < .001$) for both analyses. As expected, children with an ASD diagnosis were more likely to be in the trajectory groups with the highest scores on both the AOSI and ADOS. Furthermore, children in the Low trajectory group from the AOSI had an 80.2% chance to continue in the Low ADOS trajectory group, 67.5% of the children stayed in the Intermediate trajectory group as measured with both scales and 77.3% remained in the High trajectory group. Importantly, no children from the Low AOSI trajectory group were in the Increasing ADOS trajectory group in later childhood.

Conclusions:

Our results confirm substantial heterogeneity in the early emergence of ASD symptomatology in children at high risk for ASD. Moreover, we have shown how the emergence of signs of ASD in infancy is highly predictive of the later patterns of symptomatology. These results have strong clinical implications, supporting the need to screen infants at high risk for ASD repeatedly and to monitor closely how early signs of ASD appear, as this can be highly indicative of the clinical course. The AOSI shows good potential as an early assessment of ASD symptoms.

121 **237.121** The Predictive Value of Early Temperament and Sensory Features for Cognitive Development and Early Symptoms of Autism Spectrum Disorder in Preterm Children

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Background: There is accumulating evidence that temperament and sensory processing differs between children at high risk for autism spectrum disorder (ASD) who do and do not develop ASD. A study by Garon et al. (2018) suggests that temperament, particularly Effortful Control at 24 months, plays a role in predicting later ASD symptoms. In addition, Wolff et al. (2018) reported cross-sectional associations between sensory experiences and restricted and repetitive behavior (RRB). However, research on this matter focused mainly on high-risk siblings. Yet, preterm children are another important high-risk group for developing ASD (Agrawal et al., 2018). It could be hypothesized that also in these children, temperament and sensory features may be of predictive value for cognitive development or symptoms of ASD. Pérez-Pereira et al. (2015) for example, reported that extroverted temperament predicted better language outcome in a group of preterm children.
Objectives: This study explored the predictive value of early temperament and sensory features for cognitive development and ASD symptomatology at 36 months in a group of preterm children.

Methods: Participants were 45 children born before 30 weeks of gestation (21 girls). At the corrected ages of 10, 18 and 24 months, sensory features and temperament were assessed using the Infant/Toddler Sensory Profile (ITSP) and the Infant Behavior Questionnaire (IBQ) or Early Childhood Behavior Questionnaire (ECBQ). Mullen Scales of Early Learning, ADOS-2 and the Social Responsiveness Scale (SRS) were administered at 36 months.

Results: Linear regressions were performed to predict ADOS_RRB, ADOS_SA (social affect), SRS_RRB, SRS_SCI (social communication and interaction) and Developmental Index (DI) of the Mullen at 36 months, using the measures of temperament and sensory-related features at 10, 18 and 24 months. More sensory avoiding as measured with the ITSP_24 predicted lower Mullen_DI scores ($F(1,40) = 4.172$, $p = .048$, $R^2 = 0.094$) and higher SRS_RRB scores ($F(1,43) = 8.361$, $p = .006$, $R^2 = 0.163$). Higher ADOS_RRB scores were predicted by less sensory seeking as assessed with the ITSP_24 ($F(1,43) = 6.527$, $p = .014$, $R^2 = 0.132$). A lower score on low registration on the ITSP_10 was predictive for more social problems on the SRS_SCI ($F(1,43) = 12.508$, $p = .001$, $R^2 = 0.225$). Temperament and sensory features did not have any predictive effect on ADOS_SA scores.

Conclusions: This study indicates that sensory processing is predictive for cognitive development and early ASD symptoms in preterm children, especially at 24 months. Concerning RRB, the ITSP was predictive for both parent-report (SRS) and observational measures (ADOS-2). It is possible that children avoid stimuli because of oversensitivity and develop RRB's to cope with this oversensitivity, or that children who already have specific interests, are less tempted to process other stimuli. As for the social-communicative aspects of ASD, only parent-report (SRS) was predicted by sensory features. Children who registrate less of their environment, possibly miss attempts to social interaction from others, have less learning experiences, and may develop less optimal social skills. In this study, early temperament does not seem to be of predictive value for

ASD symptomatology or cognitive development.

122 **237.122** The Rapid Interactive Autism Screening Test in Toddlers: Further Validation and Generalization

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Background: Preliminary results from the Rapid Interactive Screening Test for Autism in Toddlers (RITA-T) pilot study supported the validity of the test in screening for autism spectrum disorders (ASD) in a highly controlled research environment. Further testing is needed to determine if the results can be replicated among a broader, more diverse population.
Objectives: To generalize and evaluate the effectiveness of the RITA-T, a new level 2 screening assessment for ASD in diverse populations. This study is further designed to determine the optimal cut-off score for use in screening ASD and thus improve referrals to tertiary care centers.

Methods: The RITA-T consists of nine activities that evaluate the participant's social, communication, and interaction skills. Use of language and verbal commands is limited to simple phrases intended to direct the participant's attention and does not rely on the participant's need to interpret complex commands that may be limited by vocabulary.

Four Early Intervention (EI) providers from the THOM EI program in Worcester, MA were trained on the RITA-T**.** The test was administered to 81 toddlers from diverse ethnic and racial backgrounds. From this group, 70 toddlers had a positive MCHAT-R (Modified Checklist for Autism in Toddlers- Revised) or other behavioral concerns for ASD. After screening with the RITA-T, toddlers were then referred to a diagnostic team that administered the Autism Diagnostic Observation Schedule-2 (ADOS-2) and the Mullen Scales of Early Learning (MSEL). A final clinical diagnosis was made as ASD or non-ASD based on testing and clinical presentation. Eleven toddlers were referred by EI after being evaluated as low risk of ASD. Clinical diagnosis was made based on the results of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) , MCHAT-R, and Batelle Developmental Inventory. Each participant's RITA-T score was compared to their final clinical diagnosis and ADOS-2 diagnosis to evaluate the validity of the RITA-T and determine the optimal cut-off score.

Results: Eighty-one toddlers (78% male) were evaluated. The age of the participants ranged from 18 to 35 months (mean age 27.3 months). The study population was 58% white, 20% Hispanic, 15% African-American, and 7% Asian. Of those, 57 (70.4%) were diagnosed with ASD and 24 (29.6%) were diagnosed as non-ASD. Optimal cutoff score for the RITA-T was determined to be 12(PPV = 0.93, NPV = 0.95). Those with a score lower than 12 were considered low risk for ASD. Patients with a score from 12 to 16 were considered to be intermediate risk requiring further evaluation, whereas those with scores higher than 16 were most likely high risk for ASD.

Conclusions: Training and administration of the RITA-T is generalizable, and results support its validity and correlation with clinical diagnoses. Cut-off score was further refined. Further testing will evaluate the effectiveness of the RITA-T screening in those 12- 18 months.

123 **237.123** The Relationship between Parent Responsiveness and Early Language Development in Children at Elevated Likelihood for ASD

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Background: Parent verbal responsiveness has been associated with later expressive and receptive language skills of children diagnosed with autism spectrum disorder (ASD) (McDuffie & Yoder, 2010; Perryman et al., 2013). However, less is known about the predictive relationship between the nonverbal and verbal responsiveness of parents of infants at elevated likelihood of ASD (EL-ASD) and their later language skills.
Objectives: This study aims to determine if nonverbal and/or verbal parent responsiveness are predictive of later receptive and expressive language skills of children at EL-ASD.

Methods: This study used extant data of 87 children who were identified as at EL-ASD at the age of 12 months based on their scores on the First Year Inventory 2.0 (FYIv2.0). These children were participants in a randomized controlled trial that tested the efficacy of a parent-mediated intervention. The Mullen Scales of Early Learning Receptive and Expressive Language Scales were used to assess the language skills of the children at infancy (13-15 months) and toddlerhood (22-25 months). An interval coding system (adapted from Yoder et al., 2009) was used to measure parent responsiveness within unstructured play. Hierarchical linear regressions were performed to determine if parent responsiveness accounted for unique variance in toddler language scores above the infant language scores and intervention group assignment. A parsimonious model was chosen based on the variables that were significantly associated with the toddler language scores.

Results: The first order correlations revealed that infant receptive language and parent verbal responsiveness to infants (i.e., proportion of intervals in which parents provided verbal responses with or without physical responses), but not nonverbal responsiveness (i.e., proportion of intervals in which parents provided physical responses with or without verbal responses), were significantly correlated with toddler receptive language. A linear regression model that included the infant receptive language scores and controlled for the study group assignment accounted for 22.65% of the variance in the toddler receptive language scores. Parent verbal responsiveness was then added to the model, and was a significant predictor, explaining an additional 14.52% of the variance in toddler receptive language (R^2 = 0.37, F (3,79) = 15.58, p<0.01).

Infant receptive and expressive language scores and parent verbal (but not nonverbal) responsiveness to infants all had significant first order correlations with toddler expressive language scores. A linear regression model that included receptive and expressive language scores of infants and study group assignment explained 36.71% of the variance in toddler expressive language scores. When parent verbal responsiveness was added to the model, it was a significant predictor, accounting for an additional 5.7% of the variance in toddler expressive language (R^2 = 0.42, F (4,78) = 14.33, p<0.01).

Conclusions: Our findings agree with previous research on the benefits of early parent verbal responsiveness for later language development, extending findings to children at EL-ASD. These results demonstrate the need for parents to provide verbal input that follows into their child's focus of attention in order to assist in the development of language skills in these children.

124 **237.124** The Relationship between Maternal Linguistic Input and Language Development in Children with ASD and Dld

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Background: Quantity and diversity of maternal linguistic input are related to child language outcomes. However, less is known about maternal and child characteristics that may impact this relationship in children with ASD. Current research suggests that in children with ASD, quantity and diversity of maternal linguistic input impacts child language skills (Fusaroli et al., 2018). In typically developing children, maternal socioeconomic status (SES) relates to maternal language input, which impacts child language outcomes (Hart & Risley, 1995). The impact of SES on maternal linguistic input in children with ASD is not well studied. Child characteristics, such as social communication deficits inherent to ASD, may be an important factor to consider (Arunachalam & Luyster, 2018). By comparing children with ASD to children with developmental language disorder (DLD) we are able to examine the unique impact that social communication difficulties, above and beyond language delays, may have on maternal language input.

Objectives: The current study aims to (1) examine the relationship between mother's use of language type (number of unique words), token (frequency of words) and type/token ratio (TTR) and child's use of language type, token, and type/token ratio (2) investigate differences in maternal linguistic input based on SES (3) to examine the extent to which ASD status moderates the relationship between maternal input and child language.

Methods: The current study included 184 mother-child dyads: 111 children with ASD (M=2.77 years, SD= .53) and 73 children with DLD (M=2.66 years, SD=.50). 10 minute mother-child interactions using a standardized set of toys were transcribed and analyzed using SALT (Systematic Analysis of Language Transcripts; Miller & Iglesias, 2008). From the transcription, type, token and TTR of total words, adjectives, nouns, prepositions, and verbs were analyzed for both the mother and child. Mothers completed a questionnaire indicating their household income. Income status was defined as follows: low income $0-$25,000, middle income $25,001-$100,000, high income greater than $100,000.

Results: We computed pearson correlations to determine the relationship between maternal input and children's lexical diversity across both populations (see Table 1). We used two-sample t-test to examine the differences in maternal input based on household income (Table 2). Linear regressions revealed that ASD status moderates the relationship between maternal language measures and children's language measures for preposition token ($F(1, 180) = 4.745$, $p < .05$) and preposition TTR ($F(1, 180) = 7.284$ $p < .05$).

Conclusions: This research highlights the importance of investigating maternal and child characteristics that may impact the relationship between maternal linguistic input and language development in children with ASD. Future research should include longitudinal approaches to investigate the relationship between maternal linguistic input and later child language outcomes to examine the extent to which types of linguistic input change base on the child's developmental level. Further research is necessary to characterize the differences in maternal linguistic input based on SES in children with communication disorders. It is essential to continue to investigate the extent to which social communication deficits may moderate the relationship between input and children language levels.

125 **237.125** The Relationship between Maternal Infant-Directed Speech and Infant Attention during the First Year

A. J. Woolard[1], *T. Armstrong*[2], *T. Benders*[3], *A. E. Lane*[4], *F. Karayanidis*[5], *V. Murphy*[6] *and L. E. Campbell*[7], *(1)University of Newcastle, Australia, Callaghan, Australia, (2)University of Newcastle, Newcastle, Australia, (3)Linguistics, Macquarie University, Sydney, Australia, (4)University of Newcastle, Callaghan, Australia, (5)Psychology, University of Newcastle, Australia, Callaghan, Australia, (6)Medicine and Public Health, University of Newcastle, Australia, Callaghan, Australia, (7)School of Psychology, University of Newcastle, Newcastle, Australia*

Background: Mothers use infant-directed speech (IDS) when talking to their infants. IDS is highly effective in regulating infant attention. The most salient aspects of IDS during the first year, when attention development is occurring rapidly, are prosodic characteristics. In particular, pitch contours are highly informative for infants and contribute to attention regulation. Children with autism spectrum disorder (autism) may experience difficulties with attention regulation, impacting schooling and social interactions. IDS is known to be associated with infant attention during interactions with others, however, little is known about the relationship between IDS and the development of attention over time. The present study examined the relationship between maternal pitch contours in early infancy and infant attention at one year of age.

Objectives: The aim of this study was to explore whether the pitch contours used by mothers during IDS with their 6-month-old infants were related to the infant's attention at 12 months, as indexed by the First Year Inventory (FYI; Reznick, Baranek, Reavis & Crais, 2007).

Methods: 21 mother-infant dyads participated in a 15-minute recorded interaction at infant age of 6 months. Infant attention was then assessed using the FYI at 12 months of age. The FYI has been adapted to assess infant attention including: responding to social attention, initiating social attention, and non-social sensory attention. A total of 3,714 pitch contours were extracted from audio collected during interactions and classified into contour types (rising, bell, sinusoidal, u-shaped, slowly-falling, rapidly-falling, and complex). Pearson's or Spearman's product moment correlations were used to determine the relationship between maternal pitch contours at 6 months of age and infant attention scores on the FYI at 12 months of age.

Results: Bell, sinusoidal and u-shaped (BSU) contours were combined to create one contour type as they have shown to be highly related in the literature. Infant scores on 'responding to social attention' were strongly associated with BSU contours ($r_s(21) = -.62$, $p=.003$), and rising contours ($r_s(21) = .62$, $p=.003$). Mothers who used less BSU and more rising contours with their infants at 6 months of age scored their infants more poorly on social attention scores at 12 months of age.

Conclusions: These results suggest that maternal pitch contours used with infants at six months of age are related to parent-reported infant attention at 12 months. In particular, mothers who used more BSU contours, which are thought to maintain infant attention, reported that their infants were more responsive to social attention at 12 months. Conversely, mothers who used more rising contours, which are typically used to attain infant attention when an infant is not attending, reported that their infants were less responsive to social attention at 12 months. As poorer attention is a common symptom of autism, the link between maternal use of IDS and at-risk groups needs to be explored further.

126 **237.126** The Relationship between Pitch Contours in Infant-Directed Speech and Infant Risk for Autism

A. J. Woolard[1], *A. E. Lane*[2], *T. Benders*[3], *L. E. Campbell*[4], *V. Murphy*[5], *L. Korostenski*[6], *F. Karayanidis*[7], *S. J. Lane*[8], *D. Barker*[9], *C. A. Mallise*[10], *O. Whalen*[1] *and J. Mattes*[9], *(1)University of Newcastle, Australia, Callaghan, Australia, (2)University of Newcastle, Callaghan, Australia, (3)Linguistics, Macquarie University, Sydney, Australia, (4)School of Psychology, University of Newcastle, Newcastle, Australia, (5)Medicine and Public Health, University of Newcastle, Australia, Callaghan, Australia, (6)John Hunter Children's Hospital, Newcastle, Australia, (7)Psychology, University of Newcastle, Australia, Callaghan, Australia, (8)Occupational Therapy, University of Newcastle, Newcastle, Australia, (9)University of Newcastle, Newcastle, Australia, (10)The University of Newcastle, Callaghan, Australia*

Background: Early mother-infant interactions comprise the sensory environment experienced by infants and mediate early development. A fundamental component of mother-infant interactions is maternal infant-directed speech (IDS), which is the unique speech register universally used when interacting with infants. IDS facilitates infant language learning and socio-communicative development via its prosodic characteristics, vis a vis pitch contours. There is little research, however, investigating how pitch contours associated with IDS are used with infants at-risk of or displaying issues with socio-communicative and language development or sensory regulation, such as those at-risk of Autism Spectrum Disorder (autism).

Objectives: The aim of this study was to characterise the utterances and pitch contours used by mothers when interacting with their infants at high-risk for autism compared to mothers of infants at low-risk for autism.

Methods: 18 mothers and their 12-month-old infants (12 male, 6 female) were participants in studies of early child development from three cohorts. Mother-infant dyads participated in a 15-minute recorded interaction. Infant risk for autism was assessed using the observer-rated Autism Detection in Early Childhood assessment (ADEC; Young, 2007) and the parent-report First Year Inventory (FYI; Reznick, Baranek, Reavis & Crais, 2007). Eight infants were assessed as at-risk for autism. A total of 5429 maternal pitch contours were extracted from the interactions and classified into contour types (rising, bell-shaped, sinusoidal, u-shaped, slowly-falling, rapid, flat and complex). Pearson product-moment correlations were performed to determine correlations between maternal pitch contour use and infant risk for autism.

Results: Mothers of clinically high-risk infants spoke less overall, with an average of 260.9 utterances during the interaction, compared to 334.2 spoken by mothers of low-risk infants. As infant risk on the parent-report FYI increased, mothers spoke fewer utterances (r=-.576, N=18, p=.01) and used fewer rising (r=-.586, N=18, p=.01), sinusoidal (r=-.636, N=18, p=.005), more complex (r=.584, N=18, p=.01) and more rapid (r=.526, N=18, p=.03) contours. As infant risk on the observer-rated ADEC increased, mothers spoke fewer utterances (r=-.631, N=18, p=.02), and used fewer flat shaped contours (r=-.679, N=18, p=.01) but more u-shaped contours (r=.619, N=18, p=.02).

Conclusions: These preliminary data suggest that mothers of high risk infants use different patterns of IDS than mothers of low risk infants. Further assessment of maternal IDS patterns from early infancy through the end of the first year of life in high and low risk infants is warranted to identify at what stage IDS patterns deviate between groups.

127 **237.127** The Relationship between Walking and Language Development Is Disrupted in Infants with Autism Spectrum Disorder

L. A. Wang[1,2], *L. D. Yankowitz*[1], *W. Guthrie*[3], *J. Parish-Morris*[1], *J. Pandey*[1], *K. Botteron*[4], *S. R. Dager*[5], *J. N. Constantino*[4], *A. Estes*[5], *H. C. Hazlett*[6], *L. Zwaigenbaum*[7], *J. Pruett*[4], *N. Marrus*[4], *J. Piven*[8] *and R. T. Schultz*[1], *(1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Department of Psychology, University of Pennsylvania, Philadelphia, PA, (3)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (4)Washington University School of Medicine, St. Louis, MO, (5)University of Washington, Seattle, WA, (6)University of North Carolina, Chapel Hill, NC, (7)University of Alberta, Edmonton, AB, Canada, (8)*Co-Senior Authors, IBIS Network, University of North Carolina, Chapel Hill, NC*

Background: Learning to walk is a critical point of change for communicative development. Walking onset is associated with subsequent increases in communication skills in typically developing (TD) infants, independent of age (Walle & Campos, 2014). This may be due to increased opportunities for social communication afforded by walking, or to other shared factors (e.g., epigenetic causes). A recent study found that infants later diagnosed with autism spectrum disorder (ASD; N=15) did not exhibit the same increased language growth after walking onset as their non-ASD peers (West et al., 2017).

Objectives: The present study uses a larger sample to (1) determine whether the relationship between walking ability and subsequent rate of language development is significantly attenuated in infants with ASD, and (2) assess whether walking ability is related to growth in language skills specifically or in nonverbal cognitive skills as well.

Methods: 156 low-risk (LR) siblings of TD children and 361 high-risk (HR) siblings of children with ASD were tested at 12 and 24 months (m) of age as part of the Infant Brain Imaging Study. Based on ASD status and Mullen Scales of Early Learning language scores at 24m, HR infants were assigned to the ASD (HR-ASD; N=80), language delayed (HR-LD; N=34), or no diagnosis (HR-ND, N=247) group. 14 LR infants with atypical outcomes (LD, N=11; ASD, N=3) were excluded from analysis. To measure walking ability at 12m, a novel composite comprised of Mullen and Vineland Adaptive Behavior Scales-II items indexing walking-related behaviors was calculated (Cronbach's α=.9). Separate mixed effects models were run predicting Mullen expressive language (EL), receptive language (RL), and visual reception (VR) raw scores including age, walking score, and a 4-level factor for group (reference=LR) as fixed effects, all interactions, and random intercepts. In these models, the age-by-walking score interaction represents the relationship between walking ability and growth in Mullen scores in the LR group, while each 3-way interaction reflects the difference in this relationship between a particular HR group and the LR group.

Results: The interaction between age and walking score was significant in the model for EL (β=0.20, p=.03), confirming that better walking was associated with increased EL growth for LR infants (Figure 1). The effect of walking scores on EL growth was significantly attenuated in the HR-ASD group compared to the LR group (β=-0.13, p=.04) and was marginally attenuated in the HR-LD group compared to the LR group (β=-0.09, p=.08). No other three-way interactions were significant for EL. No interactions including walking score were significant for RL or VR; thus, walking ability was only associated with EL development.

Conclusions: For LR infants, better walking ability at 12m was associated with greater subsequent gains in EL. Only the HR-ASD group displayed a statistically different relationship between walking ability and EL growth relative to the LR group, though this effect was trending in the smaller HR-LD group. Importantly, walking ability was related only to EL and not RL or VR growth, suggesting that walking is specifically related to EL rather than to cognitive maturation more broadly.

128 **237.128** Validation of Rapid Interactive Screening Test for Autism in Toddlers (RITA-T) in a Chinese Population

X. Kong[1], *M. Koh*[2] *and J. Kong*[3], *(1)Massachusetts General Hospital, Boston, MA, (2)Radiology, Massachusetts general hospital, Charlestown, MA, (3)MGH, MA, MA*

Background:

A growing body of evidence confirms that early diagnosis and intervention significantly impact the prognosis of individuals with Autism Spectrum Disorder (ASD). The average age for diagnosis is currently around 3-4 years, but many ASD individuals start to show signs as early as infancy.

Development of an easily applied early detection tool and screening test has become imperative and has drawn a great amount of attention in recent years.

Objectives:

The Rapid Interactive screening Test for Autism in Toddlers (RITA-T, published in 2015) is a recently developed test for early ASD detection. However, its feasibility and variation in sensitivity have never been assessed in an Asian population. The aim of this study is to evaluate this new screening method on children with an ethnically or culturally Chinese background and propose improvements and modifications to benefit more children at high risk for ASD.

Methods:

In this ongoing study, 14 Chinese children (age range from 1.5 to 4, average 2.7) living in the US were recruited. All participants met the following inclusion criteria: 1) aged 1-6 years old; 2) parents or teacher recommend further examination based on their observation or a preliminary screening; 3) Younger sibling of ASD individuals; 4) higher risk population based on survey, with established perinatal risk factor.

Results:

Preliminary analysis showed a significant correlation between the ADOS score and RITA-T score (Spearman's correlation, rho = 0.72, p =0.004). Based on the ADOS assessment, 13 children were diagnosed with ASD. With a cut line of 16 (RITA-T score), we found a sensitivity of 82% and specificity of 33%. We also administered an eye tracking test with a paradigm developed in our lab; the data analysis is still ongoing.

Conclusions:

Our preliminary results provided important proof-of-concept information on early screening using RITA-T, which may serve as a basis for further investigations.

Poster Session
238 - Education
11:30 AM - 1:30 PM - Room: 710

129 **238.129** Francophone Students with Autistic Spectrum Conditions: What Do They Have to Say Regarding Their School Inclusion Experiences?

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Background: Recently, an increasing number of students diagnosed with high functioning autistic spectrum conditions (HFASC) were able to attend mainstream high schools in both France and Quebec. Despite international studies and governmental recommendations to involve directly youth with HFASC in research, their own perspective has rarely been taken into account in francophone research settings.
Objectives: Grounded in an ecological approach where participants are acknowledged as experts and knowledge co producers, our work aims at understanding how they cope with mainstream education in high schools.

Methods: 26 teenagers with HFASC (13-17) and their parents collaborated in this research, in France (n=17) and in Quebec (n=9). This study examines qualitative data from semi-structured interviews with the teenagers in the light of descriptive analyses of two questionnaires that they completed: the *Friendship Qualities Scale* (FQS) and the *Self-Perception Profile for Adolescents* (SPPA).

Results: ***Questionnaire analysis.*** Cluster analysis identified three profiles of friendship representation (FQS), mainly distinguished by two dimensions: companionship and help/aid from a friend. Three dimensions (social acceptance, close friends and physical appearance) differentiate self-perception into a 4-group typology (SPPA). Moreover, social skills training support (individual or group sessions) were positively correlated with more confident friendship and self-representations. ***Thematic analysis.*** Managing sensory overload in the school setting (N=20), perceived immature behaviors and bullying from peers (N=19) and fatigue resulting from to important workload (N=15) are identified as the main obstacles for their wellbeing in high school. On the contrary, being included in an intensive or international academic program (N=7), being driven by a passion or a clear objective (N>15) and having a friend in the school environment (N=11) appear to be important enablers for a successful inclusion. In France, the benefits *vs* limits of the teaching assistant's presence in class (between 12 to 20 hours per week) need to be examined more closely, from the perspective of specific challenges for self-esteem and autonomy. Although strongly dependent of peers' representations, the autistic identity is generally well lived and accepted, especially outside of high school (N>18). Finally, differences between France and Quebec in access to health services and school systems appear to have little impact on adolescents' well-being but raise a number of questions regarding provision support access inequalities for certain families, considering the frequent use of private services in France.

Conclusions: When France and Quebec just released their new national plans for autism, transition from adolescence to adult life will constitute one of the major challenges for youth with HFASC in the next few years and has to be anticipated as soon as possible. This preparation would allow the adolescents to gain autonomy and practical skills to better understand their needs and strengths and allow them to speak for themselves in a professional environment. Finally, our work highlights the interest for Francophone research and society to move from a deficit-led approach to a neurodiversity paradigm, promoting empowerment of individuals and considering ASC as a valuable contribution to human diversity.

130 **238.130** Friendship and Victimisation in Children with Autism Spectrum Disorder in Support Mainstream Secondary Schools - a Mixed Method Analysis

A. Jones Bartoli[1]*, I. Dale*[2]*, Y. Dyer*[3]*, P. F. Heaton*[4] *and D. May*[5]*, (1)Goldsmiths, University of London, London, United Kingdom of Great Britain and Northern Ireland, (2)The National Autistic Society, Sheffield, United Kingdom, (3)National Autistic Society, London, United Kingdom, (4)Psychology, Goldsmiths College, University of London, London, United Kingdom, (5)National Autistic Society, London, United Kingdom of Great Britain and Northern Ireland*

Background: School-age children with autism are reported to have poorer well-being outcomes than their mainstream peers (Begeer et al., 2017). Despite research consistently indicating that children with autism are less likely to be socially included than their mainstream peers (Adams et al., 2014; Little, 2001), there is little research exploring the experiences of friendships and victimisation in autistic students in school.
Objectives: To compare well-being and social outcomes of students with and without autism attending mainstream secondary schools with an autism support base.

Methods: A mixed-methods approach was used to explore well-being and experiences of friendships and bullying of 27 young people with autism and 33 typically developing children. Groups were matched in terms of gender ratios and by age (mean age= 12 years, 1 month; SD = 0.69).

Self-report questionnaires included the Subjective Happiness Scale (Lyubomirsky & Lepper, 1999); Self-Report Coping Scale (Causey & Dubow, 1992); and the self-report Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001). Qualitative information was gathered adapting interview items from module three of the Autism Diagnostic Observation Schedule (Lord et al., 2000; as per Rowley et al., 2012).

Results: Regression analyses were conducted to examine how far coping styles and sources of support predicted well-being. Analyses revealed no interaction between Autism/comparison groups and impact of coping styles on SDQ total problem score or happiness, so both groups are considered together (regression statistics, SDQ: Adj r2 =.15, p =.005; Happiness: Adj r2 =.23, p <.001). An Internalising style of coping predicted increased difficulties (β =.35, p =.002). Statistically significant predictors of happiness were using a Problem Solving style of coping, a positive predictor (β = .44, p <.001), and Internalising style of coping, which negatively predicted happiness (β = -.25, p =.02). Sources of social support did not predict either well-being outcome.

We also examined the qualitative and quantitative information collected about friendships, bullying and social support. There are no differences between the groups on the incidences of bullying (p =.15), but students with autism were statistically less likely to use peers and close friends for support (p=.01 and p=.001 respectively). Examination of the interview data indicated greater variance in the understanding and experience of friendships amongst students with autism compared to mainstream peers, and incidences of bullying were more likely to be focused on characteristics related to autism than the range of focus for mainstream children (e.g. appearance, accent, "that person bullies everyone").

Conclusions: These findings suggests that all students, not only those with autism, would benefit from support in developing a more problem-focused style of coping with difficulties. Autistic students do have sources of social support, but are less likely to rely on similar-aged peers. This may be related to the variability we observed in understanding and experience of friendship. We suggest that better understanding the factors underpinning this variability will be an important avenue for future research, allowing schools to better target support for students who may be vulnerable to more significant social difficulties.

131 **238.131** Full Inclusion for Children with Autism in Preschool

***S. A. Yoon**, Child and Adolescent Hospital, Seoul National Univ. Hospital, Seoul, Korea, Republic of (South)*

Background: Many children with ASD spend inordinate amounts of time alone pursuing repetitive and unimaginative activities during free play time in preschool. Moreover they are lack of social communicative skills. Recently inclusive preschool settings have been increased in Korea for children with ASD and their peers are performed a role in play by fostering opportunities for modeling to them.
Objectives: The purpose of this study is to investigate the perceptions and attitudes of early childhood education teachers in inclusive settings, difficulties and needs of special education teachers, and positive and negative effects of children with autism and typical peers.

Methods: This study employs a qualitative research methodology which included participant observation and the in-depth interview with typical peers, general education teachers, special education teachers and parents.

Results: Carefully selected for this study were five integrated preschool. Using thematic content analysis, the positive and negative perceptions, attitudes, appropriateness and readiness of inclusive settings are categorized into sub-themes.

Conclusions: 4 main themes were selected: general teacher's mind and insight towards full inclusion, peer's playing with ASD, uses of special interests for children with ASD, interdisciplinary team approach

132 **238.132** Reading Comprehension in the First Year of Schooling for Verbal Students Diagnosed with Autism Spectrum Disorder

***J. M. Paynter**[1] and M. Westerveld[2], (1)School of Applied Psychology, Griffith University, Southport, Australia, (2)Allied Health, Griffith University, Southport, Australia*

Background: Students diagnosed with autism spectrum disorder (ASD) are at risk of persistent reading difficulties, particularly reading comprehension, with challenges reported in over 50% of students. Early literacy skills are strong predictors of later reading success in children without a diagnosis of ASD. To date however, limited research has investigated early literacy skills in children diagnosed with ASD and whether they are significant predictors of later reading success.
Objectives: Using the Simple View of Reading (Gough & Tunmer, 1986) as a guiding framework, we assessed the reading comprehension skills of children diagnosed with ASD in their first year of schooling and investigated 1) the concurrent links between reading comprehension and reading accuracy; 2) the concurrent links between reading comprehension and listening comprehension; 3) the links between school-age performance on reading comprehension and pre-school ability on listening comprehension, vocabulary, and print concepts (i.e. print and word awareness).

Methods: Students diagnosed with ASD were first assessed at Time 1 during pre-school (n = 57, mean age = 57.61 months, SD = 5.73) and again at Time 2 following entry to their first year of formal education (n = 41, mean age = 73.37, SD = 4.54). At time 1 all participants had their ASD diagnosis verified, could speak in short-phrases, and were able to sit and attend for at least brief periods to complete assessments. At each time point a battery of assessment measures was completed, including at Time 1: listening (story) comprehension (Profile of Oral Narrative Ability [PONA]), vocabulary (Peabody Picture Vocabulary Test-4), and print and word awareness (Phonological Awareness Literacy Screening - PreK); at time 2, reading comprehension and reading accuracy (York Assessment of Reading for Comprehension) and listening comprehension (PONA).

Results: In the first year of formal schooling, 21 of the 41 were able to accurately read two grade-level short passages. Of these 21, 38.1% performed within expected limits on the comprehension component. For the 21 students who completed the comprehension task, reading comprehension was significantly linked with reading accuracy with a medium effect, r = .44, p = .048. Reading comprehension was significantly linked to listening comprehension with a large effect, r = .83, p < .001. School-age performance on reading comprehension was significantly linked to pre-school

ability on listening comprehension (r = .69, p = .001), vocabulary (r = .78, p < .001), and print concepts (r = .47, p = .03) with medium to large effects.

Conclusions: Only 38% of the participants showed age-appropriate reading comprehension skills in their first year of schooling**.** As expected, reading comprehension showed strong correlations with both reading accuracy and listening comprehension skills, consistent with the Simple View of Reading. Finally, pre-school vocabulary knowledge and story comprehension skills significantly linked with later reading comprehension skills. Taken together these results indicate that reading difficulties may be detected prior to, and in, the early years of schooling for children diagnosed with ASD. This highlights the potential for early assessment and targeted intervention to support later reading success for students diagnosed with ASD.

133 **238.133** How Do Children with Autism Spectrum Disorder Understand What They Read?

T. Sorenson Duncan[1]*, K. Manasi*[2]*, S. H. Deacon*[2] *and I. M. Smith*[3]*, (1)Pediatrics / Psychology and Neuroscience, Dalhousie University / IWK Health Centre, Halifax, NS, Canada, (2)Psychology and Neuroscience, Dalhousie University, Halifax, NS, Canada, (3)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA*

Background: Extracting information from written material is a pillar of academic success. For most children with ASD, making sense of what they read – reading comprehension – is a noted area of challenge. To support these children's academic progress, we must understand the component skills contributing to their reading comprehension. Research suggests that children with ASD draw on two broad skills: word reading, the ability to identify words, and oral language, used to attach meaning to these words. Children with ASD tend to have advanced word reading abilities relative to their levels of reading comprehension, which when marked is referred to as hyperlexia. This raises questions about the relative importance of each component skill in the reading comprehension of children with ASD.

Objectives: This study seeks to improve our understanding of the mechanisms by which children with ASD understand what they read. Specifically, this study asks, what are the relations between reading comprehension and (a) word reading, (b) oral language, and (c) component skills of oral language for children with ASD?

Methods: In this systematic literature review, we searched four major databases, using *autis**, *child**, *reading*, *literacy*, and *academic achievement* as search terms. Studies were selected that included both reading comprehension and word reading measures from school-aged, monolingual English-speaking children with ASD. A meta-analysis was then conducted using 27 studies with data from 1018 children.

Results: Descriptive Statistics. These studies reported a wide range of word reading and reading comprehension abilities. Average standard scores for word reading ranged from 82.29-109.05, and for reading comprehension from 74.3-107.59. Consistent with a hyperlexic profile, in all but one study, the average word reading score was greater than that for reading comprehension, with the mean difference ranging from -4.84 to 29.9.

Results: Meta-analysis. Similar mean correlations were found between reading comprehension and (a) word reading (*M r*=0.685 [0.574-0.771], n=27 studies), and (b) oral language (*M r*=0.653 [0.579-0.716], n=24). Among the components of oral language skills, relations were also similar between reading comprehension and (a) vocabulary (*M r*=0.709 [0.563-0.811], n=9), and (b) sentence-level abilities (*M r*=0.701 [0.580-0.791], n=5).

Conclusions: Our results demonstrate that word reading and oral language are essential to reading comprehension for children with ASD. This finding may seem surprising given the noted hyperlexic profile of some children with ASD, which at its extreme suggests word reading in the absence of understanding. However, many assertions about reading comprehension are based on group comparisons between children with and without ASD. In our view, oral language has been over-emphasized in understanding reading comprehension because children with ASD often show more marked difference in this area. By looking within samples of children with ASD, and not only in relation to children with typical development, this study reveals key insights as to the relation between both component skills, word reading and oral language, and reading comprehension for these children. In sum, this study provides a necessary foundation for further studies of the mechanisms that underlie reading comprehension for children with ASD.

134 **238.134** How Do Educators Use Evidence-Based Practices with Students with ASD?

P. LaCava*, Rhode Island College, Providence, RI*

Background: The search for effective practices in autism spectrum disorders (ASD) has been an ongoing initiative for families and professionals alike (Simpson, 2005). While scientifically based research has been promoted since the 1960s, a push for the use of evidence-based practices (EBP) has only been targeted more recently (Odom et al., 2005). Groups such as the National Professional Development Center (Wong et al., 2014) have published critical reports on EBP, including the identification of EBP and practice guidelines. Despite these advances there still exits a research to practice gap (Parson et al., 2013). The overall objective of this research is to explore educators' understanding and use of EBP in schools.

Objectives: The objectives of this study include:

1. identify educator knowledge, opinions and attitudes about EBP
2. describe the practices educators use
3. identify barriers to using EBP
4. identify professional development needs
5. understand how educators make EBP decisions
6. pilot an EBP process tool

Methods: This multi-phase study takes place in a northeastern U.S. state and includes qualitative and quantitative methods. Phase 1, which is currently underway, includes interviews, a questionnaire, and implementation of a pilot EBP process. The questionnaire is used to identity participant demographics, educational level, ASD training, etc. Interviews are used to understand what EBP are used and how educators make EBP decisions. Member checks are used to confirm validity. Participants are also interviewed at their school before, during and after they use the pilot EBP process to gather information about the tool's validity. This tool guides educators to choose, use and evaluate EBP. Participants were recruited through autism related email list serves and must work with at least one student with ASD to be included.

Phase 2 begins in 2019 and is an online questionnaire to survey educators. Phase 1 data will help guide the construction of the questionnaire

which include sections on: participant demographics, understanding/attitudes/opinions of EBP, practices used, training and professional development.

Phase 3 which will be implemented in 2020 uses focus groups, observations and other qualitative methods to gain rich insights about ASD practice in schools as a follow up to the previous two phases.

Results: Educators have been recruited who work with students with ASD from early childhood to young adult levels. Current results indicate that professionals are using a range of eclectic practices, but most were unaware of free EBP resources (e.g., the AFIRM Modules). Some participants noted they don't use some practices with fidelity and that their school/district has limited resources to support them. To date, most participants have stated they like the pilot EBP process tool and that it is helpful for them to think about EBP and use practices with fidelity. Final results will be shared at the INSAR meeting.

Conclusions: Initial implications include the need for more specific EBP training as well as school district level coaching and infrastructure to support educators. Basic dissemination of the NPDC and other EBP work needs to be done. Final conclusions will be made after all data are collected prior to the INSAR meeting.

135 **238.135** How Do Evidence Based Practices Inform an Evidence Based Practice in Psychology Child-Centered and Teacher Coaching Intervention?

K. Pinkman[1], *L. A. Ruble*[2], *M. Adams*[2] *and J. H. McGrew*[3], *(1)Department of Educational School and Counseling Psychology, University of Kentucky, Lexington, KY, (2)University of Kentucky, Lexington, KY, (3)Psychology, Indiana University - Purdue University Indianapolis, Indianapolis, IN*

Background: When applied within a school setting, the American Psychological Association's Evidence Based Practice in Psychology (EBPP) Framework proposes that optimal clinical decision-making should emerge from a consideration of the overlapping features of the evidence-based practice, student/family preferences and strengths, and classroom teacher resources and needs (American Psychological Association Presidential Task Force on Evidence-Based Practice, 2006). A challenge faced by clinicians, parents, and classroom teachers is how best to integrate EBP's within the personalized context outlined in an EBPP framework. The Collaborative Model for Promoting Competence and Success (COMPASS) is a student-centered, teacher coaching framework based on the EBPP approach (McGrew, Ruble, & Smith, 2015; effect size range 1.1-20).COMPASS is comprised of an initial parent-teacher consultation with a focus on obtaining a shared, holistic understanding of the student with ASD at home and school from those most familiar with the student. Three student goals are identified falling within social, communication, and learning skills domains.

Objectives: To identify what EBP's are present in the intervention plans of an EBPP-informed intervention such as COMPASS. To determine the frequency that each EBP is used in the different domains and which were utilized most. To identify what EBP's are common across learning domains of social, communication, and learning skills.

Methods: Twenty-nine sets of teaching plans targeting three goal domains (social, communication, and learning skills) were evaluated for young students with ASD (age range: 3-8 years). **Procedure.** An initial codebook providing definitions and examples of the 27 EBPs was developed using descriptions from the National Professional Development Center for ASD report on EBPs for students with ASD (Wong et al., 2014). The initial codebook was reviewed and refined for accuracy and clarity by a set of three coders before a final version was approved. The final codebook was then applied to determine what EBPs appear in each section of the teaching plan. EBPs were rated as either present (1) or absent (0). Frequency was calculated by summing the number of occurrences of the EBP within each goal domain and across goal domains to determine which EBPs intersect across domains. **Interrater Reliability:** Two coders independently coded 20% of the teaching plans and 87% reliability was achieved.

Results: Twenty-two of the 27 EBP's (81%) were utilized in at least one teaching plan. Within the social domain, 6 EBPs were utilized on average and the most frequent EBP was peer-mediated instruction (27/29 plans). For the learning/work domain, 5 EBPs were used on average and the most frequently used EBP was visual support (VS) (24/29). For the communication domain, 6 EBPs were used on average and the most frequently occurring EBPs were VS and prompting (20/29). Across domainsthe most frequently occurring EBPs were reinforcement and prompting.

Conclusions: COMPASS teaching plans utilized most of the 27 EBP's within the 29 teaching plans coded. Teaching plans include a variety of EBP's and those most frequently included within domains were peer-mediated instruction and intervention, visual supports, and prompting. Across domains reinforcement and prompting were used most frequently.

136 **238.136** Integrating Family Concerns in School Transition Preparation for Diploma-Track Youth with Autism Spectrum Disorder

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Background: In the United States, federal mandates require that parents and transition-age students (14-22 years old) receiving special education services be involved in the decision-making process regarding education and service plans. However, research suggests that families and students may not be meaningfully involved in the process. In particular, students with autism spectrum disorder (ASD) are the least likely to attend or provide input in their annual meetings (i.e., Individualized Education Program meetings), compared to students with other disabilities. Researchers also document that parents of youth with ASD have concerns for their student's adult future, and are dissatisfied with transition preparation and services. Due to their academic successes, youth with ASD who are primarily included in general education, and will receive a high school diploma, may be particularly understudied or inadequately supported in preparing for life after high school. Thus, there is a need for further exploration of how schools are currently addressing the needs and concerns of families of transition-age students with ASD graduating with their same-age peers.

Objectives: The goal of this exploratory analysis was to examine the Individualized Education Programs (IEPs) of 20 students with ASD from their last year of high school, in order to: (a) describe the parent and student concerns and annual goals documented in IEPs; and (b) explore whether families' concerns are integrated in students' annual goals and objectives.

Methods: IEPs were collected directly from families or schools, as part of a longitudinal study with parents and students with ASD graduating with a high school diploma within a year. Content analysis was conducted to systematically code and classify concerns and annual goals/objectives. Additional analyses were completed to examine the congruence between concerns and goals for each individual student. Table 1 provides coding examples. We then explored patterns across all students regarding how families' concerns were being addressed in students' annual goals.

Results: Parent and student concerns and annual goals focused on a wide range of domains, such as high school academics, organization skills,

and life skills (e.g., money management, community mobility). However, in numerous cases, student and parent concerns did not align. Further, families' concerns were often not entirely addressed in the annual goals. For example, one family stated concerns about the student's academics, social/communication with peers, emotional well-being, and transition to college; however, her annual goals only addressed emotion management and strategies to complete academic work.

Conclusions: These analyses provide insight into the types of concerns and annual goals documented for diploma-track youth with ASD. Further, the findings suggest a misalignment between families' concerns and annual goals, intended to direct students' special education supports and services for the year. These findings suggest that schools may have different priorities than families. Overall, the findings highlight the need for future research on how the decision-making process in developing priorities for annual goals is occurring in practice, and moreover how family perspectives are considered in developing transition plans for high school students with ASD.

137 **238.137** Intersections between Racial Biases and Implicit and Explicit Stigma Towards Autism in Two Cultural Contexts within the United States.

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Background: Disparities in access to care and stigma negatively impact autistic individuals (Durkin et al., 2010; Gray, 2002). Disparities in access to care may constitute a form of structural stigma, or "cultural norms and institutional policies that constrain the opportunities, resources, and wellbeing of the stigmatized" (Hatzenbeuler & Link, 2014, p. 2). Racial biases in autism identification have been documented among clinicians and educators (Beeger et al., 2009). Ethnic minorities are less likely to be diagnosed with autism and are diagnosed later than white children (Valicenti-McDermott et al., 2012). Black children in the US are often misclassified with conduct disorder (CD; Mandell et al., 2007). To the best of our knowledge, no prior study has examined implicit biases in autism identification.
Objectives: To examine implicit and explicit biases in autism identification among college students at two universities within the US (New York and Georgia).

We hypothesized that participants would:

1. Express heightened explicit and implicit stigma towards CD relative to ASD.
2. Be more likely to implicitly associate black children with CD rather than ASD while associating white children with ASD over CD.

Methods:

Participants (N = 510) were recruited from public universities in NY (n = 381; Female: 264, Mean Age:19.37; White: 37%) and Georgia (n = 129; Female:105, Mean Age: 20.17; White: 80%). Participants evaluated two vignettes depicting a child with ASD or CD after being randomly assigned to view either a photo of an African-American or a European-American male child (CAFE Set; LoBue, 2014; Figure 1).

Participants rated explicit stigma towards the children in the vignettes using an adapted Social Distance Scale (Bogardus, 1933), in addition to a measure of explicit racism (Symbolic Racism Scale; Henry & Sears, 2002). Participants also qualitatively evaluated the children's condition (Figure 1). We created two Implicit Association Tests (IATs): "Disability Valence" and "Racial Bias." (Figure 2).

Results:

Regardless of race depicted, participants reported heightened explicit stigma towards CD (M=21.63, SD=5.37) compared to ASD (M=11.15, SD=4.17), t(509)=40.05, p<.001 and did not differ in their accuracy in describing the child's condition as ASD (African-American vignette: 75.6%; European-American vignette: 72.8%) or CD (African-American vignette: 53.5%; European-American vignette: 62.4%). Participants were more likely to implicitly associate good words with ASD and bad words with CD (M=.270, SD=.29), t(498)=20.83, p<.001, and to associate European-American images with ASD and African-American images with CD (M= -.064, SD=.29), t(483)= -4.82, p<.001. No associations were observed between social distance and performance on the IATs. Racism *was* associated with racial bias in NY (r = -.11, p = .04) but not Georgia (r = -.09, p = .33).

Conclusions: This evidence of implicit but *not* explicit racial bias in autism identification among non-specialists, in conjunction with prior research demonstrating that checklists fail to avert misclassification of ethnic minorities by specialists (Burke et al., 2015), suggests that implicit biases contribute to disparities in access to autism care. Future research should evaluate whether implicit attitudes contribute to diagnostic and policy decisions by specialists to clarify contributions of implicit stigma to structural stigma.

138 **238.138** Intolerance of Uncertainty and Anxiety in Children and Youth with Autism Spectrum Disorder

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Background: Anxiety is common in individuals with Autism Spectrum Disorders (ASD) and is estimated to occur in about 40% of youth with ASD (van Steensel et al., 2011). Individuals with ASD exhibit two types of anxiety: 1) traditional anxiety disorders that are consistent with the DSM-5 (e.g., social anxiety disorder, specific phobia); and 2) atypical anxiety disorders that are unique to ASD (e.g., other social anxiety, idiosyncratic phobia, fear of change) (Kerns et al., 2011). Intolerance of uncertainty (IU) is one cognitive process implicated in the development and maintenance of anxiety in ASD (Boulter et al., 2014). However, few studies have examined this relationship.
Objectives: The current study will examine: 1) the relationship between IU and atypical and typical anxiety disorders, and 2) IU and anxiety symptom severity in children and youth with ASD. It is hypothesized that IU will be strongly positively associated with atypical anxiety symptoms, as well as severity of anxiety in children and youth with ASD.

Methods: Twenty-five youth aged 8 to 14 with ASD will participate in the present project. Typical and atypical anxiety symptoms will be assessed using the Anxiety Scale for Children with Autism (Rodgers et al., 2016) and The Anxiety Disorders Interview Schedule – Autism Addendum (Kerns, et al., 2014). IU will be measured using The Intolerance of Uncertainty Scale (Comer et al., 2009). Data collection is partially complete (n=18), with

completion expected in Winter 2019. Regression analyses will be conducted to investigate the research questions.

Results: Preliminary analysis showed a significant relationship between child-reported IU and type of anxiety in children with ASD. Additionally, a strong positive relationship was found between total IU, IU subscale prospective anxiety, and anxiety severity. It is anticipated that parent-reported IU will be strongly positively associated with the atypical anxiety symptoms and anxiety severity.

Conclusions: The current study provides further support that children with ASD may exhibit avoidant responses when faced with uncertainty. Findings from the current study will provide valuable insight into the role of IU in applying and facilitating proper interventions to help children and youth cope with their feelings of uncertainty, which in turn may decrease anxiety symptoms.

139 **238.139** Jasper in the Classroom: Preschool Teacher Experiences Integrating Autism Intervention in Lausd Classroom Curriculum

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Background: JASPER (Joint Attention Symbolic Play Engagement and Regulation) is an evidence-based social communication intervention for children with autism spectrum disorder (ASD) (Kasari et al, 2006). Past research has examined a train-the-teacher model for JASPER in Preschool for All Learners (PALs) teachers in Los Angeles Unified School District (LAUSD) (Lawton & Kasari, 2012). The present JASPER in the Classroom pilot explores the experiences and feedback of teachers regarding their experiences learning and implementing JASPER within the classroom setting.
Objectives: To gain insight into the experiences of LAUSD PALs teachers who were trained to use JASPER strategies for implementation into their daily classroom curriculum.

Methods: Following the completion of the JASPER in the Classroom study, PALs teachers who received extensive training in JASPER were asked to share their experiences as participants (n=10). Teacher interviews consisted of 10 questions prompting for their feedback and were conducted and recorded via Zoom, a web call software. Recorded interviews were later transcribed and coded by two research assistants. Common themes were coded from the responses and prominent themes emerged following a consensus check. All themes were categorized and tallied. Five of the 10 questions were selected for analysis based on relevancy to the present study.

Results: Of the five selected questions, one to four prominent themes emerged per question. Of the ten teachers (n=10), 7 expressed feeling overwhelmed while initially learning JASPER strategies, while 3 expressed initial ease. When asked to report the most useful strategies learned, joint attention gestures (n=7) and language strategies (n=7) were reported to be the most useful, followed by modeling (n=4) and behavioral regulation gestures (n=3). Eight teachers reported that they will use all strategies, while 2 responded that there was one specific strategy they do not plan to employ. All 10 teachers found implementation of JASPER to be feasible in the classroom — three expressed that live-coaching is a necessary aspect of making it feasible, and three thought that having paraprofessionals coached would make it even more feasible. In terms of unprompted comments made, 7 said the strategies are generalizable throughout the day, 7 expressed that JASPER helped them in setting student goals, 5 saw visible improvements in students, and 3 said the strategies are generalizable to all students.

Conclusions: Coding common themes from interviews with PALS teachers revealed promising results of integrating the JASPER intervention within PALs classroom curriculum (n=10). While teachers expressed feeling initially overwhelmed, all found implementation of JASPER to be feasible within the classroom setting and reported they would continue the use of JASPER strategies post-study. These interviews revealed promising results of integrating JASPER intervention directly within the PALs curriculum — rather than requiring teachers to set aside classroom time to implement the intervention — which may potentially lead to an increase in social communication among students with ASD and other related disorders. This feedback regarding different aspects of learning JASPER and implementing it into the curriculum can inform similar studies moving forward, and will allow teachers to be an integral part of this process.

140 **238.140** Latent Change Score Analysis of Writing Development over 12 Months in School-Age Children with Autism Spectrum Disorder

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Background: Children with autism spectrum disorder (ASD) experience challenges with literacy development, commonly demonstrating challenges with lower-order (i.e., transcription) and higher-order (i.e., text generation) writing abilities. These difficulties have often been explored cross sectionally, but no studies have investigated the writing abilities of children with ASD using multiple time points.
Objectives: 1) To examine change in writing across two time points spaced roughly 12 months apart and 2) to explore predictors of change in writing abilities.

Methods: Seventy-two children with ASD participated in this study (Table 1). Children were aged 9-17 at the first time point (T1) and 10-18 at the second time point (T2). Time points were spaced roughly 12 months apart for all participants. Community diagnoses of ASD were confirmed with the ADOS-2. Cognitive ability (FIQ) was measured with the WASI-II, and all participants fell within the borderline to above average ranges. Writing performance was assessed using the Test of Written Language, 4th Edition (TOWL-4), a narrative writing task where participants generate a story about a provided picture. Participants received different but equivalent forms at T1 and T2. Responses were scored for Contextual Conventions (CC; lower-order writing abilities) and Story Composition (SC; higher-order writing abilities). Word count (WC) was also recorded. Two trained research assistants scored all writing samples and demonstrated excellent interrater reliability on a sample subset (n = 34; αs > .90).

Latent change score models (LCSM) were used to examine change and predictors of change between time points. LCSMs model change between two time points as a latent change factor and allow for assessing the average change between time points, the variance in the change factor (the extent to which individuals differ in change over time), and the extent to which change is proportional at T2 based on T1 (and other predictors).

Results: See Table 2 for estimates and p values. All LCSMs were run using Mplus 7.3. Participants demonstrated significant change in CC and WC but not SC. Additionally, participants showed similar amounts of change for CC and WC but varied for SC. T1 CC and SC negatively predicted latent change (i.e., participants who initially scored lower at T1 improved at T2), but T1 WC showed no association to T2. Adding additional predictors showed CC and SC remained negatively predictive, FIQ positively predicted CC but not SC, and age and ADOS-2 were not predictive for either. For WC, no predictors significantly predicted latent change.

Conclusions: Findings demonstrate that children with ASD make distinct changes in their writing abilities across 12 months. Participants showed more change in lower-order writing abilities (i.e., CC and WC) compared to higher-order writing abilities (i.e., SC). However, while initial lower-order and higher-order abilities predicted later change, initial WC did not predict later change. This provides potential further support to the graphomotor challenges experienced by children with ASD. Furthermore, FIQ appeared to positively influence growth for SC but not for CC or WC. Findings suggest further research is needed to understand the developmental trajectories of writing development in children with ASD.

141 **238.141** National Clearinghouse on Autism Evidence & Practice (NCAEP): Updating a Large Scale Systematic Review of Behavioral Interventions for Children and Youth with ASD

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Background: The National Professional Development Center on ASD (NPDC) completed a review of literature published between 1990-2011 and identified 27 evidence-based practices (EBPs) for individuals with ASD from birth through age 21. These findings have had a broad impact on the field since their publication in 2015 (e.g. seminal manuscript cited over 750 times; online AFIRM modules with over 60,000 users that support the use of each practice; identified by IACC as one of the top 20 scientific advances in ASD research). These findings are dated, however, and the National Clearinghouse on Autism Evidence and Practice (NCAEP) is conducting an updated review of the literature and new findings related to the identification of EBPs will be available for IMFAR 2019.

Objectives: The objectives of this session are to (1) identify new practices that have met the criteria for identification as an evidence based practice, (2) identify for whom they are effective (including race, ethnicity, and nationality data of study participants) and (3) identify for what outcomes the practices have an effect.

Methods: The NCAEP team used the same search strategy as the 1990-2011 systematic review, for peer-reviewed articles using variations of the terms (1) autism(e.g., ASD, Asperger) and (2) intervention (e.g., treatment, program, education). The inclusion criteria are experimental or quasi-experimental studies (single-case design and group design) that examine a behavioral, educational, or developmental (i.e., non-medical) intervention for individuals with ASD from birth through 22 years old. The following steps were completed for the systematic review: (1) search of 9 databases, (2) deduplication of search results, (3) title/abstract review (NCAEP team), (4) full-text review for inclusion (NCAEP team), (5) quality review, determination of effects, and preliminary data extraction (NCAEP trained external reviewers), and (6) consensus decision for quality and presence of effects as needed (NCAEP team). The NCAEP team is currently in the process, of reviewing and finalizing the data extraction, which is combining the information about effects, interventions, outcomes, and participants across the 1990-2011 and 2012-2017 reviews.

Results: The 2012-2017 review started with over 61,000 articles in the initial search. Currently, 640 articles have met quality criteria. See the PRISMA chart in Figure 1 for additional details about the numbers of articles during each phase of the review. Preliminary participant data indicates that more studies include 6-11.9 year-olds (56.9%) and 3-5.9 year-olds (44.6%) participants, with fewer studies including 12-14.9 year-olds (27.2%), 15-18 year-olds (18.8%), and the fewest studies including children under 3 years old (9%) and 19-22 year-olds (6%) . Also, only about 30% of included articles report race, ethnicity or nationality data. Early data shows that social (39.5%) and communication (21.0%) domains are the most common intervention targets.

Conclusions: The updated systematic review of behavioral and developmental interventions is an important step to continue to move research and practice forward to improve outcomes for children and youth with ASD. New evidence will likely shift current practice categories (e.g.technology based interventions), identify new EBPs, and provide additional data related to the efficacy of interventions for diverse populations.

142 **238.142** Online Learning: A Good Fit for Students with Autism?

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Background: Adolescents with autism are heavy users of technology for entertainment. What is not well known is how they use it to support learning. Online learning may be a way for these students to take courses in subject areas of interest that may not be available in their local high school, thus helping to prepare them for life after high school. It could also be a way to ease high school graduates with autism into post-secondary education. However, there is a void in the literature on the experiences of online learning of individuals with autism. Taking courses from the comfort of a quiet classroom dedicated to online learning, which is offered in many high schools today, or even from home, may be another way to help adolescents with autism more effectively transition to higher education and/or careers of interest.

Objectives: The purpose of this study was to explore the experiences and perspectives of secondary students with autism with online learning.

Methods: This study used a paper survey with 275 high school students with autism from 30 high schools spread across 3 states in the US. The majority of participants were male (87%), white (72%), without intellectual disability (93%), and on track to graduate high school with a regular diploma (100%).

Results: This study found that while only 27% of participants had an online learning experience, 52% indicated they were favorably disposed to taking online courses in the future. Of those students who had an online experience, the majority found it beneficial mostly due to their ability to control the amount of time they needed to learn. The majority (55%) said they liked learning online because they could take as little or as much time as they needed to work on the course and almost half (48%) indicated they liked it because they could work on it on their own schedule. Regarding the reduction in social interaction through online learning, only 19% said they liked online courses because they did not have to interact with the teacher and 18% because they did not have to interact with other students. Most participants took courses in subjects related to science and math.

Conclusions: Many students with autism who have experienced online learning find it beneficial for the control it gives them over when and the amount of time they devote to the learning. Reducing social interactions by taking online classes was less important. Online learning has the potential to help young adults with autism to ease into higher education or to fill gaps in their knowledge as they transition to adulthood. It can

also allow them to take courses more specific to their interests.

143 **238.143** Parent and Teacher Reports of Internalizing Symptoms in Children and Adolescents with ASD: Implications for School Placement

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Background: Children with autism spectrum disorder (ASD) often experience comorbid internalizing symptoms, such anxiety and depression. Students with ASD may require school-based services to mitigate effects of internalizing symptoms on daily school functioning and long-term educational outcomes. This information about children's and adolescents' emotional, behavioral, and social functioning is most useful for determining impairment and needs—including school-based supports and placements—when gathered from different informants (i.e. parents, teachers). However, differences between parent and teacher ratings of youth internalizing symptoms (INT) are common, and the effect of such differences upon school-based placement for students with ASD is unclear. Understanding how parents' and teachers' reports of internalizing symptoms affect school services is critical to improving school-based support for students with ASD.

Objectives: To (a) compare parent and teacher ratings of INT; (b) identify differences in INT for students in various school-based placements; and (c) explore parent and teacher ratings of INT as potential predictors of school-based placement.

Methods: Data were analyzed from the Simons Simplex Collection (SSC v15.0) and included 591 youths with ASD (age: range=6-17yrs, *M*=10.22, *SD*=3.09). Paired t-tests were used to compare parents' Child Behavior Check List (CBCL) and teachers' Teacher Report Form (TRF) scores on the Internalizing Composite (INT) and the three INT subscales (Somatic Complaints [SOM], Withdrawn [WTH], Anxious/Depressed [ANX/DEP]). These comparisons were then made across three school-based placement groups: 100% general education (No SpEd; *n*=221), mixed general and special education (Some SpEd; *n*=202), 100% special education (All SpEd; *n*=168). Forthcoming multinomial logistic regression analyses will permit identification of how these scores may predict school-based placement into one of these three groups.

Results: Overall, significant differences emerged between parent and teacher scores on SOM (CBCL *M*=56.55, SD=6.99; TRF *M*=53.96, *SD*=6.02), *t*(591)=7.4, *p*<.001, and WTH (CBCL *M*=62.54, SD=8.79; TRF *M*=60.51, SD=7.85), *t*(591)=5.07, *p*<.001. Among the No SpEd and Some SpEd groups, teacher and parent SOM and WTH scores differed but INT and ANX/DEP did not. However, for the All Spec group, statistically significant differences emerged between CBCL (*M*=55.63, *SD*=6.15) and TRF (*M*=58.02, *SD*=7.39) ANX/DEP t-scores, *t*(168)=-3.75, *p*<.001.

Conclusions: Overall, our findings suggest that reports of youth internalizing symptoms with ASD are nuanced in terms of the *informant* (i.e., parent vs. teacher) and *types* of internalizing symptoms (i.e., somatic complaints, withdrawn, anxious/depressed). Moreover, parent and teacher ratings of internalizing symptoms varied depending on school-based placement. These findings suggest that differences in parent and teacher ratings of internalizing symptoms—which affect multiple facets of school-based functioning for students with ASD—may impact school-based placement. This study underscores the need to utilize multi-informant data regarding internalizing symptoms so appropriate support is in place for school-age children and adolescents with ASD.

144 **238.144** Proactive Planning for Evidence-Based Practices in Schools:

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Background:

Schools are the primary service sector in which individuals with autism spectrum disorder (ASD) receive care. Although the use of evidence-based practices (EBPs) is mandated in schools (Individuals with Disabilities Education Improvement Act [IDEA] 2004; No Child Left Behind 2001), and school districts are required to provide resources and funding to support the implementation of EBPs; that is not always the case in practice. Districts sometimes fail to provide resources to comply with IDEA standards (Yell, Katsiyannis, Drasgow, & Herbst, 2003), suggesting that sometimes they adopt a reactive strategy (correctly implement EBPs only after an IDEA violation), rather than using IDEA as a framework for effective EBP implementation. Understanding factors related to proactive planning for EBP implementation may support more effective implementation.

Objectives:

To evaluate the factors related to school district use of proactive strategies to support EBP implementation.

Methods:

Thirty members from the California Autism Professional Training and Information Network (CAPTAIN), representing multiple school districts from across the state, participated in a total of six focus groups. Participants were asked to select a program for students with ASD that their district was currently implementing or had recently implemented, and to describe the implementation process.

Audio recordings of the focus group sessions were transcribed and independently coded by research associates, and inter-rater reliability was assessed by comparing coding and discussing discrepancies to arrive at agreement. N*Vivo qualitative software was used to identify themes across participants.

Results:

Participants reported that some districts provide resources to select and implement interventions based on student needs, whereas others do so reactively (e.g., after due process and litigation, or when an escalated situation occurs)(See Table 1). Proactive strategies that emerged include (1) as the number of students with ASD increases, districts provide training and resources to support EBP implementation for students with ASD (2) participants working with the district or SELPA receive a grant to fund programs, (3) districts working with CAPTAIN, an agency that supports the understanding and use of EBPs for individuals affected by ASD, (4) districts identifying student needs in general. Reactive strategies that emerged include (1) interventions being selected because of due process or litigation, (2) students being placed in non-public schools, as districts pay for non-public school tuition if they cannot offer a Free and Appropriate Public Education, (3) participants provide support for a teacher in an escalated situation involving a student with ASD, due to the lack of teacher training. Participants also shared their thoughts on why proactive strategies are not consistently implemented in their districts, and reported that while implementation of proactive strategies would require more

effort and money initially, it is cost-effective in the long run.

Conclusions:

This may give insight on how to allocate resources to proactively address student needs by appropriately selecting and implementing EBPs and prevent reactively addressing student needs after problematic situations occur. Future research should evaluate the differences between schools or districts that act proactively or reactively when providing for student needs.

145 **238.145** Quality of Life of Students with Autism Spectrum Disorder Compared to Typically Developing Students Attending Colleges in the American Northeast

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Background:

Autism Spectrum Disorder (ASD) is characterized as a developmental disorder that negatively impacts social functioning (American Psychiatric Association, 2013). As a result, navigating college can present a particular challenge for individuals with ASD relative to their typically developing peers. Approximately 17% of the 50,000 youth diagnosed with ASD who leave high school every year in the United States attend a 4-year college or university (Roux, Shattuck, Rast, Rava, & Anderson, 2015). Though more students with ASD are entering college, reviews of attrition and graduation records found that the completion rate for these students is 79.5% (Roux et al, p 46), a full 10 points lower than college-students with other disabilities. While efforts have been made to identify specific variables that may be impacting the experiences of American college students with ASD, (e.g., Gobbo & Shmulsky, 2014;) few researchers have explored the first-hand accounts of college students with ASD regarding their experiences in college. At this time, one study has been published comparing the experiences of British students with ASD to that of their neurotypical peers (Gurbuz, Hanley, & Riby, 2018). Such an evaluation has not been conducted at an American institution.

Objectives:

This study sought to compare self-reported quality of life (QoL) of students diagnosed with ASD enrolled in degree programs in the Northeastern United States with that of their neurotypical peers using an online questionnaire designed to collect both qualitative and quantitative data.

Methods:

A 68 item (17 demographics, 43 Likert-scale, and 7 open-ended) online questionnaire (adapted from Gurbuz et al.) was distributed to 42 Colleges and Universities in the Northeastern United States with dedicated support programs for students with ASD. Institutional Review Boards approved the study at all participating institutions prior to distribution of the questionnaire. Potential participants were invited to take part anonymously

Results:

981 students participated in the study (20 students with ASD). Among all participants, 78.5% were undergraduate, 15.7% Master's students, and 5.7% Doctorate students. Majority of participants were full time students (85.7%), female (74.2), Caucasian (63.2%), and single (51.1%). For participants with ASD, 35% were diagnosed less than age 5, 90% were diagnosed with a healthcare provider, and 65% report disclosing their diagnosis to their institution. The complete data analysis (i.e., Principal Component Analysis applied to the Likert-scale items to assess the factor structure of the data) will be presented at the meeting.

Conclusions:

Preliminary results of this study have important implications for institutions seeking to better support students with ASD. Further, results suggest not only differences in the college experiences of individuals with ASD, but items related to campus and academic support services also highlight areas of strength and opportunities for improvement relative to supporting this population.

146 **238.146** Read (and talk) with Me: Book Reading Interactions between Children with Autism Spectrum Disorder (ASD) and Their Caregivers.

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Background: Professionals advocate for early literacy instruction to be intentionally included in early intervention programming. This targeted instruction is particularly pertinent for children with ASD who are at increased risk for reading difficulties due to social communication deficits that are characteristic of the disorder. Caregivers are instrumental in supporting their children's literacy and oral language development. Reading aloud to children, often referred to as shared reading, has been repeatedly shown to relate to literacy outcomes.

Objectives: The primary aim of this exploratory investigation is to identify malleable factors associated with children's participation in shared reading with their caregiver. We will present our most recent findings from this project with the goal of: (1) describing and comparing shared reading between caregivers and their children with ASD and caregivers and their children with typical development (TD) and (2) evaluating the role of book selection on children's participation and adults' external reading behaviors.

Methods: A total of 37 parents and their preschool children (n = 17 with ASD; n = 20 with TD) participated in this study. Members of the research team recorded caregivers and their children reading nine books together (i.e., 3 familiar, 3 non-fiction, 3 fiction). Caregivers were instructed to read as they would typically. Researchers coded adult and child external reading behaviors (e.g., comments, questions outside of the text, responses) during shared readings.

Results: Our analyses revealed group differences in reading interactions. Caregivers of children with ASD generally talked more during readings than parents of children with TD (F (1, 35) = 5.59, p =.02, partial eta squared = .138). However, children with ASD demonstrated lower rates of responding to caregiver questions and comments compared to children with TD (F (1, 35) = 4.13, p =.050, partial eta squared = .106).

We also explored relationships between book genre (i.e., non-fiction, fiction, familiar) on external reading behaviors. We found a main effect of book genre on caregiver talk, with caregivers talking more during non-fiction books compared to other genres (Wilk's Lambda = .52, F (2, 34) = 16.01, p = <.001, partial eta squared .49). Children with ASD responded more frequently to questions posed during familiar books compared to either non-fiction or fiction books (χ^2 (2, n = 17) = 14.94, p = .001). The interaction between book genre and rates of responding was not significant

for children with TD (χ^2 (2, n = 20) = 1.30, p = .52).

Conclusions: These preliminary findings suggest that caregiver-child interactions during shared reading is qualitatively and quantitatively different for children with ASD and those with TD. Book reading interactions between caregivers and their children with ASD are generally driven by the adult reader. Moreover, many children with ASD may need support in responding to caregiver questions. These findings have potential implications for researchers as they develop shared reading interventions for this population. Malleable factors, such as book genre and caregiver external talk, could serve as the target for intervention efforts.

147 **238.147** Growing up with Autism: What Do We Know? Where Do We Need to Go?

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Background: The quantity and quality of research on autism spectrum disorder (ASD) has grown dramatically over the past few decades. Multiple workgroups have conducted systematic reviews of autism intervention research to identify effective interventions and discriminate new and promising approaches from the deceptive and improbable. The majority of autism intervention research included in these reviews, however, is focused on early intervention and early childhood development (Wong et al., 2014). In recent years, funding agencies and scholars have called for researchers to broaden their scope to address the needs of adolescents and adults with ASD (IES Request for Applications, 2014).
Objectives: The primary research aims are as follows: (1) to evaluate the extent to which the field is responding to this call of broadening research efforts to include adolescents and adults with ASD; and (2) to describe the type of research being conducted and outcomes of interest.

Methods: We conducted a systematic scoping review of empirical research published between 2008-2017 that included at least one individual with ASD age 12 or older. The research team created a protocol that detailed study inclusion criteria, search terms, and appropriate library search databases. Studies were initially screened for inclusion based on a title and abstract review; studies that met eligibility were then subjected to full-text review. The following variables were extracted for each included study: date of publication; study type (e.g., intervention; descriptive); participant ages; primary intervention outcome/study variables.

Results: We will present our results in adherence with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The initial search revealed 2182 studies. Approximately 25% of these studies (n = 529) met criteria to be included in the review. Descriptive analysis of publication dates shows a consistent increase in the number of published empirical studies from 2008 to 2017 that include adolescents or adults with ASD. A total of 27 studies published in 2008 met inclusion criteria compared to 122 studies in 2017. Data on the nature and type of studies is forthcoming.

Conclusions: Our data suggest that the field is responding to the need to broaden research efforts to include adolescents and adults with ASD. The intent of this scoping review was to provide a broad overview of the current state of our empirical knowledge for this population. These findings may inform researchers as to specific areas of need that remain under addressed in the current body of literature. It is important to note that we evaluated these studies primarily for content. Evaluation of methodological quality of studies was beyond the scope of the current review but will be needed if the goal is to identify specific evidence-based practices for this population. This review should be viewed as a launching point for follow up meta-analytic studies in which researchers attend to methodological rigor as part of their evaluation process.

148 **238.148** Reading Skills in Children and Adolescents with ASD

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Background: There is a limited amount of research on ASD and academic functioning (Keen, Webster, & Ridley, 2016). A review of intervention literature specific to children with ASD conducted by Wong and colleagues (2015) found that only 12 percent of the reviewed articles emphasized academic outcomes. Achievement profiles within this population vary (Assouline, Nicpon, & Dockery, 2012), but many individuals with ASD experience academic difficulties, including those who have cognitive abilities in the average range (Estes et al., 2011; Kim, Bal, & Lord, 2018). Reading skills are particularly variable in children with ASD (Nation, Clark, Wright, & Williams, 2006), but research suggests that reading comprehension skills tend to be more impaired than reading fluency within this population (e.g., Mayes & Calhoun, 2008; McIntyre et al., 2017; Whitby & Mancil, 2009). McIntyre and colleagues (2017) found that in a sample of children with ASD, ADHD, and TD, 55%, 33%, and 11%, performed 1 standard deviation or greater below the mean on a standardized measure of reading comprehension, respectively. Assessing reading skills during psychological and psychoeducational evaluations for all students with ASD is important, as it will assist with important educational and school-based intervention planning.

Objectives: Research suggests that several neurocognitive and language abilities play a role in reading deficits in children with ASD (e.g., May et al., 2013; McIntyre et al., 2017; Sansosti et al., 2013). Additional research is needed to more comprehensively understand these relationships. Moreover, given the importance of measuring reading skills in children with ASD, examining how consistently primary standardized assessment tools measure reading skills within this population is needed. The current study preliminarily explores the following research questions: (1) What are the neurocognitive and language correlates associated with reading skills in children with ASD in comparison to individuals without ASD (with and without reading difficulties)?, and (2) is there any variance in reading skill performance across three commonly used standardized assessments in children with ASD?

Methods: Data collection will commence January 2019. Participants in the current study will be children with ASD, specific learning disability (SLD), or TD children between the ages of 6 and 17 and their parents/caregivers and teachers. Child participants will complete a hearing screening, the CELF-5, WISC-V, GORT-5, and reading subtests of the WJ-IV ACH, WIAT-III, and KTEA-3. Children's parents and teachers will complete the ASRS, BRIEF-2, and Conners-3.

Results: For this presentation, descriptive data will be presented. If there have been sufficient participants, repeated measures regression or multilevel modeling (MLM) will be used.

Conclusions: The current presentation will highlight preliminary neurocognitive and language correlates of reading performance for children with ASD and children without ASD (with and without reading difficulties) and discuss the similarities and differences in reading performances across these groups as measured by commonly used standardized achievement tests. The importance of measuring reading performance in youth with ASD, understanding factors that may influence reading skills in this population, and clinical and educational implications will be addressed.

149 **238.149** Relationship between Food Selectivity and Sensory Hyper-Responsivity in Children with Autism Spectrum Disorder: A Qualitative Study

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Background: Sensory hyper-responsivity is one of a major symptomatic condition in individuals with autism spectrum disorders (Marco et al., 2011). This symptom appears in various types of modalities and have been suggested to associate food selectivity (Cermak et al., 2010). Children with ASD are overly selective in their eating patterns that they are lack of food variety in intaking flesh fruits and vegetables especially in their earlier developmental stage (Emond et al., 2015). Whereas several studies that examined relationship between sensory hyper-responsivity and food selectivity by quantitative investigation using several questionnaires, little is known about its neurophysiological basis.

Objectives: To obtain more information with regard to the influence of sensory hyper-responsivity on food selectivity in children with ASD, we conducted a study applying a qualitative KJ method which is generally accepted in language data analysis.

Methods: Four children with ASD (7 ~ 14 year-olds male, respectively) and their mothers were participated. The mother answered the Short Sensory Profile (SSP; Tomcheck & Dunn, 2007) which evaluate the severity of hyper- / hypo-responsivity. Three out of four children were over 1 or 2 standard deviation of the standardized mean both in the total score (62, 87, 125 / maximum of 190) and sub-category of Taste / Smell Sensitivity (6, 6, 20 / maximum of 20). Thus, we defined them as 'High sensitivity type' relative to a child defined as 'Low sensitivity type'. Semi-structured interview (30 ~ 50 min) was performed using a guideline which we had developed. We heard "favorite foods" and "disliking foods" as well as those texture and other sensory features for the children and mothers. The authors classified the foods according to that the children are favorite or disliking, and made categories following semantic similarities after putting labels as to speech contents.

Results: We mainly focused on differences between High and Low sensitivity types. We found 3 categories and 8 sub-categories in High sensitivity types (Figure 1). "Difficulty of chewing and swallowing" was related with pickiness to avoid foods that is not easy to eat and bite. "Hyper-responsivity to food texture" was related with avoiding foods' textures and shapes which influence easiness to swallow. They disliked sticky, dry, limp textures of the foods. The category involved preference to eat dark taste. Avoiding of intaking of flesh fruits and vegetables was found. "Atypical picky to food appearance" involved hesitating to eat from foods' appearance. In contrast, Low sensitivity type tended to prefer to weak tastes' foods and flesh vegetables. Influence of visual appearance of foods did not be reported.

Conclusions:Our qualitative study demonstrated that food selectivity is constructed several factors which are shared with all children with ASD having high sensory hyper-responsivity. The result that both "difficulty of chewing and swallowing" and "Hyper-responsivity to food texture" contributed food selectivity was seemed to derived from sensory abnormalities when taking the foods. Chewing and swallowing can be done functioning various nerves in the swallowing reflex. The current study suggested that sensory and motor disabilities might be underlying in food selectivity.

150 **238.150** Resilience in the First Year of College for Students with ASD

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Background: Adjustment in the first year of postsecondary education is challenging for all students, but those with autism spectrum disorder (ASD) and other learning disabilities experience greater psychosocial and academic difficulties (HERI, 2011). Knowledge about the college experience of those with ASD is increasing (e.g. Gelbar, et al., 2014), but little is known about factors contributing to the success of these students. Resilience has been referred to as adjustment and adaptation to college with optimal outcomes in grades, and mental health (Hartley, 2011). Objectives: The current study will examine predictors of adjustment of individuals with ASD, ADHD/LD, or no disability in their freshman year of college.

Methods: This secondary analysis looked at the nationally representative sample of college students who completed both the Cooperative Institutional Research Program (CIRP) Freshman Survey at the start of and the Your First College Year Survey at the end of their 2016-2017 academic year (n=9493). Respondents were divided into three groups: self-report of learning disability (LD), or attention deficit hyperactivity disorder (ADHD) (n=483), having ASD (n=23) or reporting no learning issues (n=4275). Regression models were applied to each group to identify predictors of adjustment. Individual survey items were combined to create the predictors of social support, high school scores, service access, study habits, and family resources. Items were combined into the outcome variables of academic performance, and overall satisfaction.

Results: Regression models were run for each group on each outcome with bonferonni correction for multiple posthoc tests. For the group with **no learning issues**, significant predictors were **1)** good academic study habits for improved mental health (b=0.20, p<0.00) and better academic performance (b=0.74, p<0.00), **2)** higher ratings of social support for improved mental health scores (b=0.02, p<0.01), and **3)** higher high school test scores for better academic performance (b=0.74, p<0.00). For those **ADHD and/or LD**, significant predictors were **1)** better study habits for, improved mental health scores (b=0.22, p<0.00) and better academic performance (b=0.84, p<0.00), and **2)** higher high school test scores and for better academic performance (b=0.14, p<0.00). For those with **ASD**, the significant predictor was **1)** better study habits for better academic performance (b=0.93, p<0.02).

Conclusions: For the no learning issues group, academic study skills predicted both academic success and optimal mental health in the first year, with social support and high school test scores playing additional roles. The ADHD/LD group had similar predictors of academic study skills and high school test scores. However, for those with ASD, neither social support nor test scores played a role in first year resilience, with the only factor being academic study habits. Results suggest that all students benefit most from support in academic study habits and that resources may need to be directed towards building this important skill. Further investigation with a larger group of students with ASD is warranted.

151 **238.151** Response Differences on the Minecraft Writing Assessment: Comparisons between Children with Autism Spectrum Disorder, Children with Attention-Deficit/Hyperactivity Disorder, and Typically Developing Children

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Background: Children with autism spectrum disorder (ASD) demonstrate broad challenges with transcription and text generation. Recent studies have shown that these challenges are related to difficulties with language, social communication, and executive functions. The Minecraft Writing Assessment (MWA) was designed to explore writing challenges in children with ASD compared to children with attention-deficit/hyperactivity disorder (ADHD) or typical development (TD). Preliminary findings have shown group differences on word production but have not explored potential relationships between broader task performance and text production across groups.
Objectives: 1) To examine group differences in response style to the prompt, audience awareness, and items recalled during video recall or writing; 2) to compare relationships between word production with item recall during video recall and writing.

Methods: A total of 132 (66 with HFASD, 29 with ADHD, and 37 TD) children participated who were matched on age (M=14, SD=2.24). Both clinical groups were matched on FIQ. ASD diagnoses were confirmed using the ADOS-2, and ADHD diagnoses were confirmed using the Conners-3. All participants completed the experimenter-designed MWA that included a questionnaire about Minecraft, watching and recalling items from a short two-minute gameplay video, and a ten-minute writing prompt where participants either handwrote or typed a story about the video to a specific audience (a peer their own age who had never played Minecraft). Writing samples were counted for words and were coded as either being written in a narrative or a descriptive style. Audience awareness was coded dichotomously for including at least one comment/detail intended for someone unaware of Minecraft. Item recall was coded for 35 items across seven categories for immediate video recall and inclusion in writing sample (Table 1). All categories were also scored dichotomously for whether a child recalled any item within a given category (Table 2).

Results: Groups did not differ on response style (67-85% wrote descriptively) or audience awareness (28-36% addressed an audience; Table 1). Groups differed on item inclusion, with ASD and ADHD performing lowest on total item inclusion (Table 1). Children with ASD or ADHD often performed lowest for recall during video or writing for items remembered per category (Table 1) and for any items were recalled per category (Table 2). ASD showed a moderate relationship between word count and item inclusion (r=.46, p<.0005) but not video recall (r=.23, p=.07). ADHD showed a moderate relationship with word count and both video recall and item inclusion (rs=.60-.61, ps<.001). Both were unrelated for TD, though prior findings suggested this was due to less variability in observed word count. Partial correlations with FIQ demonstrated similar findings across groups.

Conclusions: Groups responded similarly to the prompt, but children with ASD demonstrated specific difficulties with item recall, particularly with children with ASD showing more prominent gaps in recall categories compared to children with ADHD or TD children. Children with ADHD showed a more consistent relationship compared to children with ASD between recall and inclusion of items with word count. These findings offer insights into potential predictors associated with writing difficulties in children with ASD.

152 **238.152** Self-Directed Video Prompting: Promoting Rapidity of Skill Acquisition and Independence across Settings

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Background: Achieving independence across a variety of post-school settings is critical for students with ASD. With post-school outcomes of students with ASD being very low compared to peers without disabilities and challenges students with ASD encounter in daily life, the need to examine strategies that contribute to independence in completing vocational, daily living, and functional tasks is important. One strategy that could be a game-changer and could bridge the skills gap is technology. Video prompting (VP) is one such practice that has been found effective in teaching skills to students with ASD. The presentation describes the results of the study that examined the effects of point-of-view VP with least-

to-most prompting (LMP) system on the rapidity of students' vocational skill acquisition. While many studies examined the use of VP in teaching students with ASD, studies that examined the effects of VP on teaching vocational skills were limited. Further this presentation shares the strategy for decreasing the need for extensive job coaching and shifting adult prompting to self-prompting using technology.
Objectives: The purpose of this study was to examine the effects of point-of-view VP with LMP system on the rapidity of skill acquisition of two students with ASD and two students with ID when working on school-based job tasks with process steps that required students to pay attention to the process of task completion rather than the functional step itself.

Methods: A multiple probe across students design of SCRD (Horner & Baer, 1978) was used to identify the effects of a VP and LMP intervention on students' skill acquisition during a vocational task**.** Four students with ASD and ID participated in the study. Visual analysis and effect size calculations (Tau-U) were used to analyze data, as is recommended for SCRD data, to determine the existence and magnitude of a causal relation between the intervention and outcome (Kratochwill et al., 2013).

Results: Each of the four students showed significant increases in skill acquisition between the baseline and intervention phases (see Table 1 and Figure 1). The weighted average Tau-U resulted in 1.0, demonstrating a strong effect of the intervention between baseline and both the intervention phase and VP-only phase. The Tau-U effect with 90% confidence intervals was between 0.7695 and 1.

Conclusions: The VP and LMP as a combined intervention is effective in improving vocational skills of students with both ASD and ID. Given the versatility of this method, and the ease with which it can be created and personalized, VP and LMP can be used by educators to teach a variety of skills to students with ASD. Upon skill acquisition, students can use VP as a self-prompting support and fade it as necessary for completion of various tasks without relying on adult prompts. This method can also be used throughout one's life in a variety of settings due to the versatility and portability of the strategy.

153 **238.153** Sleep Problems and School Functioning in Adolescents with ASD

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Background:
Sleep problems are common in adolescents with ASD (Cortesi, Giannotti, Ivanenko, & Johnson, 2010), with reported percentages of up to 88% (Hodge, Carollo, Lewin, Hoffman, & Sweeney, 2014). While a growing number of studies show that sleep problems during adolescence have a major impact on school functioning in typically developing adolescents (e.g. Dewald, Meijer, Oort, Kerkhof, & Bögels, 2010; Curcio et al., 2006; Pagel, Forister, & Kwiatkowki, 2007), the relationship between sleep problems and school functioning in adolescent with ASD is not yet clear. The majority of these studies have used subjective measurements of sleep, which are known to have a poor reliability compared with objective sleep measures (like actigraphy). Subjective sleep measurements are important to establish sleep quality, however, objective measurements can't be ignored (Goelema, 2018). Therefore, both objective and subjective sleep measurements are included to investigate the relationship between sleep and school functioning in adolescents with ASD.

Objectives:

The objective of the present study is to identify the most relevant features of objective and subjective sleep variables in relation to school functioning in adolescents with ASD.

Methods:

In a repeated measures design (daily measurements over a period of three weeks) 20 adolescents with ASD and sleep problems were assessed on self-reported measures of sleep and school functioning by means of a webapp. The adolescents completed a sleep diary with questions about sleep onset latency (SOL), number of awakenings, wake time after sleep onset (WASO), total sleep time (TST), sleep quality, napping, last night's activities, electronic media-use and caffeine use. At the end of each day they completed questions about their school functioning (mood, concentration, stress, fatigue, mental effort and physical exercise). Also one of their parents and a teacher completed questions about the adolescents' functioning. Additionally, in ten adolescents, sleep was measured with a sleep tracker (Elan, Philips ©) throughout the study period. The Elan obtains reflective, green-spectrum photoplethysmography (PPG) data from the wrist and acceleration data (ACC) using an internal 3D accelerometer. Variables used from the Elan device are: SOL, (TST), WASO, number of awakenings and sleep efficiency (SE).

Data were analyzed with network analysis level to explore the relationships between aspects of sleep and school functioning. Network analysis is a new and promising analysis to establish a network representing the relations between directly measured variables (nodes), which can be performed on individual and group level (Costantini et al., 2015; Epskamp, Waldorp, Mõttus, & Borsboom, 2018). In total, the network contains 17 nodes: TST, SOL, WASO, number of awakenings (measured with the Elan and self-reported), sleep quality, mood, fatigue, stress, concentration, electronic media-use and caffeine use, physical exercise and mental effort (self-reported). Three separate network analyses with the same 17 nodes (at group and individual level) are performed: 1) aspects of sleep and school functioning measured by adolescents, 2) aspects of sleep and school functioning measured by parents and 3) aspects of sleep and school functioning measured by teachers.

Results: Results will be presented at the conference.

Conclusions: Conclusions will be presented at the conference.

154 **238.154** Steam Education to Empowerment Autistic Children: Exploration of an Project-Based Methodology with Reverse Inclusion

M. Baquerizo*, M. Hurtado and B. Lucero, Turing: science, technology and neurodiversity, Lima, Peru*

Background: Different studies show that individuals with an autism spectrum condition (ASC) tend to gravitate towards the fields of science, technology, engineering, art and mathematics (STEAM). The approach in childhood to these fields, not only can enhance the talent, also facilitate the development of social and communication skills. **Objectives:** We describe the vision of our approach and the exploration of a project-based methodology with reverse inclusion.Methods: This methodology was applied in workshops to groups of children between 8 and 15 years old, especially related to robotics, electronics and programming. Data were obtained from a participant observation and analyzed qualitatively.
Results: It is important that the groups conform according to interests, and the activities around the project are structured to the maximum, the roles must be defined according to the complexity of the activity and the characteristics of each child. It is convenient to include other activities

not structured to facilitate the generalization of social and communication skills. The inclusion of neurotypical children and autistic facilitators is very positive. **Conclusions:** Our project-based methodology with reverse inclusion It seems to be useful for STEAM education in ASC, this type of approach can to bridge the gap in social inclusion of autism community in developing countries.

155 **238.155** The Academic Background of Teachers Working in Specialized Classes with Adolescents Who Have Autism Spectrum Disorder

***M. Bessette**, Psychology, Université du Québec à Montréal, Montreal, QC, Canada*

Background: In Quebec, a majority of students with autism spectrum disorder [ASD] are educated in specialized classes within a mainstream school. Their teachers usually have an academic background in special education, but they are not equally prepared to work with children with ASD. In addition, the teaching profession requires a constant actualization of knowledge and skills and teachers must always adapt to the numerous changes that will occur during their career. However, unfavorable conditions to a thoughtful approach towards their professional development still exist. Moreover, researchers found insufficient data demonstrating empirically the efficiency of professional development on students learning.

Objectives: This study, which is financed by the Social Sciences and Humanities Research Council and is part of a larger research project, aims to compare 1) the initial training and the continuing education and training of teachers working in specialized classes with adolescents who have autism spectrum disorder and 2) their needs for further continuing education and training.

Methods: The participants consisted of fifteen teachers (fourteen women and one man) working in specialized classes with six to ten adolescents with autism spectrum disorder. Each participant took part in a semi-structured interview based on an interview grid and a questionnaire regarding their sociodemographic and occupational characteristics. The teachers' training was subjected to an exploratory and descriptive analysis, with transcripts of the teachers' comments coded in two Excel files.

Results: The teachers' initial training is homogeneous, most of them holding a bachelor's degree in Special education. The teachers' continuing education and training is very heterogeneous in both quantity and quality. Furthermore, many trainings followed by teachers are not research-based. The teachers' needs are also large and varied.

Conclusions: The continuing education and training of teachers working with adolescents who have ASD must be oriented and recognized by a board that would implement obligatory guidelines for professional development. And, to ensure their quality, trainings should only be provided by renowned experts certified by this board. Moreover, according to research, supervision is the best form of training for professional development. Therefore, teachers should have the opportunity to be supervised by qualified professionals.

156 **238.156** The Classroom Environment and Engagement of Australian Students with Autism Spectrum Disorder As Reported By Their Teachers

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Background:

Despite an increase in inclusive education, there is little research investigating teachers' experiences of educating students on the autism spectrum. To date, few studies have described the use of classroom supports for students on the autism spectrum, and studies have yet to compare the instructional material used in the classroom and the engagement of students on the autism spectrum compared to their classmates.

Objectives:

The current study explored the classroom practices of Australian teachers working with students on the autism spectrum. The classroom supports implemented to facilitate learning of students on the autism spectrum were investigated here. Teacher reported engagement in classroom activities and the frequency of instructional material use were compared for students on the autism spectrum and the remainder of the class.

Methods:

Eighty-seven classroom teachers involved in the Longitudinal Study of Australian Children with Autism (LASA) completed a questionnaire pack reporting on student behaviours, and engagement and teaching practices. Teachers selected the accommodations and supports they provided to students in their class on the autism spectrum to indicate those that were most frequently used in support of learning. Frequency of student engagement in classroom activities and the frequency of instructional material use were both coded on a 3-point scale (0- never or rarely, 1-sometimes, 2-often) for students on the autism spectrum specifically and for the remainder of the class.

Results:

Modified or alternate tests, slower paced instructions and allowing more time to complete tasks were the most common modifications made in the classroom to support the learning of students on the autism spectrum. Teacher reported student engagement differed in many ways for students on the spectrum when compared to their classmates. Students on the spectrum required significantly more individual instruction from the classroom teacher ($Z=-2.98$, $p=.003$), or individual instruction from another adult ($Z=-2.83$, $p=.005$). In contrast, the remainder of the class were more likely to listen to whole class instructions ($Z=-2.33$, $p=.020$) and were significantly more likely to engage in classroom discussions by responding to questions ($Z=-3.12$, $p=.002$) than students on the spectrum. According to teachers, students' performance on portfolio tasks and student attitude/behaviour were important when determining the grades of the class as a whole and the performance of students on the spectrum. However, performance relative to a set standard ($Z=-2.82$, $p=.005$), performance relative to the rest of the class ($Z=-2.82$, $p=.005$) and homework ($Z=-3.31$, $p=.001$) were endorsed as significantly more important when determining the grades of the whole class and less important when evaluating the grades of their students on the spectrum specifically. There were no significant differences in the teacher reported use of instructional materials to support the learning of students on the autism spectrum compared to their classmates, with similar instructional materials used class wide.

Conclusions:

The results from this study have important implications for schools and teachers supporting children on the autism spectrum, within the school environment.

157 **238.157** The Effects of Background Noise on Reading in Children with Autism Spectrum Disorder

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Background: Commonplace noises in classrooms may result in unfavorable listening environments that negatively affect student learning, including reading skills (Klatte et al., 2010; Maxwell & Evans, 2000). Little is known about how noisy classroom environments impact students with ASD with regard to academic performance. Previous research indicates that individuals with ASD are more at-risk for difficulties with reading (Brown et al., 2013) and attention problems (Leyfer et al., 2006; Mayes & Calhoun, 2007), which could be further impacted by noisy environments. In a recent pilot study (McClain et al., in review), researchers found that children with ASD evidenced significantly lower reading comprehension skills than TD children. However, with background noise, this difference was nonsignificant. Further research is needed to explore the effects of multiple background noises on reading skills in children with ASD.
Objectives:

The current project has the following objectives:

1. To determine differences in reading fluency performance across various background noises for children with ASD.
2. To determine differences in reading comprehension performance across various background noises in children with ASD.
3. To determine differences between children with ASD and TD children in reading fluency performance across various background noises.
4. To determine differences between children with ASD and TD children in reading comprehension performance across various background noises.

Methods:

Participants

Currently, participants in the present study are children diagnosed with ASD (*n*=3) and typically developing children (*n*=13) between the ages of 6 and 12. Children with ASD are identified by parent report and scores on the Autism Spectrum Rating Scale (Goldstein & Naglieri, 2013). Of note, data collection is ongoing. It is anticipated that a minimum of 20 children with ASD and 40 TD children will be included in the final analyses.

Procedures

Participants attended two clinic visits. At clinic visit one, participants completed the WISC-V, a brief language and hearing screening, and the GORT-5 (Form A) while their caregivers completed a demographic questionnaire and three rating forms (i.e., ASRS, BRIEF-P, and Conners-3P). During clinic visit two, participants were administered four reading fluency and comprehension curriculum-based measurements (CBMs) in four different conditions: (1) Quiet, (2) One-Person Talker, (3) Classroom Noise, and (4) White Noise. Participants completed these conditions in an audiologic sound-treated testing booth to ensure extraneous noises were minimized.

Results: Performance on reading fluency and comprehension CBMs are the dependent variables. Reading fluency is measured by percent words read correct and percent of errors made per minute. Reading comprehension is measured by percent comprehension questions answered correctly. The researchers will use multilevel models to determine differences in reading fluency and comprehension between experimental groups and background noises.

Conclusions: While data collection is ongoing, results from an initial pilot study indicate differences in reading fluency and comprehension performance across groups and sound conditions. No specific predictions are included due to the study's exploratory nature. However, findings may help education professionals and parents provide ideal work environments in the school and home settings for children with ASD.

158 **238.158** The Endrew Decision's Impact on the Education of Students with Autism: Implications for School Practice and Policy

S. Hurwitz*, Special Education, Indiana University, Bloomington, IN*

Background: Learners with autism, like all students with disabilities, are entitled to receive a free appropriate public education (FAPE), a component of the Individuals with Disabilities Education Act (IDEA). Historically, the *free* and *public* components have been fairly straightforward; however, the *appropriate* aspect has been at the center of contentious lawsuits. In 2017, the U.S. Supreme Court provided guidance regarding what constitutes an appropriate education for students with disabilities in *Endrew v. Douglas County*. The *Endrew* case centered around a student with autism, and we use it to discuss how the ruling will impact the education of students with autism and to offer recommendations for practice and policy.
Objectives: This study helps education researchers, school leaders, teachers, and families to understand the legal background of special education law and how *Endrew* may alter it going forward.

Methods: We analyze the legal history of the educational benefit standard prior to *Endrew,* and discuss the split in the lower courts that led to the Supreme Court hearing this case. Examining both sides, we debate whether *Endrew* is the educational "game changer" that disability advocates hope it will be.

Results: We make recommendations for schools and education policy in light of the fact that Endrew's family received tuition reimbursement for the specialized (ABA-based) private school that they enrolled him in after he failed to make progress at his local public school. After the ruling, more families may request placement in similar private or charter schools. We find that the decision may not alter the educational approach for students with autism who are progressing alongside their peers. On the other hand, it elevates academic and functional expectations for students who, like Endrew, are placed in self-contained classrooms or are not making grade-level progress.

Conclusions: We provide a list of suggestions for schools: Schools should prioritize behavior management in order to facilitate academic and functional progress at school; IEP goals should be ambitious and measurable to ensure that students are making annual progress; teachers should be trained in evidence-based practices that work for students with autism. There may be an increase in the number of families requesting evidence-based practices, like ABA, from the public school system, and/or placement in alternative settings like specialized charter and private schools.

159 **238.159** The Friendship LAB Social Skills Program for Students with ASD in a Community Setting: A PILOT Study

C. A. Waugh*, Applied Psychology and Human Development, Ontario Institute for Studies in Education, University of Toronto, Toronto, ON, Canada*

Background: The ability to effortlessly and instantaneously modulate to another's perspective, which emerges early in typical development, is a hallmark deficit in Autism Spectrum Disorders (ASD). Among the consequences of this deficit is the reported disparity of friendship among individuals with ASD. Given the contribution of friendship to social and academic outcomes fostering healthy peer relationships is of great importance. Although the need to prioritize social skills development in ASD treatments is not a new notion (Klin & Volkmar, 2000), the urgency of this need has not translated into readily available educational programs to be used in community settings. Previous research suggests that The Friendship Lab is effective in improving social skills and increasing social engagement among children with ASD and may be implemented in the community (Waugh & Peskin, 2015).

Objectives: The present study examines the extent to which social responsiveness and peer relationships improve following the completion of The Friendship Lab program offered in a community setting.

Methods: Thirteen children (10 males and 3 females) with high-functioning ASD, 11-12 years of age (*M* = 11.6, SD = 0.26), participated in this study. Nine weeks of concurrent classes were held for children and their caregivers. The children received instruction via PowerPoint lessons using comic strips to depict social scenarios. Lessons were followed by game play and weekly homework assignments, including hosting playdates, were given. The Social Responsiveness Scale (SRS; Constantino, 2002) was used as an outcome measure immediately at the conclusion of the intervention. Each child and caregiver were also interviewed prior to intervention and then again at a six-month post intervention.

Results: Two-tailed pairwise *t*-tests (pre- and post-intervention) revealed that following participation, children improved significantly on total SRS scores, *p* =.01. They also showed significant improvement on the SRS Social Communication Interaction Index of the SRS, *p* =.02. Although not specifically targeted, improvements were also found on the SRS subtest of Restricted Interests and Stereotypical Behaviours, p =.16. Anecdotally, children appeared to enjoy participation and group leaders reported ease in delivering the manualized curriculum. Parents reported that their children appeared more confident and willing to take initiative in social interactions following participation. At 6 months post-intervention, all families reported having hosted at least one playdate during the previous two months (*M* =6.6, SD=11.76). Children also reported significant increases in their number of friends *p*=.02.

Conclusions: Results indicate that children participating in the Friendship Lab improved in their social responsiveness and peer relationships after having participated in the program. The findings of this pilot study suggest that this social skills intervention can be effectively delivered in a community setting.

160 **238.160** The Impact of Attention on Reading in Adolescents with Autism Spectrum Disorder

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Background: Research suggests that attention plays an important role in the development of reading skills even after controlling for other known predictors of reading such as general cognitive functioning (IQ; e.g., Rabiner & Coie, 2000) and receptive language skills (e.g., Cain & Bignell, 2013). Most research examining the relationship between attention and reading has been conducted with either typically developing (TD) children (e.g., Dally, 2006; Rabiner & Coie, 2000), or with individuals with Attention-Deficit Hyperactivity Disorder (ADHD) and/or reading disorders (e.g., Kibby et al., 2014; Stern & Shalev, 2013). Less research has been conducted with students with Autism Spectrum Disorder (ASD). The few studies that have examined the relationship between attention and reading in ASD samples suggest that word reading skills are associated with sustained attention (May et. al, 2013; Mayes and Calhoun, 2007). For TD populations, sustained attention has been more strongly associated with reading comprehension skills (e.g., Arrington et al., 2014).

Objectives: The aim of the present study was to examine the relationship between sustained attention and two specific reading abilities; word reading skills and reading comprehension. In addition, we examined if sustained attention adds to the prediction of word reading and reading comprehension above and beyond two other known predictors of reading; IQ and receptive language skills.

Methods: The study included 22 adolescents (M_{age} = 14.3 years old) recruited from a school providing services to students with special education needs presenting with a primary diagnosis of ASD. Most participants had below average general cognitive functioning (M_{FSIQ}= 62.3, *SD*= 22), as defined by the full-scale IQ of the WASI-II (Wechsler, 2011). Attention was measured using the d' score of the Conners' Continuous Performance Test 3rd Edition (CPT 3; Conners, 2014), a computerized attention task. Reading performance was assessed on the Word Reading and Reading Comprehension subtests of the Wechsler Individual Achievement Test-Third Edition (WIAT-III; Wechsler, 2009). Receptive language skills were assessed on the Listening Comprehension subtest of the WIAT-III.

Results: Word Reading scores were not significantly correlated with any predictors (FSIQ, listening comprehension performance, attention). Reading Comprehension scores were correlated with FSIQ (*r*= .43, *p*<.05), attention (*r*=-.76[1], *p*<.01), and listening comprehension (*r*=.70, *p*<.01). A multiple regression analysis was conducted with Reading Comprehension as the outcome measure and the three predictors as the independent variables. The predictors explained 72.8% of the variance in reading comprehension (R^2 =.73, F(3,16)=14.28, *p*<.01). Listening comprehension (β = .44, *p*<.05) and attention (β = .44, *p*<.05) were significant predictors of reading comprehension in the regression but FSIQ was not.

[1] On the CPT-3, a greater score indicates a poorer performance.

Conclusions: Our results suggest that for adolescents with ASD and lower than average cognitive functioning, sustained attention and receptive language skills both play a significant role in reading comprehension. A better understanding of the cognitive factors influencing reading achievement could have a number of implications regarding how reading difficulties in students with ASD can be remediated, such as targeting attention to remediate reading difficulties in students who do not respond to traditional reading interventions.

161 **238.161** The Impact of an Inclusive Pre-College Program on Preparation for Higher Education for Students with ASD

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Background: Challenges for students with autism in college include difficulty with social communication and adjustment to changing support structures, as well as challenges with day-to-day problem-solving (Dentes & Koles, 2012). The difficulties in transitioning from high school to college contribute to these problems, since students are often not provided with explicit instruction on the systems changes and new skills required to be successful in a higher education setting (Cai & Richdale, 2016). Despite the challenges that persist for college students with ASD, specific supports designed for students with ASD are uncommon and unproven (Gelbar, 2016). Since 2015, the University of Delaware has offered

high school students with disabilities a higher education preparation experience through an inclusive pre-college program. This presentation examines a subset of students diagnosed with Autism Spectrum Disorder and the effects of program participation on readiness for post-secondary education.
Objectives: Explore the impact of a pre-college program for high school students with autism:

- Identify trends in changes to an assessment of learning strategies
- Share student reflections on growth from the program
- Describe post-program changes for the student

Methods: Students received instruction in self-advocacy, social-communication and study skills through two primary interventions: 1) a three-credit, lecture-based course called Metacognitive Strategies, which emphasizes requisite academic and independent skills for college; and 2) academic coaching, an interpersonal process which has been found to be effective in enhancing student success (Mitchell & Topf, 2016). Following completion of the five-week program, students receive follow-up support through individualized and group meetings. A case study approach will be used to describe four previous students with ASD who participated in the pre-college program. Demographic characteristics, including academic profile and high school-based supports pre- and post-program will be shared. Changes in individual standard scores and percentiles on the Learning & Study Strategies Inventory (LASSI; Weinstein, Palmer, & Acee, 2016) will be presented. Educational achievement (e.g., grades in college-level courses) will be described, as well as changes to supports post-program.

Results: Each of the four students exhibited an increase on the study skills assessment and described greater confidence in college. Common themes among students included similarities in gains on LASSI (e.g., subscales in Attitude, Concentration, Time Management), and student reflections on changes from the program (e.g., greater confidence in pursuing college; increased ability to self-advocate). All four students successfully passed both college-level courses in the program. Students advocated for changes to their IEP/504 post-program in order to mirror accommodations more similar to college. This included one student advocating for a reduction in support from paraprofessional services.

Conclusions: Authentic higher education experiences in preparation for college entry shows significant promise for students with ASD. Students participating in a pre-college program showed an increase in study skills, expressed greater confidence in their ability to succeed and knowledge of how to be successful in higher education. The implementation of college-based accommodations and practice navigating higher education systems serves as an opportunity for the student to explore best-fit accommodations and authentically utilize them before enrolling in undergraduate courses as a college freshman.

162 **238.162** The Quality of IEP Goals for Students with ASD in 60 High Schools

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Background:
Individual Education Plans are the foundation upon which the educational experience of students with disabilities is built, with annual goals at the heart of the document. In order to measure student progress, it is imperative that these goals and objectives are measurable and linked to assessments. This presentation summarizes an analysis of the quality of IEP goals written for students with ASD from 60 high schools prior to intervention in each of the four domains focused on in a RCT study entitled, the Center on Secondary Education for Students with Autism (CSESA).
Objectives:

- Describe the quality of IEP goals for students with ASD in total and for each of the 4 CSESA domains including: a) if they were written for one target b) if antecedent conditions are clear, c) if they are observable and measurable and d) if mastery criteria are included.
- Determine if there is a significant difference in the quality of goals written for students in a diploma seeking compared with an alternative program.
- Describe the percentage of goals with accompanying data and the amount of time spent coaching educators to write high quality goals.

Methods:
Prior to any intervention, the CSESA research team collected information on the existence and quality of goals written in each of four areas (academic, social, transition, & independence and behavior) for high school students from 60 high schools in three states totaling 1442 goals. Information about the use of data for monitoring progress was obtained.
The goals written for students in the diploma seeking programs (57% of the total) and those in a modified program (43% of the total) were compared across quality features using a chi-square analysis.
Results:

- Only 61% of the goals were taken from the student's IEP written from those already written to address one of the four content areas targeted. The domain with the highest number of goals was academics and the lowest number was transition. Only 25% of the total goals met the criteria for high quality in all areas. The most goals meeting the full quality criteria were Academic (30%), and the least high quality goals addressed Social (18%) competence (see Table 1).
- The chi-square tests revealed that there was a significant difference between programs, with students in the modified program having a higher number of goals that had a single target selected, χ^2 (1, N = 385) = 5.63 p = .020, antecedent conditions clear, χ^2 (1, N = 384) = 9.31, p = .002, the target skill/behavior observable and measureable, χ^2 (1, N = 384) = 6.61, p = .010, and having met mastery criterion, χ^2 (1, N = 385) = 9.04, p = .003.
- Only 13% of all IEP goals written had accompanying data to support baseline performance.

Conclusions:
Professional development is needed to improve the quality of the IEP goals written for high school students with ASD, especially in the social

domain, and for students who are diploma bound and completing their education in general education settings.

163 **238.163** The Relationship between Turn Taking and Joint Attention in Interactions between Caregivers and Young Children with Autism

***K. Lee**, S. Safran and H. Schertz, Indiana University, Bloomington, IN*

Background:
It has been theorized that turn taking, defined as simple back-and-forth exchanges, is foundational to joint attention (Schertz, Odom, Baggett, & Sideris, 2018; Mundy, 2016). Turn-taking sequences may be used to convey instrumental or social intent. While turn taking may be foundational to joint attention, studies that distinguish social and instrumental turn-taking functions and their relationship to joint attention are limited.

Objectives:

The study sought to analyze the strength and direction of the relationship between turn taking (i.e. social and instrumental) and joint attention. We hypothesized that social turn taking would be positively correlated to responding to and initiating joint attention, and that instrumental turn taking would not.

Methods:

This research utilized pre-existing video data of 20 toddlers with autism from the Joint Attention Mediated Learning (JAML) intervention study (Schertz et al., 2018), which was designed to help toddlers with autism learn social preverbal communication (i.e. joint attention) through caregiver-child interaction. Spearman's (1904) Rank-Order Correlation Coefficient was employed to determine the strength and direction of the relationship between social turn taking and instrumental turn taking with joint attention. Instrumental Turn Taking (ITT), Social Turn Taking (STT), Responding to Joint Attention (RJA), and Initiating Joint Attention (IJA) were measured using a video observational coding system. The STT, RJA, and IJA measures from the Precursors of Joint Attention Measure coding manual (Schertz, Horn, Lee, & Mitchell, 2018b) were used. An ITT measure was added to the coding criteria for the present study. A primary observer coded a total of 120, 10-minute videos (six per participant) for observances of variables, and a secondary observer coded 25% of the videos. The mean percent agreement (and ranges) of interobserver agreement for ITT were 93.47% (76-100%), 95.22% (71-100%) for STT, 98.31% (88-100%) for RJA, and 99.15% (95-100%) for IJA.

Results:

Correlational analysis revealed a significant positive relationship between instances of STT and RJA, (18) = .481, $p < .05$, one-tailed. In addition, there was a significant positive relationship between instances of STT and IJA, (18) = .622, $p < .00$, one-tailed. In other words, there were tendencies for participants who showed more STT to also show more RJA and IJA. The coefficient of determination (was calculated and indicated that 23.13% of the variance in STT is shared with RJA and 38.68% of the variance in STT is shared with IJA. Correlational analysis revealed no significant relationship between ITT and RJA, (18) = .337, $p = .07$, one-tailed, and between ITT and IJA, (18) = .161, $p = .24$, one-tailed.

Conclusions:

The current study identified a positive relationship between social turn taking and both joint attention variables and no relationship between instrumental turn taking and either joint attention variable. While not causal, these findings may support the theory that social turn taking, a simple form of dyadic engagement, is foundational to triadic joint attention, a more complex form of engagement. A larger sample size is needed for future investigation for a more rigorous examination to validate the hypothesis.

164 **238.164** There's No "One-Size-Fits-All" Approach: How Future Faculty Plan to Teach Autistic College Students

***B. R. Nachman**, University of Wisconsin-Madison, Madison, WI*

Background: Higher education institutions are experiencing increased enrollments of autistic college students, as White, Ollendick, and Bray (2011) estimate that up to approximately two percent of college students may meet the criteria for autism. Faculty who are ill prepared to effectively teach autistic college students may undermine students' academic success, as opposed to capitalize on their interests and strengths (Austin & Peña, 2017). We must shift our attention toward supporting future faculty (e.g., faculty-aspiring graduate students and postdocs), though there is an absence of literature on educating them about autistic college students. Consequently, this study illuminates the possibilities of reaching future faculty who prioritize designing inclusive classroom experiences.
Objectives: The purpose of this mixed methods evaluation study is to examine both the efficacy of an online autism-centered unit of an "Inclusive Teaching" course – focused on inclusivity, equity, and cultural diversity issues – as well as future faculty readiness to teach autistic college students. In particular, the research questions were threefold: 1) How do course unit activities promote future faculty understandings of autistic college students and Universal Design principles?"; 2) How do future faculty describe characteristics of autistic college students?; 3) How do future faculty self-report their comfort, knowledge, and preparation to teach autistic college students?

Methods: This study, following a mixed methods evaluation design, gathered data from participants via three sources: surveys with Likert-scale and open-ended questions (distributed before, immediately after, and six months following the autism unit); written responses to vignettes (prompting participants to note how classroom context influences teaching techniques); and interviews (conducted one month and seven months after the course concluded). I utilized Dedoose to conduct open coding and structural coding for each of the interviews, vignettes, and open-ended survey questions, clustering similar themes into categories. I also conducted descriptive statistics of the quantitative data, marking participants' changes in comfort, knowledge, and preparation. I mixed findings across the qualitative and quantitative strands through comparing participants' descriptions of their autism comfort, knowledge, and preparation with how they answered Likert-scale questions on similar topics.

Results: Three themes surfaced, each related to the individual research questions. First, participants found vignettes as helpful in recognizing and addressing various manifestations of autism in college students, drawing on anecdotes in guiding their planned teaching techniques, such as developing inclusive group work assignments. Second, participants described autism as impacting individuals across the lifespan, compared to their previous understandings of this as a "childhood disorder." Thus, future faculty shared examples of how they can support autistic students' individualized needs in navigating college. Third, based on survey data, participants exhibited growth in their level of comfort, knowledge, and preparation to teach autistic college students, noting how engagement in the course unit elevated their confidence in meeting students' capabilities for academic success.

Conclusions: Training future faculty about autistic college students appears effective in boosting future faculty preparation, comfort, and knowledge of this student population. Additionally, this course unit provided them with an outlet to learn about, experiment with, and reflect on their inclusive teaching techniques.

165 **238.165** Training Academy: Supporting Educational Personnel to Train Their Staff in ASD

ABSTRACT WITHDRAWN

Background:
Education professionals rarely receive specialized training in autism. This study further evaluated a new Training Academy to support existing school personnel to train their own staff. Following a successful pilot study (IMFAR, 2017), this abstract now reports the full results of our developed training model. Participants attended the Training Academy as a collaborative cohort. The cohort received training materials and in-vivo practice sessions, prior to delivery of each training. Participants were required to provide their own school staff with 3 trainings: ASD for a general audience; ASD specific to paraprofessionals; ASD specific to speech, social work and O.T.

Objectives:

This study investigated the effectiveness of the Academy model to increase education professionals competence in delivering training to their staff. Two consecutive cohorts were utilized. The study addressed:

- educator change in competence of training skills gained across the training period
- the relationship of educators self-efficacy to outcome
- the relationship of educator self-efficacy to professional experience prior to training

Methods:

Participating educators (n= 29) who attended the Academy completed a structured questionnaire pre and post training.

The questionnaire emphasized key aspects of training competencies. Three sections described a training scenario related to (i) general ASD knowledge, (ii) paraprofessional competencies (iii) related services competencies. The final questionnaire had 12 questions; maximum score, 72.

In addition, the participants completed the ASSET, a self-report measure to assess self efficacy in ASD specific skills (Ruble et al.,2013).

Results:

1. i) T-test revealed that there was a significant ($p<.01$) increase in competence scores pre and post training academy for each type of training provided (general ASD, paraprofessional, related services).
2. ii) ASSET scores were divided by the mean to create high and low self efficacy groups. To compare group performance pre and post training, scores were entered into a repeated measures multivariate analysis of variance, with time (pre, post) as the within subjects repeated measure and group (high, low SE) as the between factor.

There was no significant group by time interaction effects.

iii) To determine the effect of prior experience on educator self-efficacy, data was entered in a logistic regression model with group membership (high and low self-efficacy) as the dependent variable, and lifetime number of ASD students, educational level, and years teaching as covariates. There were no significant effects of professional experience predicting self-efficacy group membership.

Conclusions:

These results indicate the effectiveness of our training program. By attending the training, educators increased their confidence in their ability to train the autism curriculum to their staff. Educators in both the low and high self-efficacy groups increased their training competence scores over the training period. Furthermore, educators' self-efficacy for training competencies appeared to have little relationship to their prior professional experience, experience with autism or their educational level. This has important implications for training educational professionals. Even professionals who have many years experience, or who have taught many students with ASD, can increase their own training competence by attending an intensive training. The Training Academy is now being provided to professionals in subsequent cohorts.

166 **238.166** Utah Neurodiversity Workforce Program (UNWP): A Higher Education Consortium to Deliver an Education-to-Employment System

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Background: UNWP is a state-wide participant-oriented research (POR) program with active involvement by autists to create a comprehensive (unwp.utah.edu) education-to-employment pathway for neurodiverse individuals across Utah. The research is based on interviews with students with autism, parents, staff and faculty (N=62) in higher education indicating the need for specialized services for neurodiverse students. UNWP collaborates with high schools, community and industry partners and is funded by the Governor's Office of Economic Development to improve post secondary entry/completion and employment rates for individuals with ASD.
Objectives: To implement and evaluate the educational pathway including: 1) Increase in higher education success for neurodiverse students; 2) Inter-institutional collaboration of resources from post-secondary sites; and 3) improvement of employment outcomes between the employment needs of Utah's growth industries and the untapped pool of skilled neurodiverse individuals.

Methods: Participant-oriented research involving autists in all areas of program development, implementation, and evaluation of the pathway model.

Results: Year 1 included awareness training to 200 higher education faculty/staff. The program received strong evaluations indicating importance of increasing awareness of neurodiversity. Embedding this model into existing student support services infrastructure of institutions of higher education and vocational-tech schools both ensures its success and enhances existing multi-collaborative relationships. For example, partnering

with Student Career Services, we tapped into their industry partners to provide work-based learning opportunities based on individual student interests and talents. UNWP also increased their staff awareness of the strengths and challenges of this student population and how to best support them in achieving meaningful employment. Awareness trainings to 100 managers and employees in the tech industry and WBL experiences with students with ASD have initiated discussions with HR on how current hiring procedures are creating barriers for this population. Another benefit is that managers began to think more deeply about leveraging the talents of all employees through greater sensitivity to diversity based on evaluations. Seventeen students participated in technology industry work-based learning with 2 students successfully placed in competitive full-time positions. Year 2 is a replication of the model to 3 statewide higher education institutions and is currently underway. This presentation will be a discuss of lessons learned in this participant-oriented research model.

Conclusions: The strength in the development of the UNWP pathway model has been the inclusion of autists in all aspects of development and implementation. Autists are active participants in the development of all educational materials and trainings. This POR research and program development details the scope of the issue, highlighting the challenges and barriers for these students, the benefits that they could contribute to unfilled jobs in the tech industry, and demonstrates how this pathway can be scaled to address this problem state-wide. From this participant-oriented research we have created a state-wide, collaborative, inter-institutional network to meet industry needs. Based on the program development and successful academic, community and industry partnerships, UNWP offers a high rate of return-on-investment. Our pathway model has promising potential for replication across the states and in other international communities.

167 **238.167** Developing a Participatory Autism Training through Collaboration with Autistic College Students and Non-Autistic High School Students

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Background: Autistic people are negatively impacted by misconceptions about and stigma towards autism (Botha et al., 2018). Participation in a brief online autism training was associated with reduced stigma towards and increased knowledge about autism among college students internationally (Gillespie-Lynch et al., 2015; Obeid et al., 2015; Someki et al., 2018). Past research suggests that modifying autism stigma among adolescent boys is challenging (Staniland & Bryne, 2013); an intensive autism training was associated with improved behavioral intentions among adolescent girls (Ranson & Bryne, 2014). Autistic people may be able to use their autism expertise to improve autism trainings (Gillespie-Lynch et al., 2017).

Objectives: A participatory team composed primarily of autistic college students and non-autistic high school students developed, evaluated and iteratively revised an autism training to increase its potential to ameliorate stigma towards and misconceptions about autism.

Methods: Three autistic (and one non-autistic) college students and seven non-autistic high school students helped adapt an autism training by making concepts/assessments more accessible and adding videos wherein autistic college students shared their insights. High school students in the Bronx (18 female, 35 male) completed a pre-test (assessing demographics, stigma (social distance scale; Bogardus, 1933), and autism knowledge (adapted from prior knowledge measures; Stone, 1987, Harrison, 2017), an in-person autism training delivered by high school students, and a post-test (identical to the pre-test with space for open-ended feedback). While 43.4% of the high school students completed the post-test immediately after the training, 56.6% did the post-test a week later due to limited class time. After evaluating data from the high school students, we revised the training/assessments and administered them online to NYC college students (289 female, 142 male) who completed pre-tests (α social distance= .91; α = autism knowledge = .79) and post-tests immediately before and after the training.

Results: Among high school students participating in an early adaptation of the training, repeated measures ANOVAs with gender and time of post-testing as between subjects variables revealed no changes in stigma associated with training (p =.89) but improvements in knowledge, F (1,48) =4.58, p=.04. Among college students participating in the revised training, improvements in both stigma, F(1, 429) = 61.42, and knowledge were observed, F(1, 429) = 139.48, ps< .001. Females reported lower stigma and higher knowledge (ps < .001) and enhanced improvement in knowledge relative to males (p = .02). Open-ended feedback was overwhelmingly positive, e.g., "I honestly enjoyed this very much, the videos were excellent. I wanted to add that this really opened my eyes to what I would actually like to do with my life:)"

Conclusions: Participation in an initial participatory training adaptation was associated with improved knowledge but *not* improved stigma among primarily male high school students. Participation in a longer revised training (with more videos and opportunities for interactive engagement) led to improved knowledge *and* stigma among primarily female college students. In future research, we will use an identical participatory training with high school and college students to evaluate associations between developmental stage, gender and responsiveness to anti-stigma training.

Poster Session
239 - Emotion
11:30 AM - 1:30 PM - Room: 710

168 **239.168** Topography and Correlates of Emotional Response in Psychiatrically Hospitalized Children and Adolescents with ASD

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Background: Poor emotion regulation (ER) in individuals with ASD contributes to the high rates of co-morbid psychiatric and behavioral problems, psychotropic medication prescription, and psychiatric hospitalizations. While research on ER in ASD has increased recently, it has mostly relied on questionnaire data from higher functioning individuals or structured tasks in very young children. We lack understanding of the topography and

correlates of poor ER in more severely affected older children and adolescents who require intensive treatment for serious emotional and behavioral disturbance.

Objectives: The present study assessed emotional response to distressing tasks in youth with ASD during psychiatric hospitalizations. We: 1) Describe behavioral and affective responses to tasks, and 2) Analyze relations between individual differences in functioning and autism severity and response to tasks.

Methods: Participants include 112 children and adolescents from the Autism Inpatient Collection (AIC) who were administered a subset of modified paradigms from the Laboratory Temperament Assessment Battery (Lab-TAB) designed to elicit negative affect. Participants represented the full spectrum of intellectual and functional abilities (see Table 1 for participant characteristics).

Affect (valence and intensity) and behavioral response (BR; e.g. inappropriate behavior, aggression) were coded in 10 second intervals from videotapes of assessments. The following variables were calculated from coded data: proportion of intervals with negative response (negative affect or BR), mean intensity of negative response [from 1 (mild) to 5 (highly negative)], average length (i.e. number of intervals) of negative response, range of affect [from -3 (highly negative) to +3 (highly positive)], and negative lability (i.e. proportion of intervals with large negative changes in affect [≥ 3 unit changes] from previous interval).

Results: Table 2 displays descriptive statistics for the six variables describing affect and BR in the initial baseline period (prior to distressing tasks) and during the task portions of the Lab-TAB assessment. As can be seen in the table, mean intensity of negative response, length of response, and range of affect were significantly higher during tasks than baseline.

Furthermore, children with lower adaptive functioning displayed more intense and longer negative responses and more negative lability. Individuals administered ADOS Module 1 (non-verbal/single words) showed more frequent, more intense, longer, and more labile negative responses than individuals administered Module 2 (phrase speech), 3 (fluent speech, child), or 4 (fluent speech, adolescent/adult). Interestingly, despite this relation to verbal ability, negative response variables were largely unrelated to non-verbal IQ and ADOS severity score, with the exception that lower IQ participants displayed higher negative lability.

Conclusions: This is the first study to empirically examine emotional response in children and adolescents with ASD and severe emotional and behavioral problems across the full spectrum of functioning. Results indicate huge variability in response to frustrating tasks that appears to be related, in part, to adaptive functioning and communication abilities. Results highlight the importance of examining ER in non-verbal and severely affected individuals.

169 **239.169** Alexithymia Is Associated with Impaired Interoceptive Accuracy but Not Interoceptive Signal Perception in ASD and Other Populations

D. A. Trevisan*, M. R. Altschuler, A. Bagdasarov, C. Carlos, S. Duan, E. Hamo, S. Kala, M. L. McNair, T. C. Parker, D. Stahl, T. Winkelman, M. Zhou and J. McPartland, Child Study Center, Yale University School of Medicine, New Haven, CT*

Background:

Alexithymia, a condition characterized by difficulties identifying and describing one's own emotions, has high co-occurrence with ASD and other disorders (Bird & Cook, 2013). Prior research is mixed, with studies demonstrating that alexithymia is associated with both heightened (Scarpazza et al., 2015) and reduced (Herbert et al., 2011) perception of interoceptive signals (i.e., internal bodily cues and sensations). Both heightened and reduced signal perception can be maladaptive; the former leading to poor modulation of interoceptive signals, and the latter leading to inadequate detection of interoceptive signals. Maintaining healthy bodily and emotional functioning requires "accuracy" in discriminating interoceptive signals and associating those signals with specific feelings or physiological states (e.g., hungry, nauseous, or angry). Delineating the mechanisms that underlie alexithymia is critical for understanding shared psychophysiological risk factors for various disorders and for considering treatments for alexithymia.

Objectives:

To conduct a meta-analysis to determine the extent to which various facets of interoceptive ability and alexithymia are related, and to determine the methodological factors and sample characteristics that account for heterogeneity among studies.

Methods:

Meta-analysis aggregated effects from all empirical studies reporting a statistical association between interoceptive ability and alexithymia across typically developing and disordered populations. Interoceptive ability was conceptualized into subjective and objective dimensions aligning with orientation to and ability to discriminate/specify bodily cues: 1) Objective Signal Perception—the ability to perceive and track bodily processes, such as one's own heartbeat, 2) Subjective Signal Perception—self-reported awareness of bodily cues, and 3) Interoceptive Accuracy —self-reported ability to discriminate bodily cues or associate them with feelings or physiological states. Moderating effects of Diagnosis —typically developing, ASD, and eating disordered–were also examined.

Results:

A random effects model revealed a summary effect size across all 55 independent samples (total N = 6246) of r=-.161, p=.004, indicating that interoceptive ability is associated with lower alexithymia across studies. Analyzing facets of interoceptive ability separately, neither Objective Signal Perception nor Subjective Signal Perception (r=.033, df=28, p=.514), was significantly related to alexithymia (r=.080, df=13, p=.352). However, Interoceptive Accuracy was related to lower alexithymia (r=-.452, df=18, p<.001). Combining all subgroups, Diagnosis significantly moderated effect size strength $Q_B(2)$=18.61,p<.001. While interoceptive ability was not significantly related to alexithymia in typically developing samples (r=-.024, df=37, p=.616), it was related to lower alexithymia in ASD (r=-.501, df=5 p=.006) and eating disordered samples (r=-.493, df=6, p<.001).

Conclusions:

Reduced interoceptive ability is associated with alexithymia across studies, and this effect is driven by reduced Interoceptive Accuracy but not Objective or Subjective Interoceptive Signal Perception. This finding clarifies confusion in the literature and improves conceptual understanding of the alexithymia construct. We propose that ASD may be associated with both hypo and hyper-perception of interoceptive cues (negating statistically significant associations between Signal Perception and alexithymia), but that impaired Interoceptive Accuracy accounts for higher alexithymia in ASD and other disorders. The moderator analysis suggests that the mechanisms contributing to alexithymia may differ according to diagnosis, such that interoceptive deficits underlie alexithymia in ASD and eating disorders but not in the general population.

170 **239.170** Basic and Self-Conscious Emotional Experiences Recounted By Children with and without Autism Spectrum Disorder

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Background:

The ability to reflect on one's emotional experiences is central to effective social and interpersonal life. Studies have shown that children with Autism Spectrum Disorder (ASD) struggle with recounting more complex emotions, but not basic emotions (Losh & Capps, 2006). This is important because complex emotions, especially self-conscious emotions (e.g., guilt, pride), facilitate social relationships and societal norms.

Objectives:

Using a detailed linguistic coding scheme, the purpose of this study was to evaluate children's personal recounting of specific basic and self-conscious emotional experiences in contrast to studies that have examined general categories of emotions. Relations between ASD symptomatology, Theory of Mind (ToM) abilities, receptive vocabulary, and recounting of emotions were also assessed.

Methods:

Twenty-three children with ASD and 38 neurotypical (NT) children participated, and were tested following IRB approval and appropriate consent procedures. See Table 1 for participant characteristics (e.g., SRS-2, CARS-2, FSIQ, ToM, etc). Children were asked to recount two experiences of each basic (i.e., happy, fear, sad), and self-conscious emotion (i.e., pride, embarrassment, guilt). Responses were audio-recorded, and then transcribed and coded by two raters. Each response was coded for appropriateness of the content (0-3), length in number of clauses, and number of prompts needed to elicit a response.

Results:

Children with ASD provided less appropriate content in recounting experiences of pride, embarrassment, and guilt than NT children. However, no significant differences were found between children with and without ASD when recounting experiences of basic emotions. In terms of number of clauses, children with ASD produced briefer descriptions of emotional experiences pertaining to embarrassment and guilt than NT children. Across both types of emotions, children with ASD needed more prompts in order to elicit examples of the emotions than NT children. However, this was qualified by the fact that for some emotions (i.e., guilt), children with ASD were more likely to simply not give a response, and therefore we did not continue with prompting. In children with ASD, social functioning (SRS-2) predicted the number of prompts needed to elicit sad, embarrassing, and guilty recounts, as well as the number of clauses in their recount of embarrassing experiences. ToM predicted the appropriateness of the content for sad and pride recounts, and the number of clauses for sad experiences but only for children with ASD. For NT children, vocabulary ability predicted appropriateness of the content for fear and pride recounts.

Conclusions:

Our findings show that children with ASD were on par with their NT peers in recounting experiences of basic emotions. However, for self-conscious emotions, children with ASD showed less appropriate content and, in some cases, briefer responses. Children with ASD also needed more prompting in eliciting emotional experiences than NT children. There was some evidence that social functioning and ToM were predictive of the performance of children with ASD, whereas only vocabulary predicted performance for NT children and only for a subset of emotions. Many emotion training programs focus exclusively on basic emotions. Our results suggest that it may be more beneficial if programs focus on self-conscious emotions.

171 **239.171** Cognitive Emotion Regulation in Autism

A. N. Ruigrok[1], *S. Griffiths*[1], *R. Holt*[1], *G. Renouf*[1], *M. C. Lai*[2] *and S. Baron-Cohen*[3], *(1)University of Cambridge, Cambridge, United Kingdom, (2)The Hospital for Sick Children, Toronto, ON, Canada, (3)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: Autism is a heterogeneous neurodevelopmental condition. Co-occurring mental health conditions such as depression are more prevalent amongst autistic individuals. These conditions show sex/gender differences in prevalence in the neurotypical (NT) population, with more women being diagnosed with depression. Having heightened autistic traits, but not an autism diagnosis, has also been related to a higher rate of depression, and cognitive emotion regulation (CER) strategies have been shown to influence depressive symptomatology. Bruggink and colleagues (2016, Research in Autism Spectrum Disorders) found that autistic individuals used more "Other Blame" and less "Positive Reappraisal" CER techniques than NT individuals, as measured by the CER Questionnaire (CERQ). However, differences in sex/gender or influence of autistic traits were not measured.

Objectives: To test for group and sex/gender differences in CER strategies between autistic and NT adults. We hypothesise that (1) the autism group and the high autistic trait group use more negative coping strategies and less positive CER strategies than the low autistic trait NT group and (2) any sex/gender differences would be attenuated in the autism group.

Methods: Participants were recruited through the Cambridge Autism Research Database (CARD) and included 854 individuals who completed the CERQ, Autism Spectrum Quotient (AQ) and the Patient Health Questionnaire (PHQ-9), a depression symptom questionnaire. Participants were divided into three groups based on diagnosis and AQ score (high > 26): 172 autistic males, 51 high-AQ NT males; 60 low-AQ NT males; 212 autistic females; 120 high-AQ NT females; and 239 low-AQ NT females. NT participants included did not suspect an autism diagnosis. All participants were matched on gender assigned at birth and gender currently identified.

Results: Two MANCOVAs were run to test for overall difference in adaptive or maladaptive strategy use. Alpha level was set at .025 to correct for multiple comparisons. Factorial ANCOVAs were done to examine group and sex/gender differences in strategy use (False Discovery Rate corrected within adaptive or maladaptive strategies). Bonferroni corrected pairwise-t-tests were used to test for group differences within single strategies. No group-by-sex/gender interactions were found in use of CER strategies. Across group, sex differences were found on "Other-Blame", with men tending to use this strategy more often than women. Group differences were found on 7 of the 9 subscales of the CERQ, after controlling for age and depression scores. The autism and high-AQ groups scored higher on depression symptoms and employed negative coping strategies ("Self-blame", "Catastrophizing") more often and positive styles ("Positive Refocusing", "Refocus on Planning", "Positive Reappraisal", "Putting things into Perspective") less often than the low-AQ NT group.

Conclusions: Autistic and high-AQ individuals show higher levels of depression symptomatology and use more negative coping styles, and less

positive coping styles than low-AQ NT individuals, even after controlling for group differences in depression scores. Future research will examine if use of CER strategies, or if differences general wellbeing, life events and alexithymia moderate or mediate depressive symptomatology. If CER styles mediate or moderate depression in these groups, targeting CER use may be a helpful avenue for therapy.

172 **239.172** Dealing with Distress: Cognitive Correlates of Coping Strategies in Young Children with ASD

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Background: Individuals with Autism Spectrum Disorder (ASD) have difficulty establishing effective emotion regulation skills and consequently experience behavior problems (Sofronoff et al. 2007). Common coping strategies identified in literature on typical development are described as constructive/goal-oriented, venting, and passive/avoidance, and have shown both direct and indirect effects on positive and negative outcomes (Eisenberg et al., 1993; Blair et al., 2004). Although there is some evidence to support the relation between cognitive ability and the regulation of emotions (Mazefsky et al., 2013), research is limited in addressing how specific elements of cognitive functioning impact coping behaviors.
Objectives: The aim of this study was to compare types of coping strategies used in a heterogeneous sample of children with ASD, and explore the way in which varying levels of IQ may influence their use of coping strategies.

Methods: Participants were 83 children, 48 with ASD and 35 typically developing controls (age range 2–7; *M*= 4.23 years, *SD*= 1.15, 77% male). IQ was assessed using the Stanford Binet-5. The ASD participants were split into two subgroups based on expressive language: low verbal (up to basic phrase speech; N =33) and high verbal (verbally fluent; N = 15). Participants were presented with a series of tasks that were designed to be frustrating (e.g. toy with a broken part). Coping strategies during these tasks were coded as: instrumental, avoidance, aggression, disruption, venting, social-monitoring, and support-seeking (Eisenberg et al., 1993; Marcelo & Yates, 2014).

Results: The strategies were summed to create three composite variables of positive strategies (instrumental, social-monitoring, and support-seeking), negative strategies (aggression, disruption, and venting), and avoidant strategies (avoidance; Jahromi et al., 2012; Zantinge et al., 2017). There was a significant difference in coping strategies based on group ($F(6, 156)=10.24$, $p< .001$). The ASD low verbal group used less positive strategies compared to the ASD high verbal and typically developing groups ($p< .001$). The ASD low verbal group used more negative strategies compared to the typically developing group ($p=.047$). In addition to the group differences, moderation analyses within the ASD group revealed a significant two-way interaction between non-verbal IQ and high versus low verbal ability ($\beta=-.432$, $p=.043$). Higher non-verbal IQ scores predicted greater use of positive coping strategies for the low verbal ASD group (*simple slope*= -0.02, $p=.008$). There were no significant interactions between verbal or full scale IQ and verbal ability predicting positive, negative or avoidant coping strategies.

Conclusions: Children with ASD and low verbal ability displayed fewer positive coping strategies during frustrating events compared to their peers. However, within this group higher non-verbal ability was associated with more positive coping strategies. Thus, non-verbal cognitive functioning may have a protective effect, supporting the expression of constructive coping strategies. This suggest that individuals who appear to be significantly impaired can demonstrate effective coping when undergoing challenging situations. These findings are important for continuing to explore the mechanism by which stressful experiences influence behavior and what factors may or may not lead to more positive outcomes in children with ASD.

173 **239.173** Degree of Emotional Openness of Mothers with Children with Autism Spectrum Disorder

***A. Lampron**, N. Poirier and N. Moussa, Psychology, Université du Québec à Montréal, Montréal, QC, Canada*

Background: Emotional openness refers to the access of someone's own emotional experience, to certain characteristics that can describe our emotional experience (e.g., the tendency to be open, accessibility and apprehension of information that emotions provide), to a long-term and evolving openness (e.g., greater access to emotions) and ultimately social outcomes (e.g., emotional exchanges in interpersonal relationships). The model of emotional openness allows us to evaluate the different emotional processes perceived in a person and the coherence between them (Reicherts, Genoud and Zimmermann, 2012). This model is based on five central dimensions: the cognitive and conceptual representation of emotions (REPCOG), the communication of emotions (COMEMO), the perception of internal emotional indicators (PERINT) and external (PEREXT) and the regulation of emotions (REGEMO) (Reicherts, Genoud and Zimmermann, 2012). An additional dimension is added to the model, the normative restrictions of affectivity (Reicherts, Genoud and Zimmermann, 2012).
Objectives: The purpose of this study is to explore the dimensions of emotional openness in mothers with children with Autism Spectrum Disorder (ASD).

Methods: Forty-seven Quebec mothers of children with ASD participated in this study. Mothers are aged between 28 and 51 years old. The average age of mothers is 38 years old. The Emotional Opening Dimensions (DOE-36) questionnaire (Reicherts, 1997, 2007) is used to assess the degree of emotional openness of mothers.

Results: Mean and standard deviations for the six dimensions of emotional openness are presented (Table 1). The weakest dimension is the normative restrictions of emotional openness whereas the highest dimension is the cognitive and conceptual representation of emotions. Correlations between the different dimensions of emotional openness are analyzed. The initial model of emotional openness is presented by including the different correlations found in the sample (Figure 1). Associations between the dimensions of emotional openness, the age of the mother, and the gender of the child were made. The age of the mother is positively and significantly associated with the cognitive and conceptual representation of emotions (r = 0.328 *), but with no other dimension of emotional openness. The gender of the child is negatively and significantly associated with the perception of external emotional indicators (z = -1.974 *) and the normative restrictions of emotional openness (z = -2.097 *). Thus, mothers with a male child have a lower score on the perception of external emotional indicators (m = 3.36) than mothers with a female child (m = 4.10). Also, mothers with a male child have a lower score on normative restrictions of emotional openness (m = 2.90) than mothers with one female child (m = 3.80).

Conclusions: This study highlights the profile of the emotional openness of mothers with children with ASD. Specific interventions can also be put in place to work on the weaknesses of the emotional openness of these mothers.

References: Reicherts, M., Genoud, P. A. et Zimmermann, G. (2012). *L'ouverture émotionnelle : une nouvelle approche du vécu et du traitement*

*émotionnels.*Wavre, Belgique : Éditions Mardaga.

174 **239.174** Development of a Visual Autistic Identity and Emotions Scale

A. Riccio[1], *J. Delos Santos*[2], *S. K. Kapp*[3], *A. Jordan*[4], *D. S. Smith*[5], *D. DeNigris*[6] *and K. Gillespie-Lynch*[7], *(1)Department of Psychology, The Graduate Center, City University of New York (CUNY), New York, NY, (2)Hunter College, City University of New York, New York, NY, (3)University of Exeter, Exeter, United Kingdom, (4)CUNY, Staten Island, NY, (5)College of Staten Island, CUNY, Staten Island, NY, (6)Psychology & Counseling, Fairleigh Dickinson University, Madison, NJ, (7)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY*

Background: Non-speaking individuals and those historically labeled as "low-functioning" have rarely been included in research on perceptions of autism (Jones et al., 2013; Sequenzia, 2017). The prevailing use of "high/low-functioning" to qualify autism, groupings rejected by self-advocates as inaccurate and offensive, reduces the complexities and abilities of autistic people (Endow, 2015; Kenny et al., 2016). Due to marginalization of these groups, the ways non-speaking people experience autistic identity is not represented in the current literature. Measures using alternate modes of communication are needed to reach more autistic individuals so they may share their experiences. In the current study, we adapted a visual measure widely-used to assess emotions, the Self-Assessment Manikin (SAM; Bradley & Lang, 1994), composed of scales representing valence, arousal and control, to develop a visual autism identity scale.

Objectives: To create and evaluate a novel visual measure of autistic identity comprised of picture-based representations of core aspects of the lived experience of autism, identified by autistic members of our research team, and associated emotion rating scales.

Methods: A participatory team of 5 autistic and 4 non-autistic researchers iteratively developed an adapted version of the SAM (Figure 1), drawn by an autistic co-author, and a list of core aspects of the lived experience of autism (Table 1). Adaptation of the SAM was guided by an evaluation of the original SAM wherein autistic teenagers (n=15) and autistic (n=16) and non-autistic (n=148) college students were asked "What do you think these pictures are measuring?" Responses were qualitatively coded after researchers obtained reliability. We are currently evaluating the psychometric properties of the full scale by having autistic adolescents and college students rate each aspect of the lived experience of autism and relating responses to the RAADS-14 (Eriksson et al., 2013).

Results: Autistic and non-autistic participants exhibited pronounced difficulties interpreting the widely used SAM emotion scales. The scale for valence was most often understood, with 81% of autistic/93% of non-autistic participants correctly interpreting the scale. In contrast, only 19% of autistic/28% of non-autistic participants correctly identified the arousal scale. Many participants instead described hunger or physical pain (52% autistic, 39% non-autistic). Similarly, only 6% of autistic/16% of non-autistic participants correctly identified the control scale. Most interpreted the scale as body size or height (84% autistic, 65% non-autistic). By attending to the types of errors participants made with the original SAM, the participatory group developed 4 emotion rating scales (Figure 1): valence (sad to happy), anxiety (calm to anxious), pride (shameful to prideful), and energy level (depleted to energetic), as well as a visual measure of centrality to self.

Conclusions: Findings highlight that an emotion rating scale that is very widely used (5644 citations) is confusing for autistic and non-autistic youth. Measures of emotion that are developed in a participatory manner, with many opportunities for people to provide open-ended interpretations and careful validation, are clearly needed. After validating our autistic identity scale, we will use it with autistic people across the spectrum to gain a fuller understanding of autistic experience and identity.

175 **239.175** Double Dissociation in Amygdala and Insula to an Auditory "Looming" Threat Task

A. N. Bennion[1], *D. N. Top*[2], *K. Smith*[2], *C. A. Larson*[3], *C. Rich*[2], *T. White*[2] *and M. South*[4], *(1)Psychology, Brigham Young University, Provo, UT, (2)Brigham Young University, Provo, UT, (3)Neuroscience, Brigham Young University, Provo, UT, (4)Psychology & Neuroscience, Brigham Young University, Provo, UT*

Background: Understanding the mechanisms that underlie anxiety in autism is a critical task for experimental and clinical research. Previous studies have shown atypical fear conditioning response in autistic samples. However, because fear conditioning requires learning, other processes potentially complicate the interpretation of results. Neuroimaging studies of auditory "looming" have shown amygdala activation in response to sounds that appear to be coming "toward" the person in contrast to neutral or to "receding" sounds. We proposed using a looming task to investigate neural fear response without the need for any contingency learning.

Objectives: A multi-method study of auditory looming and receding in young autistic adults. We hypothesized typical fear response (e.g., amygdala and insula) in the autism sample compared to neurotypical young adults, suggesting that other factors underlie atypical fear conditioning and elevated anxiety in autism.

Methods: 25 AUT and 31 age and ability matched neurotypical (NT) young adults listened to sounds that get progressively louder (looming) or quieter (receding) while undergoing fMRI scans. The auditory stimuli consisted of pulsed tones of 2000ms duration and a 1kHz carrier frequency that were amplitude-modulated with a smoothed square wave envelope of 5Hz. The 2000ms sound sweeps were multiplied with an exponential function to obtain sound pressure level changes of 15dB (rising intensity sound, 70-85dB; falling intensity sound, 85-70dB; constant intensity sound, 77dB). Stimuli were presented bilaterally. All analyses were corrected for multiple comparisons using family-wise error correction.

Results: There was a main effect for group in left amygdala activation, NT>AUT (F=14.35; p=0.008) but no main effect for sound condition or group x condition interaction. There was a main effect for condition in bilateral insula, looming > receding (right: F=58.19; p=0.000; left: F=51.55; p=0.000) and a main effect for group for right insula, in the opposite direction, AUT > NT (F=39.53; p=0.000), but no group x condition interaction.

Conclusions: While we initially hypothesized that task response would not differ between groups, these and other data coming into our lab suggest a story of "physiological inflexibility" in which a restricted range of psychophysiological response in autism may contribute to frequent outbursts, meltdowns, or crippling anxiety. The neural response to threat differs between autism and neurotypical samples even when no learning is required, and may contribute to higher-order symptoms of anxiety that are so frequent in autism.

176 **239.176** Examining How Children with and without ASD Extract Emotion from Prosody

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Background:
Individuals with Autism Spectrum Disorder (ASD) have difficulty perceiving and expressing emotions. Since prosodic changes in speech (i.e. changes in intonation, stress, rhythm, etc.) are crucial for extracting information about the emotional state of the speaker, an inability to perceive and interpret these prosodic changes may lead to impairments in social communication.

Objectives:

Previous work investigating individuals with ASD's ability to identify the affective intentions conveyed by changes in speech prosody have been complicated by the fact that experimental stimuli often carry affective value in both their prosodic and their semantic content. The objective of this study was to use non-verbal affective sound-clips to determine whether children with ASD have difficulty extracting affect from changes in prosody. This research also explored whether a difficulty extracting affective intent from changes in prosody may be related to social competence.

Methods:

Children with (n=26) and without (n=26) ASD between the ages of 6 and 13 years listened to short non-verbal affective sound-clips and were required to match the emotion expressed in the noise burst to either an emotional face, or an emotion word. Affect bursts were obtained from the Montreal Affect Voices database, while faces were obtained from the Karolinska Directed Emotional Faces database. The Multidimensional Social Competence Scale (MSCS) parent report was used to measure social competence.

Results:

A 2 (Stimulus type: Face, Word) by 2 (ASD: Yes, No) repeated measures analysis of variance was conducted on matching accuracy. There was a main effect of stimulus type, $F(1,50)= 71.10$, $p< .001$, $n^2= .587$, as accuracy was higher when affect bursts were matched to words (M= 84.86, SE= 1.30), relative to faces (M= 73.24, SE= 1.30). The stimulus type by group interaction was also significant, $F(1,50)= 4.630$, $p= .036$, $n^2= .085$, as children with, (M= 84.78, SE= 1.84), and without, (M= 84.94, SE= 1.84), ASD performed similarly when matching the affective sound-clips to words, but the children with ASD, (M= 70.19, SE= 1.84), were less accurate than children without ASD, (M= 76.28, SE= 1.84), when matching the affective sound-clips to faces. Accordingly, MSCS scores were positively correlated with face, ($r(50)= .281$, $p= .048$), but not word, ($r(50)= .023$, $p= .874$), matching accuracy.

Conclusions:

Children with and without ASD accurately matched affective noise bursts to emotion words, suggesting children with ASD can accurately extract the affective meaning conveyed by changes in prosody. Children with ASD were less accurate at matching the noise bursts to the emotional faces, suggesting that children with ASD struggle to make use of this information in a social context. Given that affect-face matching accuracy was correlated with social competence, the inability to integrate social information derived from a speaker's voice and face may interfere with effective social communication. Future research will explore whether this difficulty reflects a difficulty in extracting the affective meaning from faces, or whether it may represent a difficulty integrating emotional information from multiple modalities.

177 **239.177** Exploring Emotional Regulations Strategies Used By Adolescents with Autism and Mild Intellectual Disability: A Preliminary Study

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Background: Prevalence rates in Australia currently estimate that one in 70 young Australians are on the autism spectrum. Over 70% of Autistic people will have a co-occurring intellectual disability, and an equal number will also suffer from mental illness. Yet currently we know little about why, or how to better protect this vulnerable population. Autistic adolescents with Intellectual Disability (ID) have significantly higher rates of mental health disorders than their typically developing peers. Studies of the general population have linked poor emotional regulation (ER) to mental health problems. Researchers have suggested that emotional dysregulation may be a core difficulty for many people with autism. But there is dearth of research exploring the development of emotional regulation skills in Autistic adolescents with ID.
Objectives: The primary aim of this mixed method study was to investigate which adaptive ER strategies were being used successfully by Autistic adolescents with Mild ID. The secondary aim was to explore the emotional regulation strategies (both adaptive and maladaptive) being used in times of sadness, anger and anxiety.

Methods: Three focus groups were conducted with 22 key informants (parents, teachers and allied health professionals) with extensive experience supporting Autistic adolescents with ID. Quantitative data was analyzed for percentages and trends and converged with a content and thematic analysis of the qualitative data.

Results: Reports indicated that across the emotions of sad, anger and worry, numerous ER strategies are being successfully implemented by this population. Autistic Adolescents with Mild ID are reported to use a range of adaptive ER strategies, however the most commonly used strategies often involved distraction or a change of physical state, rather than engaging cognitive strategies, such as reappraisal. Adaptive ER strategies were reported to be more effective when the adolescent is displaying a lower level of emotional intensity. When emotions are at a high level of intensity, cognitive ER strategies become ineffective, with an adult carer / parent assuming responsibility for regulating the adolescents' emotions. Parents reported less child direct self-regulation strategies and more parent guided regulation or re-direction strategies.

Conclusions: This study provides an insight into the difficulty that Autistic adolescents have in being able to control their emotions. The study also suggests that compared to their typically developing peers, this population demonstrates less ability to self-regulate and greater reliance on being regulated by others. Co-regulation strategies, which are the stepping stone for typical development, also seem to be limited across all contexts. Outcomes from this study provide the first insights into EC in Autistic adolescents with ID and have implications for future clinical intervention models. Findings from this study are being used to inform an adolescent and Mild ID adaptation of the first autism specific, evidence and emotion-based intervention, Westmead Feelings Program. The results have formed highlighted the need for a greater focus on emotion coaching for parents, teachers and professionals.

178 **239.178** Feasibility of Measuring Physiological Reactivity in More Severely Affected Youth with Autism in a Psychiatric Inpatient Setting

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Background:
Previous literature demonstrates that individuals with Autism Spectrum Disorder (ASD) can present with arousal dysregulation and difficulties with arousal modulation; however, objective physiological measures of arousal are seldom used in these studies, especially in youth with ASD who are severely affected (i.e., minimally-verbal and/or co-morbid intellectual impairments).

Objectives:

Assess the feasibility of exposing more severely affected youth with ASD from an inpatient psychiatric unit to experimental tasks designed to elicit frustration while wearing a wireless biosensor. We hypothesized that there would be significantly more physiological reactivity during demand tasks than at rest.

Methods:

Forty-five participants drawn from a larger sample (mean age = 12.8, range 6-20yrs; 74.1% male; 20.2% racial or ethnic minority; non-verbal IQ mean = 76.5, sd = 23.7; ADOS Module distribution: 28.9% Module 1 non-verbal, single words; 10.7% Module 2 phrase speech; 44.6% Module 3 fluent speech, child; 17.9% Module 4 fluent speech, adolescent/adult) of the Autism Inpatient Collection (AIC) were administered a subset of tasks designed to elicit negative affect (an inhibitory control task: Tower and two frustration/anger tasks: Locked Box, End of the Line) from the Laboratory Temperament Assessment Battery (Lab-TAB) that began with and interspersed baseline rest conditions. A wrist-worn wireless biosensor (Q Sensor, Affectiva, Inc.) was used to record electrodermal activity (EDA) and resulting data was parameterized within each segment (i.e. task) as normalized mean skin conductance level (SCL), linear trend change, and skin conductance response (SCR) as measured by coefficient of variation (CV).

Results:

An exploratory repeated-measures ANOVA with 7 factors (4 baselines and 3 tasks) revealed a main effect of task on CV ($F(6)=17.5$, $p < 0.0001$) and all Bonferroni-adjusted t-tests showed statistically significant differences between sequential resting baselines and demand tasks (Table 1, Figure 1). Log-adjusting the data to achieve assumptions of sphericity did not change results. The normalized SCL (mean) and trend were not significantly different across demand tasks, seemingly due to similarly escalating arousal during each frustration-inducing condition.

Conclusions:

The current study is the first we are aware of to measure physiological reactivity during standardized tasks in more severely affected youth with ASD in a psychiatric inpatient setting. SCR increases during demand tasks vs. antecedent baselines and an overall increase in SCL and trend throughout the Lab-TAB suggest that the tasks effectively increase physiological arousal associated with distress/frustration/negative affect. We conclude that ambulatory EDA is a feasible and useful objective measure of arousal for those with severe ASD who are unable to provide reliable self-reports, potentially enhancing future studies of temperament, emotion regulation, and emotion expression in this understudied segment of the autism population. Future work is underway to code these sessions for affect/emotion expression and explore relations between arousal, frustration, and emotional response.

179 **239.179** Gender Differences in Emotion Dysregulation in an Autism Inpatient Psychiatric Sample

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Background: Research on gender differences in Autism Spectrum Disorder (ASD) has shown that females are more likely to present with emotional problems such as anxiety and depression. These emotional difficulties may be related to underlying deficits with emotion regulation (ER), defined as modifications of one's emotional state to promote adaptive behavior. In general, it has been found that poor ER in ASD exacerbates social impairment and increases risk for psychiatric and behavioral problems. Although there is growing appreciation for ER impairments in ASD, understanding factors that increase risk for poor ER is limited. Given the higher rates of internalizing problems in females vs. males with ASD, it is possible that females are particularly vulnerable to ER deficits. It is also possible that other characteristics that vary widely in ASD impact the association between gender and ER.
Objectives: This study aimed to: 1) Explore gender differences in ER in a psychiatric sample of children, adolescents, and young adults with ASD and a wide range of functioning; 2) Investigate whether other characteristics, such as age, nonverbal IQ, or verbal ability moderate the association between ER and gender.

Methods: Data from psychiatrically hospitalized youth diagnosed with ASD (n = 698; 144 females) aged 4-20 years were collected as part of the Autism Inpatient Collection (AIC). This is an ideal dataset for this question, given the full range of ER impairments and wide variability in functioning level, with approximately half of the sample being nonverbal. ER was assessed with the Emotion Dysregulation Inventory (EDI; Mazefsky et al., 2016, 2018), a caregiver-report which produces theta scores (M= 0, SD= 1) for Reactivity (EDI-R; poor ER and high emotional intensity) and Dysphoria (EDI-D). Nonverbal IQ was assessed with the Leiter International Performance Scale (Leiter-3; Roid et al., 2013). Verbal ability was estimated based on the Autism Diagnostic Observation Schedule (ADOS-2; Lord et al., 2012) modules.

Results: Significant gender difference was found for the EDI-R [0.80 (0.84) vs. 0.97 (0.78), $p = 0.026$] and EDI-D [0.51 (0.84) vs. 0.71 (0.78), $p = 0.013$], with females showing significantly higher emotion dysregulation compared to males. Age did not significantly moderate the association between ER and gender (Reactivity: $F(1, 694) = 0.19$, $p = 0.66$; Dysphoria: $F(1, 683) = 3.00$, $p = .08$). Similarly, verbal ability (Reactivity: $F(1, 694) = 0.08$, $p = 0.77$; Dysphoria: $F(1, 683) = 0.62$, $p = .43$) and non-verbal IQ (Reactivity: $F(1, 578) = 0.14$, $p = 0.71$; Dysphoria: $F(1, 566) = 1.79$, $p = .18$) did not significantly moderate the association between ER and gender.

Conclusions: Results indicate that female psychiatric inpatients with ASD have more severe dysregulation than inpatient males with ASD. None of the analyzed factors (i.e., age, nonverbal IQ, verbal ability) moderated the association between gender and ER, indicating that gender alone

contributed to the differences in ER. Improved understanding of ER presentation in females with ASD is critical, as these symptoms may differentially impact females and/or warrant a different treatment emphasis.

180 **239.180** Investigating Electrodermal Response and Anxiety in Preschool Children with ASD

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Background: Estimates suggest that up to 80% of children with autism spectrum disorder (ASD) experience clinically significant levels of anxiety suggesting the need for earlier screening and intervention. However, assessment of anxiety in this population is challenging and, particularly, in younger children. Electrodermal response (EDR), a noninvasive physiological measure of autonomic activity, has been shown to quantify levels of anxiety in typically developing children but evidence shows significant variability in autonomic function in children with ASD. Additionally, the utility of EDR as a measurement for anxiety in preschool-aged children with ASD is relatively unexplored.
Objectives: To investigate EDR among young children with ASD compared to typically developing children during a face-to-face cognitive task and to explore the relationship between EDR and anxiety symptoms.

Methods: Twelve children ages 6-7 years with ASD and no intellectual disability and fifteen age-matched typically developing children participated to date. Groups did not differ in verbal, spatial, or nonverbal intelligence measured with the DAS-2. EDR was measured as participants performed a digit span task, which assesses verbal and working memory. The maximum fluctuation in EDR was recorded for each trial unless the fluctuation did not exceed 0.05 microsiemens. Scores were averaged into 30 second epochs across the first two minutes of the task. Parents responded to the BASC-2 about emotional and behavioral challenges, including anxiety symptoms.

Results: Children with ASD had higher parent reported anxiety, $t(25) = -2.73$, $p=.02$. Repeated measures ANOVA was used to examine the EDR between groups and their pattern of response over the first four 30s epochs of the task. A main effect of time, $F(3, 72)=3.9$, $p=.01$, indicated that EDR increased throughout the task (i.e., as it became more difficult). EDR also differed by diagnosis, $F(1, 24)=3.1$, $p=.04$, due to larger responses for children with ASD. Across diagnostic groups, children with more reported anxiety exhibited greater EDR during the first, $r(28)=.48$, $p=.01$, and second, $r(28)=.48$, $p=.009$, 30s epochs of the task. When the RM-ANOVA was conducted with anxiety covaried, the main effect of time remained significant, $F(3, 69)=3.2$, $p=.03$, and there was a trend for time x anxiety, $F(3, 69)=2.6$, $p=.06$, but diagnostic group did not significantly differ, $p=0.13$.

Conclusions: Children with ASD had significantly higher anxiety levels and EDR during the digit span task compared to typically developing controls. Overall, both groups exhibited increasing EDR as the task became more difficult. However, greater EDR during the first minute of the task was related to higher anxiety levels and, when anxiety was co-varied, the relation between anxiety and EDR over time approached significance. This preliminary data suggests that parents observe significantly more anxiety among children with ASD by early elementary school and that EDR may be a potentially useful index of anxiety. In particular, higher initial reactivity during a task with both social and cognitive demands and differences in EDR patterns over time may capture anxiety among young children. In the coming months, we plan to increase our sample size and further examine the relation between ASD, anxiety, and EDR.

181 **239.181** Living with Intolerance of Uncertainty: Experiences from Families of Autistic Children

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Background:
Anxiety is common in autistic children. One key mechanism underlying anxiety is intolerance of uncertainty (IU), which is a tendency to react negatively on an emotional, cognitive, and behavioural level to uncertain situations. Previous research has indicated that autistic people may be particularly vulnerable to experiencing IU and that there may be important interactions between IU and autism related characteristics. Understanding the contexts, responses to, and impact of IU is critical to the development of appropriate anxiety interventions.

Objectives:

We aimed to explore the types of uncertain situations that cause difficulties for autistic children and how IU impacts on the daily lives of autistic children and their families.

Methods:

60 families were recruited to the study through clinical services or a research database in the North East of England. The children were aged 6 – 16 years, had a diagnosis of ASD, and were experiencing anxiety related to difficulties tolerating uncertain situations in their daily lives. Parents completed Intolerance of Uncertainty Scale - Parent (IUS-P), which reported on their child's IU. Where possible, children completed the child self-report Intolerance of Uncertainty Scale (IUS-C). Parents completed the Anxiety Scale for Children–ASD to assess their child's anxiety and, where possible, children completed the corresponding child version of the scale. Parents completed a semi-structured interview during which they identified two everyday uncertain situations that were challenging for their autistic child: the first was a situation that their child would like to participate in that was difficult for them due to uncertainty (e.g., after school activities), and the second was a situation that was a necessary part of everyday life that their child struggled to engage with due to uncertainty (e.g., completing homework). Parents were asked to report on their child's reactions to these situations, the intensity and duration of their responses and the impact on the child and the wider family unit. The data from the semi-structured interviews were then analysed thematically.

Results:

The levels of child IU reported by parents and children are comparable with other published studies and above indicative clinical cut offs. Parents identified a range of contexts in which their child experienced IU, including situations where there is potential for exposure to aversive sensory stimuli, challenging social communication contexts, changes to routines, and performance related uncertainty.

Conclusions:

Our data indicate that in this sample of 60 families with an autistic child who is experiencing anxiety, rates of both child and parent reported child IU are high, supporting previous research. Parents were able to identify a range of everyday situations which are characterised by

uncertainty that interfere significantly with child and family functioning. Both autism-related characteristics and experiences (e.g., sensory hypersensitivity, social communication difficulties, rigidity) and IU were identified as important in these everyday situations, and were found to interact to increase anxiety. . These data provide further support for the importance of considering the interplay between IU and autism-related characteristics in the development of interventions to tackle anxiety for autistic people.

182 **239.182** Multimodal Emotion Recognition in Children with Autism Spectrum Disorder: Vocalizations Are More Informative Than Faces or Music

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Background: The social and communication difficulties cited among children with autism spectrum disorder (ASD) appear to be associated with problems in emotion recognition skills, as typically depicted with facial expressions or non-verbal vocalizations (e.g., laughter, crying). The extent to which these disparities reflect a general concern may be studied with an alternative modality of specific interest to children with ASD, such as music. Systematic comparisons of emotion recognition in faces, vocalizations, and music are lacking.
Objectives: The objective was to provide an initial comparison of emotion recognition skills in children with ASD across the modalities of face, vocalization, or music.

Methods: Twenty-two children with ASD between the ages of 8-14 (*M*=10.7, *SD*=1.49) years participated in this study. They completed tasks associated with identifying emotions in faces, vocalizations, and music, presented in counterbalanced order. Each modality included 8 happy, 8 sad, and 8 fearful emotional expressions from validated stimuli sets for a total of 72 stimuli. After each stimulus was presented on a computer screen for 1.5-2 seconds, the participants selected the verbal label that described the stimuli best from the three possible options of happy, sad, fearful.

Results: Friedman nonparametric repeated measures t-tests revealed mean accuracy scores that were significantly above chance (ranging from 64-93%). A difference in emotion recognition accuracy was found across modalities, $p = .0001$. Post hoc analysis with Wilcoxon signed rank tests (Bonferroni $p < .017$) revealed that the participants more accurately identified emotions from vocalizations than faces ($p < .001$) and music ($p < .0001$), but did not differ in accuracy for faces versus music ($p = .072$). A difference in accuracy was found across emotions $p = .031$, as the participants more accurately identified happy emotions versus fear ($p = .005$). No differences in accurate identification were found between happy versus sad ($p = .039$) and sad versus fear ($p = .65$). A significant modality by emotion interaction was found, $p < .0001$. Post hoc analyses with a Bonferroni correction of $p < .005$ revealed that sadness was more easily identified in vocalizations than music ($p = .001$), and fear was more easily identified in vocalizations than faces ($p = .001$) and music ($p < .001$). No significant differences were found in the accurate identification of happy emotions across modalities ($p > .009$), or between sad faces and vocalizations ($p = .16$), sad faces and music ($p = .045$), or fearful faces and music ($p = .235$).

Conclusions: Significant differences in identifying emotions across modalities were found as the participants identified sadness and fear more accurately in vocalizations than in faces and music, but identified happy emotions equally accurately across all modalities. Contrary to expectations, these findings suggest that the identification of negative emotions when conveyed through non-verbal vocalizations, rather than faces or music, may be easier or more informative for children with ASD.

183 **239.183** Uncovering Empathizing and Systemizing Skills in Autism Spectrum Disorder through Perception of Emotional and Structural Aspects of Music

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Background: The empathizing-systemizing (E-S) theory posits that autism spectrum disorder (ASD) symptomology is related to biases towards empathizing and systemizing traits (Baron-Cohen, 2002). More severe ASD symptomatology is associated with greater deficits in empathizing, a drive to recognize and respond to others' emotions, and superior skills in systemizing, a drive to analyze or construct systems. Music is a unique medium for measuring empathizing and systemizing skills of people with ASD given their common affinity and skill in this area (Heaton, 2009). The examination of musical empathizing and systemizing skills is a relatively novel line of inquiry and thus has only been explored using questionnaires with typically developing (TD) people (e.g., Kreutz et al., 2008; Dahary et al., 2018).
Objectives: The purpose of this research is to assess the ability of an ASD group in completing musical empathizing and systemizing tasks and to compare their task performance to that of a TD group.

Methods: Seventeen adolescents with ASD (aged 12-16 years) and 50 TD adults (aged 18-32 years) completed a musical empathizing task and a musical systemizing task using stimuli adapted from Vieillard et al., 2008. On the musical empathizing task, participants identified the emotion (happy, sad, or scary) of musical excepts and on the musical systemizing task, participants identified if pairs of musical excerpts were the same or different, with one repeated pitch altered on different trials. Both tasks were composed of 24 trials which varied in stimuli complexity (12 easy and 12 difficult trials). It took about 30 minutes to complete both tasks.

Results: The ASD group performed above chance level on the musical empathizing (≥33%) and systemizing (≥50%) tasks, demonstrating successful completion of both tasks ($p < .001$). A mixed design ANOVA model revealed a main effect of task such that, both ASD and TD groups were more accurate on the musical empathizing task than on the musical systemizing task ($p < .001$). A 3-way interaction between task, stimuli complexity, and group showed that ASD and TD groups were equally accurate on the musical empathizing task across easy and difficult trials, but not on the musical systemizing task ($p < .05$). While the ASD group performed less accurately on the easy trials of the musical systemizing task, both groups were equally accurate on the difficult trials.

Conclusions: This study is the first to assess musical empathizing and systemizing skills in ASD through task performance. We demonstrate that adolescents with ASD can understand both emotional and structural elements of musical excerpts; partially supporting but also running counter to the E-S theory. Results may instead support the enhanced perceptual functioning theory of ASD (Mottron et al., 2006), which posits that, when processing complex auditory information, enhanced perception of people with ASD creates a disadvantage (i.e., easy trials of the systemizing task) or can confer an advantage or lead to typical perception (i.e., difficult trials of the systemizing task). However, processing of emotions in music is typical. Results thus lend credence to using music interventions to teach emotion processing skills in ASD.

184 **239.184** Observed Emotion Dysregulation in Children with Autism during a Frustrating Task

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Background: Emotion dysregulation (ED) is a common reason for higher rates of anxiety, depression, and anger in individuals with autism. This population has been shown to display greater ED during frustrating tasks than peers without autism (Jahromi et al., 2012). Parent report measures of ED in children with autism predict poorer adaptive skills (Uljarević et al., 2018) and more internalizing and externalizing (maladaptive) behaviours (Berkovitz et al., 2017). However, few studies look at how observed behavioural ED relates to adaptive and maladaptive behaviours in this population. To address this gap, we adapted the Emotion Dysregulation Inventory (EDI; Mazefsky et al., 2018) as an observational measure of children's ED during a frustrating task.
Objectives: 1) Evaluate the reliability of an observational measure of ED. 2) Investigate associations between children's behavioural ED and success during a frustrating task. 3) Examine associations between parent report of child adaptive and maladaptive behaviours, and children's observed ED.

Methods: Preliminary findings are based on 32 children with autism aged 8-13 years (M_{age} = 9.6 years, Males = 31). Children completed a computerized mirror tracing persistence task (MTPT-C, Strong et al., 2003), where they attempted to trace a star with an irritating sound occurring with each tracing error. The task consisted of 3 practice phases and a test phase where children had the option to quit. Observed ED was measured via standardized observer coding of expressed reactivity and dysphoria using a coding scheme adapted from the EDI. Children's observed reactivity and dysphoria scores were correlated with success on the MTPT-C during practice phases and persistence on the test phase. The adaptive skills, internalizing and externalizing composites of the Behaviour Assessment System for Children parent report (BASC-3) were correlated with observed ED.

Results: Coding ED observationally using the EDI demonstrates excellent inter-rater reliability (ICC= 0.94 for reactivity and ICC = 0.93 for dysphoria). Observed reactivity and dysphoria across practice phases were positively correlated with the number of times the child made errors due to being too slow (reactivity: r_s = **.**54, p = .002; dysphoria: r_s = .65, $p < .000$). Mean reactivity and dysphoria negatively correlated with persistence (reactivity: r_s = -.33, p = .07; dysphoria: r_s = - .40, p = .03) and percentage of the star traced (reactivity: r_s = - .43, p = .02; dysphoria: r_s = - .47, p = .01). Both reactivity and dysphoria negatively correlated with the adaptive skills composite (reactivity: r_s = - .36, p = .05; dysphoria: r_s = - .45, p = .01), but not indicators of maladaptive behaviour.

Conclusions: The EDI is a reliable observational measure of ED for children with autism and observed ED during a frustrating task is associated with task behaviours. Findings also highlight that higher levels of reactivity and dysphoria during a frustrating task are associated with lower levels of adaptive skills, but not maladaptive behaviours. This may reflect differences between state-level experiences of negative affect due to a frustrating task, and broader trait-level behaviours observed in naturally occurring situations.

185 **239.185** Parent Discussions of Emotion Regulation Strategies with Their Child with ASD Is Associated with Parent Ratings of Child's Emotion Regulation

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Background: Parents play a key role in their child's emotion regulation (ER; e.g., Eisenberg et al, 1998). For example parent scaffolding of children with ASD's emotion regulation during a discussion task was associated with child externalizing behaviour but not internalizing behaviour (Ting & Weiss, 2017). The current study extended this work by including a typically developing (TD) comparison group of children without ASD and examining whether parent emotion-regulation strategies (scaffolding and elaboration) during discussion of an emotion vignette was associated with parent ratings of emotion regulation in school-aged children with ASD compared to those without ASD.

Objectives: The focus was: 1) Are child characteristics associated with how parents speak with their children about emotions and emotion regulation, and 2) Do these associations differ between groups of parents of children with and without ASD?

Methods: Forty-one parent-child dyads participated in the study (21 children with ASD, 20 TD, M_{age} = 10, M_{IQ} = 108). Parents completed the Multidimensional Social Competence Scale (MSCS; Yager & Iarocci, 2013). Through parent-report, the MSCS examines several domains of social competence, including the Emotion Regulation (ER) subscale that is used in the current study (e.g. "his/her emotional responses tend to be extreme"). Each parent-child dyad participated in a two-vignette discussion task where the main character was either anxious or angry. The dyads discussed the main character's emotions and what emotion regulation strategies they thought would help the character. Conversations were coded for parent elaborations of emotions (e.g., helping the child better understand emotions) and scaffolding of emotion regulation strategies (e.g., helping the child to understand and generate emotion regulation strategies).

Results: Poisson family regression was used to examine the research questions. Predictor variables included diagnosis, age, IQ, child ER, and the interaction between diagnosis and child ER. The data from each discussion was examined separately (anxiety vs. anger) and there were two outcome variables for each discussion: elaboration and scaffolding.

When discussing anxiety, the omnibus test predicting parent *elaboration* was not significant (p = .84). When predicting parent *scaffolding*, however, the omnibus test was significant (p = .01) and there was a trending effect of diagnosis (p = .08) where parents of children with ASD used more scaffolding than parents of children without ASD.

Within the anger discussion task, the omnibus test predicting *elaboration* was significant (p < .01), as were all predictor variables (p <.05). Parents of children with ASD were likely to use more elaboration when their child was rated to have better ER compared to when their child had lower rated ER. Parents of children without ASD, however, were likely to use less elaboration when their child had better ER, compared to when their child had lower rated ER (Figure 1). The omnibus test when predicting *scaffolding* was not significant (p = .13).

Conclusions: The findings suggest that parent behaviour when discussing emotion is complex and may be associated with child characteristics such as child emotion regulation, specific emotions being discussed, and child diagnosis.

186 **239.186** Parent-Reported Rates and Stability of Suicidal Ideation and Intent in School-Aged Children with Autism Spectrum Disorders

M. C. Hunsche[1], *S. Saqui*[1], *P. Mirenda*[1], *T. Bennett*[2], *M. Elsabbagh*[3], *S. Georgiades*[4], *I. M. Smith*[5], *P. Szatmari*[6], *W. J. Ungar*[7], *T. Vaillancourt*[8], *J. Volden*[9], *C. Waddell*[10], *A. Zaidman-Zait*[11], *L. Zwaigenbaum*[9] *and C. M. Kerns*[1], *(1)University of British Columbia, Vancouver, BC, Canada, (2)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (3)McGill University, Montreal, PQ, Canada, (4)McMaster University, Hamilton, ON, Canada, (5)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (6)The Hospital for Sick Children, Toronto, ON, Canada, (7)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada, (8)University of Ottawa, Ottawa, ON, Canada, (9)University of Alberta, Edmonton, AB, Canada, (10)Simon Fraser University, Vancouver, BC, Canada, (11)Tel-Aviv University, Tel-Aviv, Israel*

Background: Suicide is the second leading cause of death in youth aged 10-24 years (Statistics Canada, 2012). Research suggests that youth with autism spectrum disorder (ASD) are at an elevated risk for suicide compared to neurotypical peers (Mayes et al., 2013). However, there is little research on suicidality in youth with ASD (Horowitz et al., 2017). An understanding of the emergence of suicidal thoughts and behaviours in this population is vital for informing prevention services.
Objectives: This study (a) examined the frequency of parent-reported suicidality (ideation, intent) and self-harm behaviours in children with ASD across four time points (ages 7 to 11); and (b) endeavoured to document the age of emergence of suicidal ideation and behaviours to inform optimal service provision.

Methods: Data collected from 99 families across four time points from the Canadian *Pathways in ASD* study were included in the current analyses. Data were included if the CBCL was completed at all four time points. Participating parents completed the *Child Behaviour Checklist 6-18* (CBCL) at four time points between ages 7.3 – 11.9 years. CBCL items included Item 18: *Deliberately harms self or attempts suicide*, and Item 91: *Talks about killing self*, were used to assess suicidality risk, with rating of 1 "somewhat /sometimes true" or 2 "very true/often true" considered endorsement. Descriptive statistics were compared across time points and a repeated-measures ANOVA was conducted to compare the mean frequency of parental item endorsement across time points.

Results: Repeated-measures ANOVA suggest no significant difference in endorsement of Items 18 or 91 over the four time points. Of the 99 participating parents, 15.2% reported self-harm at least once across the four time points, and 12% reported suicidal ideation. Regarding self-harm, 12% of parents reported this at one time point; 0% at two time points; 2% at three time points; and 1% at all four time points. Regarding suicidal ideation, 8.1% of parents reported this at one time point; 3% at two time points; 1% at three time points; and 0% at all four time points. Self-harm was endorsed most frequently at T1 and T4 (both *n* = 7), and ideation was endorsed most frequently at T3 (*n* = 6).

Conclusions: Parents of school-aged children with ASD reported relatively high rates of suicidal ideation and self-harm behaviour across all four time points in comparison to rates of parent-reported self-harm and suicidal ideation in neurotypical children (3% and 0.5%, respectively, compared to 15% and 12% in our sample) (Aitken et al., 2016). Scores did not change significantly across time points; however, suicidal ideation and self-harm were observed to persist in some children over time. Prior work has suggested similar rates of self-harm and suicidal ideation in adolescents with ASD (12% and 15.7%, respectively) (Culpin et al., 2017). This suggests that in children with ASD, suicidality (ideation and self-harm behaviour) may emerge during the early school years and may persist into adolescence. Further research is needed regarding supports and interventions to address emergent suicidality in children with ASD.

187 **239.187** Patterns of Emotion Recognition in Speech and Song Among Children with ASD: Investigating the Effects of Emotion and Intensity

T. Fernandes, *J. Burack and E. M. Quintin, Educational & Counselling Psychology, McGill University, Montreal, QC, Canada*

Background: The social communication profile characteristic of persons with ASD may be related to difficulties in inferring the emotional state of others from several components of social interaction including speech. Yet, researchers have not reliably found deficits in emotion recognition from speech, depending on the specific emotions and the intensity to which they are conveyed. In one example of a strength, people with ASD appear to be particularly able to recognize emotions from instrumental music. The extent to which this strength is generalizable can be seen if it

is extended to song (vocal music).
Objectives: We compared emotion recognition from speech and song among children with ASD by examining the effects of specific emotions and emotional intensity.

Methods: Thirty children with ASD (age M= 11.67, SD = 2.28) completed a computerized task in which they identified emotions of varying intensity from spoken or sung sentences with neutral semantic content. The task comprised of 64 trials (2 stimuli conditions [speech and song] X 4 emotions (happy, angry, sad, scared) X 2 actors (1 male) X 2 statements X 2 intensity [normal vs. high]). The participants also completed the Verbal Comprehension Index (VCI) of the WISC-V and were divided into groups (N=15) based on a median split of a VCI score of 75.

Results: A repeated-measures ANOVA with emotion recognition accuracy as a dependent variable, stimuli condition (speech vs. song), emotion, and intensity as within subject repeated factors, and VCI group as a between subject factor revealed significant main effects of stimuli condition ($p < .001$), emotion ($p < .001$), and intensity ($p < .001$). The main effects were that accuracy was significantly better for speech compared to song and for emotions conveyed intensely compared to normally. Accuracy was highest for angry trials and lowest for scared trials across speech and song . A significant emotion X condition interaction ($p < .001$) was found as recognition of anger and fear was more accurate in speech than in song, while happiness and sadness were recognized as accurately in both conditions. A significant emotion X intensity interaction ($p < .001$) was found as recognition of happiness, anger and fear was more accurate for trials with high intensity, while recognition of sadness was more accurate for trials with normal intensity. The VCI group effect was not significant.

Conclusions: The results from this study demonstrate that children with ASD more easily recognize intensely conveyed emotions (except in the case of sadness) from speech compared to song. This suggests that their observed strength in recognizing emotions from instrumental music may not extend to song. The finding that fear was less accurately identified as compared to other emotions supports the amygdala theory of ASD, that they may show atypical connectivity of the amygdala, an area implicated in fear perception and response. These findings also have implications for interventions that extend beyond recognition of facial expressions and considers emotion intensity by first teaching emotions that are intensely conveyed followed by those that are more subtle.

188 **239.188** Psychometric Properties of the Danva-2 in High-Functioning Children with ASD

***A. J. Booth**, C. J. Rajnisz, J. D. Rodgers, S. L. Andrews, M. Thomeer and C. Lopata, Institute for Autism Research, Canisius College, Buffalo, NY*

Background:
Impairment in facial emotion recognition (FER) has been documented in high-functioning individuals with autism spectrum disorder (HFASD) across a variety of emotions, research methodologies, and assessment tools (Harms, Martin, & Wallace, 2010). Some have proposed that these deficits contribute to the social difficulties that define ASD (Schultz et al., 2003). One of the most frequently used FER measures in HFASD studies (McMahon, Lerner, & Britton, 2013) is the Diagnostic Analysis of Nonverbal Accuracy – Second Edition (DANVA-2; Nowicki & Carton, 1993). However, despite its use in this population, no studies examining the psychometric characteristics within a homogenous HFASD sample have been conducted. Examination of the validity and reliability of the DANVA-2 within samples of children with HFASD would add to the interpretability of previous research utilizing the measure and support future use.

Objectives:

This study assessed the (1) internal consistency, (2) test-retest reliability, and (3) near and broad concurrent validity (comparisons with other established FER and social functioning measures) of the DANVA-2 faces subtests. In addition, this study also explored the relationships between performance on the DANVA-2 and child age, intelligence, and language abilities.

Methods:

Participants. One-hundred twenty-one children, ages 6-13 years, with HFASD were included in this study. Analysis subgroups were formed from the total sample ($N = 121$) for concurrent validity ($n = 36$) and test-retest reliability analyses ($n = 21$ for 5-week and $n = 21$ for 12-week stability). Each child had a prior clinical diagnosis of ASD, a WISC-IV abbreviated IQ >70 (VCI or PRI >80), and a CASL expressive or receptive language score >75. All diagnoses were confirmed using the ADI-R.

Measures. DANVA-2; Cambridge Mindreading Face-Voice Battery for Children (CAM-C); Social Emotional Evaluation (SEE); Behavior Assessment System for Children, Second Edition-Parent Rating Scales (BASC-2-PRS); Social Responsiveness Scale (SRS); Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV); Comprehensive Assessment of Spoken Language (CASL).

Procedures. All data were collected as a part of the screening and baseline assessments for psychosocial treatment trials. Test-retest reliability samples for the 5-week and 12-week intervals were obtained by using participants from no-treatment (wait-list) conditions.

Results:

Internal consistency estimates were .70 for the DANVA-2-AF and .75 for the DANVA-2-CF subtests. For the DANVA-2-AF, reliability coefficients for immediate, 5-week, and 12-week retest intervals were .84, .75, and .68, respectively. For the DANVA-2-CF, reliability coefficients for the immediate, 5-week, and 12-week retest intervals were .78, .90, and .43, respectively. DANVA-2 scores were strongly associated with the CAM-C and SEE but unrelated to parent BASC-2 and SRS ratings. Significant correlations (small to moderate) were found between DANVA-2 scores and child age, IQ, and language ability.

Conclusions:

Internal consistency and test-retest reliability of the DANVA-2 in an HFASD sample were found to be adequate for research purposes. Likewise, the measure strongly converged with other tests of emotion recognition. However, further research is needed to determine whether the DANVA-2 adequately predicts social competence and ASD symptomology and to what extent participant demographic characteristics may impact DANVA-2 performance.

189 **239.189** Stability, Concurrent Validity, and Relationship to ASD Symptoms of the Cambridge-Mindreading Face-Voice Battery for Children in a Large Sample of High-Functioning Children with ASD

***J. D. Rodgers**, A. J. Booth, C. J. Rajnisz, J. Lodi-Smith, M. Thomeer and C. Lopata, Institute for Autism Research, Canisius College, Buffalo, NY*

Background:
Significant heterogeneity of results has been found in studies of emotion recognition (facial and vocal) in high-functioning individuals with autism spectrum disorder (HFASD). Some studies identify a broader deficit across emotions, while others do not support a deficit. This may be related to inconsistent measurement tools (Harms et al., 2010; Lozier et al., 2014). Despite this inconsistency, emotion recognition has often been used as an outcome measure in trials of psychosocial interventions for children with HFASD (e.g. McMahon et al., 2013; Lopata et al., 2018).

Objectives:

The current study examined the properties of a carefully constructed measure of emotion recognition that uses dynamic facial stimuli (CAM-C Faces) and vocal stimuli (CAM-C Voices) with a range of emotional content, including both simple and complex emotions (Golan et al., 2015) in a large sample of children with HFASD. We predict the total correct, simple emotion items, and complex emotion items of the CAM-C Faces and CAM-C Voices will show: (1) high test-retest stability, (2) robust correlations with other measures of emotion recognition, and (3) a small but significant relationship with ASD symptoms (SRS-2).

Methods:

Participants were drawn from multiple psychosocial intervention trials for children with HFASD. The total sample was 267 individuals (ages 6-12) with a diagnosis of ASD (91% Male; 93% Caucasian). Inclusion criteria also included WISC-IV short-form IQ >70 (VCI or PRI ≥80), and a CASL expressive or receptive language score >75. A majority of participants (96%) also had ADI-R scores confirming the diagnosis of ASD.

The following measures were assessed at screening and baseline of their respective intervention trials: Cambridge Mindreading Face-Voice Battery for Children (CAM-C); Diagnostic Analysis of Nonverbal Accuracy – Second Edition (DANVA-2); Social Emotional Evaluation (SEE); Social Responsiveness Scale-Second Edition (SRS-2)

Results:

Stability. Test-retest stability was assessed over 3-months and 9-months. For the 3-month interval (n = 21), the stability ranged from r = .404 to .760. For the 9-month interval (n = 50), the stability ranged from r = .531 to .756.

Relationship to other measures of emotion recognition. The CAM-C was substantially related to the two other measures of emotion recognition. For the DANVA-2 (n = 168), correlations ranged from r = .424 to .608 between the CAM-C variables and a sum of adult and child faces subtests. For the SEE (n = 36), correlations ranged from r = .532 to .656 between the CAM-C variables and a total score of receptive emotion recognition.

Relationship to a measure of ASD symptoms. We did not find a meaningful relationship between any of the CAM-C variables and ASD symptoms. For the SRS-2 (n = 267), all correlations were non-significant and less than r = .08.

Conclusions:

We found the CAM-C was both a stable and valid measure of emotion recognition, relative to other measures of the same construct. The lack of a relationship between this measure and a measure of ASD symptoms challenges the assumption that emotion recognition independently contributes to the broader deficits in ASD.

190 **239.190** The Experience of Embarrassment in Adults with and without Autism Traits

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Background:
Embarrassment may have evolved in order to maintain social order, given that embarrassed people typically recognize and regret their social transgression or misbehavior (Miller, 2007). Thus, people who display signs of embarrassment are often better liked and more readily forgiven than those who do not (Keltner & Anderson, 2000). However, despite its importance for social interactions, little is known about the experience of embarrassment in Autism Spectrum Disorder (ASD; Adler et al., 2015; Hillier & Allinson, 2002; Thiébaut et al. 2016).

Objectives:

The present study explored how adults with ASD traits (ASD-T) may experience or respond to embarrassing scenarios compared to adults without ASD-T. Additionally, gender differences in the experience of embarrassment were considered. Relations between proneness to embarrassment and theory of mind (ToM) and fear of negative evaluation were also assessed.

Methods:

A total of 72 adults, those with ASD-T (n = 36) and those without, or neurotypical adults (NT; n = 36), participated. The Social Responsiveness Scale (SRS-2-Adult; Constantino, 2012) was used to identify individuals who showed evidence of ASD-T from those who did not. Research has shown that the SRS-2 can be used to distinguish between individuals with ASD traits from those without (Ingersoll et al., 2011). See Table 1 for additional demographic information.

Participants' proneness to embarrassment was measured using the embarrassment subscale from Sabini et al. (2001). Participants were asked to place themselves within 10 embarrassing scenarios and rate how likely it is that they would experience embarrassment for that event using a 7-point Likert scale (7 = extremely likely). Participants also provided ratings of anger, fear, guilt, regret, and shame in response to each embarrassing scenario. This allowed us to determine (1) how much embarrassment participants felt they would experience in a given scenario, and (2) how much the embarrassing scenarios elicited other emotions.

Participants also completed the Faux Pas Test-Adult (Stone et al.,1998) as a measure of ToM, and the Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983). Following informed consent, all measures were completed online using a secure survey platform.

Results:

A mixed-model ANOVA and appropriate follow-up tests showed that adults with ASD-T rated embarrassing scenarios similar to NT adults in terms of how much embarrassment they thought each would elicit (see Table 2). However, adults with ASD-T reported higher levels of fear, guilt, and shame in response to embarrassing situations than NT adults. Faux-pas detection and detection of false-beliefs were positively related to higher embarrassment ratings in adults with ASD-T, but not in NT adults (see Table 2). Additional results (see Table 2) will be discussed as they relate to BFNE and gender comparisons.

Conclusions:

Although adults with and without ASD-T were similar in their ratings of embarrassment, the embarrassing scenarios were more likely to elicit other, particularly negative emotions, in adults with ASD-T. The current results also suggest that ToM may play a greater role in feelings of embarrassment in ASD-T than in NT adults. Understanding how embarrassment is perceived may inform social-emotional programs for adults with ASD.

191 **239.191** The Relationship between Emotion Recognition Ability, Subjective Emotional Intensity, and Traits Associated with ASD

F. Shafai[1], *E. Gateman*[2], *A. Abraham*[2], *M. K. Stow*[3], *S. E. Schulz*[4], *E. Altoum*[2], *S. Handy*[2], *A. Hawkins*[2], *C. Sakellis*[2], *T. W. W. Ho*[2], *N. E. Scheerer*[5], *G. Iarocci*[5] *and R. A. Stevenson*[4], *(1)The University of Western Ontario, London, ON, Canada, (2)University of Western Ontario, London, ON, Canada, (3)Psychology, University of Western Ontario, London, ON, Canada, (4)Western University, London, ON, Canada, (5)Simon Fraser University, Burnaby, BC, Canada*

Background: Individuals with Autism Spectrum Disorder (ASD) have been shown to have difficulty with emotion recognition in various studies. It has been suggested that these results are associated with symptom severity, where those who struggle the most with recognizing emotions are those with the highest rates of traits common in ASD. It is still unknown as to which ASD-related traits are most strongly correlated with atypical emotion recognition.
Objectives:

1) Assess whether emotion recognition accuracy is higher for individuals with less ASD-related traits.

2) Determine if subjective ratings of emotional intensity are associated with measures of ASD-related symptoms.

Methods: We assessed emotion recognition accuracy and subjective ratings of emotional intensity using videos of actors saying the same phrase while expressing different emotions, both facial expressions and auditory prosody, at varying intensities. Following each video, individuals reported which emotion the actor just expressed and rated the intensity of the emotion on a scale of 1-9. Each actor expressed anger, disgust, fear, happiness, sadness, and surprise at low and high intensity, as well as a non-emotive control condition. Trials were gaze-controlled to ensure that individuals were looking at the screen prior to each video being presented. Autistic traits were measured using the Broad Autism Phenotype Questionnaire (BAPQ), and social competency was measured using the Multidimensional Social Competence Scale (MSCS). Mean accuracy and intensity ratings were calculated and correlated with levels of autistic traits. This study is ongoing and has collected data from typically-developing (TD) young adults (n=29).

Results: The initial results of this ongoing study indicate that subjective emotional intensity ratings are positively correlated with the *Rigidity* subscale of the BAPQ (r-values 0.324> 0.385) and are negatively correlated with the *Pragmatic Language* subscale (r-values -0.257>-0.296). Emotional intensity ratings were also positively correlated with the *Social Inferencing* and *Emotion Regulation* (r-values 0.257>0.410) subscales of the MSCS, but were negatively associated with the Empathic Concern subscale (r-values -0.279>-0.308) (Figure 1).

Conclusions: Results from this on-going study suggest that subjective intensity ratings of emotions are related to autistic traits. Interestingly, these associations were in the expected direction for some, but not all, of the subscales of interest. As social inferencing and emotion regulation are necessary for comprehending cues in social contexts, it was unsurprising that these related to subjective ratings of emotion intensity. One would predict that empathic concern, however, would also be positively correlated with intensity ratings. It is possible that the negative association may be mediated by other factors, for instance, anxiety, where a disassociation between the concern for another's emotional state can be overshadowed by the internal perception of the emotions being displayed. Similarly, the negative correlation between subjective emotion intensity ratings and pragmatic language may be influenced by factors related to anxiety or influenced more by visual features of the face rather than the auditory prosody of the stimuli. As these findings are found in TD individuals with varying levels of ASD-related traits, further investigation is needed to determine if these results are also found for individuals clinically diagnosed with ASD.

192 **239.192** The Role of Somatic Symptoms on Emotion Recognition in Young Children with ASD

T. M. Rutter, *A. J. Lee, M. Feller, C. Quinnett, L. Molina and B. J. Wilson, Seattle Pacific University, Seattle, WA*

Background: Children with autism spectrum disorder (ASD) often display challenges in facial emotion recognition (FER; Lozier, Vanmeter, & Marsh, 2014). While previous literature suggests individuals with ASD demonstrate challenges in detecting negative emotions compared to typically developing (TD) peers (Ashwin, Chapman, Colle, & Baron-Cohen, 2006), recent literature suggests this extends to detection of happiness (Sato et al., 2018). Internalizing symptoms have been shown to be related to FER challenges (Székely, Tiemeier, Jaddoe, Hofman, Verhulst, & Herba, 2014), however, anxiety and depressive symptoms constitute much of the FER literature across youth samples (i.e., Demenescu, Kortekaas, den Boer, & Aleman, 2010). Given that somatic symptoms in childhood predict later anxiety and depressive disorders (Shanahan, Zucker, Copeland, Bondy, Egger, & Costello, 2015), somatic symptoms are a subset of internalizing symptoms that warrant further investigation. We are unaware of any studies that investigate the unique role of somatic symptoms on FER in young children with ASD.
Objectives: Our objective was to develop a greater understanding of factors associated with accurate recognition of happiness among children with ASD. We hypothesized that somatic symptoms would moderate the relation between developmental status and accuracy response time.

Methods: Participants were 152 children (ages 3:0 to 6:11) and their parents. Eighty-four TD children (42% female) and 68 children with ASD (19% female) were examined. Parent ratings from the Behavioral Assessment System for Children - Second Edition (BASC-2; Reynolds & Kamphaus, 2004) were used to measure somatic symptoms. Children completed a dynamic emotion recognition task via laptops in a laboratory setting. Two trials of twenty slides were presented; scores reflect the mean slide number of first accurate recognition. Higher scores indicate slower recognition.

Results: A moderation analysis was conducted using the SPSS 25 macro PROCESS (Hayes, 2013) to evaluate whether the association between developmental status and recognition of happiness was moderated by parent-reported child somatic symptoms. Children's age was controlled for in the analysis. Results indicated significant main effect of status on emotion recognition (B = 8.490, CI_{95} [3.035, 13.945], p = .002). The main effect of somatic symptoms on emotion recognition was not significant (B = .038, CI_{95} [-0.048, 0.120], p = .386). The contribution of the interaction between status and somatic symptoms was significant (B = -0.121, CI_{95} [-0.233, -0.008], $\Delta R2$ = .02, $F(1,147)$ = 4.512, p = .035. At low-to-moderate levels of somatic symptoms, children with ASD were slower to recognize happiness, while at high levels of somatic symptoms, children with ASD recognized happiness quickly and performed as well as their TD peers.

Conclusions: The current study found children with ASD were slower to recognize happiness compared to their TD peers at low-to-moderate levels of somatic symptoms. However, high levels of somatic symptoms appeared to sensitize children with ASD in their recognition of happiness, with performance similar to TD peers. While studies have shown this sensitizing effect on FER for broadband internalizing symptoms (Rosen & Lerner, 2016), our study provides evidence that somatic symptoms may be a unique contributor to emotion recognition in children with ASD.

193 **239.193** Negative Affectivity As a Mediator of the Association between Caregiver Psychological Distress and Psychopathology in Infants with Early Signs of Autism Spectrum Disorder (ASD)

L. Chetcuti[1,2], *M. Uljarevic*[3], *K. J. Varcin*[2,4], *M. Boutrus*[2,5], *A. J. Whitehouse*[2,4] *and K. Hudry*[1,2,6], *(1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (3)Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, Stanford University, CA, (4)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (5)Telethon Kids Institute, University of Western Australia, Perth, Australia, (6)Victorian Autism Specific Early Learning and Care Centre, La Trobe University, Melbourne, Australia*

Background: Individuals with an Autism Spectrum Disorder (ASD) diagnosis experience higher rates of internalizing and externalizing symptoms/disorders than the general population. However, little is known about the pathways towards the development of co-morbid psychopathology in this population. Children's negative affectivity (i.e., propensity towards negative emotions) and caregiver psychological distress are established risk factors for psychopathology in non-autistic children. Further, there is evidence linking early caregiver psychological distress to subsequent variation in child temperament. Bringing together these lines of evidence, a recent study (Allen, Oshri, Rogosch, Toth, & Cicchetti, 2018) found that negative affectivity mediates the association between caregiver psychological distress and psychopathology among non-autistic children. It remains unclear whether this pathway extends to individuals with ASD symptoms; yet, two separate strands of research provide evidence for heightened caregiver psychological distress and negative affectivity in the ASD population.
Objectives: To explore whether the pathway identified in non-autistic children – from caregiver psychological distress to child negative affectivity to child psychopathology – is also observed among a cohort of infants presenting with varying levels of ASD features.

Methods: Participants were a community-referred sample of 103 infants (68% male) aged 9-16 months (*M* = 12.39, *SD* = 1.97) showing early signs of ASD, and a primary caregiver (96% biological mothers). Caregivers completed a series of questionnaires. Psychological distress was measured using the Depression Anxiety Stress Scale (DASS-21), infant negative affectivity was measured using the Infant Behavior Questionnaire-Revised (IBQ-R), and infant internalizing and externalizing symptoms were assessed via the Infant-Toddler Social and Emotional Assessment (ITSEA). Infant ASD features were assessed using the Autism Observation Schedule for Infants (AOSI), a semi-structured observational measure. An SPSS macro was used to estimate the total and indirect effects of caregiver psychological distress on infant internalizing and externalizing (modelled separately) via infant negative affectivity (mediator) at varying levels of ASD features (moderator).

Results: Caregiver psychological distress, infant negative affectivity, and infant internalizing and externalizing symptoms were positively interrelated. Infant ASD features were positively associated with internalizing symptoms (only). The model explained a large proportion of the variance in infant internalizing and externalizing symptoms (44% and 24%, respectively). Infant negative affectivity fully mediated the association between caregiver psychological distress and infant psychopathology in both models. No interaction terms involving the AOSI were significant, indicating that the significance of direct and indirect effects did not vary as a function of infant ASD features.

Conclusions: These results – showing temperamental negative affectivity to mediate the link between caregiver psychological distress and infant psychopathology – are consistent with findings in non-autistic children, with effects in this community-referred cohort of infants not moderated by level of ASD features. While these results require replication and longitudinal validation, they suggest that interventions designed to mitigate internalizing and externalizing psychopathology should apply irrespective of infant ASD symptom presentation.

194 **239.194** Utility of Temperament for Predicting Psychopathology in Infants with Early Signs of Autism Spectrum Disorder (ASD)

L. Chetcuti[1,2], *M. Uljarevic*[3], *K. J. Varcin*[2,4], *M. Boutrus*[2,5], *A. J. Whitehouse*[2,4] *and K. Hudry*[1,2,6], *(1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (3)Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, Stanford University, CA, (4)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (5)Telethon Kids Institute, University of Western Australia, Perth, Australia, (6)Victorian Autism Specific Early Learning and Care Centre, La Trobe University, Melbourne, Australia*

Background: High rates of internalizing and externalizing psychopathology are reported among individuals with a diagnosis of Autism Spectrum Disorder (ASD). However, the mechanism/s underlying this pattern of co-morbidity remain poorly understood. Abundant research on normative development suggests that individual differences in early temperament characteristics can promote either risk or resilience to the development of psychopathology. Surprisingly, only a handful of studies have explored the relation of temperament to psychopathology in the context of ASD. These existing studies explored associations between psychopathology and *individual* temperament traits, as opposed to multiple-trait *configurations* which more aptly describe each person as a whole. Further, existing studies restricted their focus to individuals with established ASD diagnosis, limiting generalizability to early development when behavioural features of ASD and psychopathology first emerge.
Objectives: To (a) identify distinctive temperament subgroups within a cohort of infants presenting with early signs of ASD and (b) explore the utility of these temperament subgroups for predicting variability in internalizing and externalizing symptoms.

Methods: Participants were a community-referred sample of 96 infants (67.7% male) aged 9-16 months (*M* = 12.38, *SD* = 1.94) showing early signs of ASD. Parents/carers completed the Infant Behavior Questionnaire-Revised (IBQ-R), a 191-item measure of infant temperament, and the Infant-Toddler Social and Emotional Assessment (ITSEA), a 161-item measure of social-emotional and behavioural problems. Latent profile analysis was used to identify temperament subgroups from IBQ-R subscale scores, and one-way ANOVA were used to explore between-subgroup differences across ITSEA domains/scales.

Results: Three temperament subgroups were identified: (1) *well-regulated* (*n* = 51), characterized by high cuddliness, falling reactivity, and soothability, (2) *active/negative reactive* (*n* = 23), characterized by high activity level, distress to limitations, sadness, fear, and low falling reactivity, and (3) *inhibited/low positive* (*n* = 22), characterized by low smiling and laughter, high intensity pleasure, vocal reactivity, approach, and perceptual sensitivity. *Active/negative reactive* infants had the highest levels of separation distress and broad externalizing symptoms, while

inhibited/low positive infants had the highest levels of depression/withdrawal. Both *active/negative reactive* and *inhibited/low positive* subgroups had higher levels of broad internalizing symptoms than *well-regulated* infants, who had the lowest reported levels of co-morbid psychopathology. There were no differences between temperament subgroups with respect to age, sex, or developmental/cognitive ability. *Inhibited/low positive* infants presented with more ASD features than the other subgroups.

Conclusions: Temperament characteristics may contribute to variability in internalizing and externalizing symptoms in young children with early signs of ASD. This study provides an empirical foundation for the development of individualized interventions for the prevention and treatment of co-morbid psychopathology in ASD. The person-centered approach utilized in this study afforded a more nuanced understanding of temperament-psychopathology relations, and the broad inclusion criteria for participant infants extends the generalizability of results across the full continuum of ASD feature presentation.

Poster Session
240 - Epidemiology/population studies
11:30 AM - 1:30 PM - Room: 710

195 **240.195** Neonatal Polyunsaturated Fatty Acid Levels in Association with Autism Spectrum Disorders: Results from a California Population-Based Case-Control Study

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Background: Polyunsaturated fatty acids (PUFAs) play key roles in neurodevelopment. Only a few studies have examined prenatal PUFAs in association with autism spectrum disorder (ASD), and results have not been consistent. No prior study has examined the association between measured neonatal levels of PUFAs and ASD, yet PUFAs measured in the newborn period may better capture the more biologically-relevant window of PUFA uptake in the developing brain during late pregnancy than measurements earlier in pregnancy.
Objectives: To determine whether levels of PUFAs, measured in neonatal bloodspots, differ in in children with ASD as compared to those without ASD.

Methods: We conducted a population-based case-control study of 500 cases and 500 general population (GP) controls in order to examine maternal and newborn PUFA levels in association with ASD. Cases, identified from the California Department of Developmental Services (DDS), were matched on sex and month and year of birth (2011-2013) to GP controls, who were randomly selected within strata of matching factors from birth certificate files after excluding DDS clients. For neonatal analyses, 200 cases and 200 controls from the larger study were randomly selected. Newborn bloodspots were obtained from the California Biobank Program, and PUFA levels were measured using liquid chromatography-mass spectrometry/high resolution mass spectrometry (LC-MS/HRMS).To adjust for hematocrit, potassium levels were used to normalize PUFA levels.Logistic regression analyses, accounting for matching factors and other potential confounders, were used to calculate odds ratios (ORs) between PUFA levels (as individual fatty acids and as summed classes of n-3 and n-6 PUFAs) and ASD.

Results: PUFAs were quantifiable above background levels in newborn bloodspots and demonstrated sufficient stability and precision in this matrix. With the exception of docosahexaenoic acid (r=0.42, p<.0001), neonatal PUFA levels were not correlated with maternal PUFA levels in mid-pregnancy serum. Geometric mean levels of individual neonatal PUFAs did not significantly differ between cases and controls. In adjusted analyses we did not observe significant associations between quartiles of PUFA levels and ASD, though a non-significant reduction in risk with the highest quartile of n-3 PUFAs was suggested (OR for Q4 v Q1=0.72, 95%CI 0.40, 1.29). When examining extremes of the distribution, we observed a significant reduction in odds of ASD according to the highest 5thpercentile of n-3 PUFAs (relative to the interquartile range (IQR), OR=0.18, 95%CI 0.04, 0.88). A similar association was found for the highest levels of total PUFAs overall (OR=0.25, 95% CI 0.06, 1.01), along with a suggested increase in risk of ASD for those with the very lowest levels of total PUFAs (lowest 5thpercentile relative to IQR, OR=2.20, 95% CI 0.92, 5.25).

Conclusions: Findings from this population-based case control study suggest that individuals with the highest levels of neonatal n-3 and total PUFAs may have reduced odds of ASD; however, these associations were estimated with low precision and require replication in other studies. Given the role of PUFAs in fetal brain development, and the fact that neonatal PUFAs represent a critical window for PUFA exposure and neurodevelopment, further examination of these associations is needed.

196 **240.196** Neonatal Thyroid Stimulating Hormone and Subsequent Diagnosis of Autism Spectrum Disorders and Intellectual Disability

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Background: Thyroid abnormalities in early life, if left untreated, are associated with adverse neurodevelopmental outcomes, including intellectual disability (ID). However, evidence addressing the role of neonatal thyroid hormones in the altered neurobiology underlying autism spectrum disorders (ASD), particularly among its subphenotypes, is limited.
Objectives: To determine the association between neonatal thyroid hormone levels and subsequent diagnosis of ASD, ID, and subphenotypes of ASD.

Methods: Utilizing data from the Early Markers for Autism (EMA) Study, we conducted a population-based, case-control study among a sample of 4.5-9-year-old children born during 2000-2003 in Southern California. We examined neonatal thyroid-stimulating hormone (TSH) levels measured during routine newborn screening among children later diagnosed with ASD (n=524), ID (n=124), and general population (GP) controls (n=402). GP controls were randomly sampled from birth certificate files and frequency matched to cases by sex, birth month, and birth year. TSH was further

analyzed in relation to ASD subgroups defined by intellectual ability and onset type (early onset ASD vs. ASD with regression) ascertained by expert review of records from the California Department of Developmental Services. ASD cases with composite scores on standardized cognitive tests less than or equal to 70 were classified as ASD with intellectual disability (ASD+ID) and those with scores greater than 70 were classified as ASD without intellectual disability (ASD-noID). We modeled differences in TSH levels between ASD or ID status vs. GP controls using odds ratios (ORs) obtained from multivariate unconditional logistic regression. We examined neonatal TSH both as a continuous (ln-transformed) and as a categorical variable based on percentiles. In sensitivity analyses, we examined relationships excluding preterm (gestational age <37 weeks) and multiple births.

Results: In models adjusting for matching factors (sex, birth month and year), birthweight, gestational age, and age at newborn bloodspot collection, we found no association between continuous neonatal TSH levels and ASD (adj-OR: 0.96, 95%CI: 0.76-1.21) nor ID (adj-OR: 0.95, 95%CI: 0.69-1.30). Results were similarly null for models examining percentiles of TSH. Among ASD subphenotypes, we observed an inverse trend between neonatal TSH and odds of ASD with regression; ASD with regression was marginally associated with continuous TSH (adj-OR: 0.76, 95%CI: 0.55-1.06) and significantly associated with the highest quartile of TSH (adj-OR: 0.48, 95%CI: 0.26-0.92). The odds of ASD-noID were also lower with increasing TSH but this relationship was more modest and not significant in models of continuous TSH (adj-OR: 0.83 95%CI: 0.63-1.11) and models comparing the highest to lowest TSH quartiles (adj-OR: 0.68, 95%CI: 0.40-1.14). Neonatal TSH was not associated with early onset ASD nor ASD+ID. Sensitivity models excluding preterm and multiple births yielded similar findings.

Conclusions: While there was little evidence that neonatal TSH is related to overall risk of ASD, our findings suggest that neonatal TSH levels may be associated with particular subtypes of ASD defined by onset type and co-occurrence of intellectual disability. Given that thyroid hormone deficiencies at birth are amenable to therapy, further scrutiny of the intersection of thyroid hormones and ASD is warranted, with attention to ASD subphenotypes.

197 **240.197** Neurodevelopmental Outcomes of a High-Risk Autism Spectrum Disorders Cohort of Full and Half Siblings

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Background: The Markers of Autism Risk in Babies – Learning Early Signs (MARBLES) Study is an autism high-risk cohort that started enrolling families in 2006. Eligible families include an older biological sibling with a confirmed Autism Spectrum Disorders (ASD) diagnosis and a new younger sibling followed prenatally until 36 months. The new younger sibling is referred to as the child of interest (COI). The COIs are followed for early signs of ASD and other developmental delays. Research assessing the risk factors of younger siblings for developing ASD or other non-typical development (non-TD) is limited.

Objectives: To assess the risk of developing ASD or non-TD for younger full and half siblings. To compare Autism Diagnostic Observational Schedule (ADOS) comparison (severity) scores among the COIs with a confirmed ASD or non-TD diagnosis and their sibling relationship (full vs half).

Methods: Logistic regression was used to compare the diagnostic outcomes (ASD, non-TD, or TD) and linear regression on ADOS severity scores to sibling relationship (full versus half siblings). All analyses were adjusted for child gender, race, ethnicity, and birth year; and maternal age and education.

Results: We reviewed 275 COIs (116 females and 160 males) who completed a 36 month developmental assessment including Mullen Scales of Early Learning and ADOS with a final diagnosis of ASD (64), non-TD (70), and typically developing (TD, 141) COIs. Of the 275 COIs, 239 had an older full sibling with ASD (97 females 142 males) and 36 had an older half sibling with ASD (18 females and 18 males). When comparing the sibling relationship and its association with an ASD diagnosis, there was no significant risk associated with being diagnosed with ASD versus TD (p=0.49; OR= 0.722; 95% CI: 0.283,1.843). However, a full younger sibling was associated with a borderline significantly higher risk of being diagnosed with non-TD (p=0.08; OR=.414; 95%; CI: 0.151 1.133) . Younger siblings diagnosed with ASD were compared using their autism severity scores obtained from the ADOS. Being a full siblings was associated with higher autism severity scores (p=0.04). Among children with non-TD, no significant difference severity score was found between full and half siblings (p=0.14).

Conclusions: We found no significant difference in estimated risks of developing ASD or non-TD for younger full and half siblings based on the sibling relationship. Full younger siblings diagnosed with ASD have a higher ADOS severity score, when compared to the half siblings with the same diagnosis. Though our study suggests some differences in outcomes between younger full and half siblings, our sample size is small and larger studies are needed to confirm these findings.

198 **240.198** Patterns of Developmental Milestone Delay Identified Using Latent Class Analysis in a Finnish Population Based Sample of Autism Cases and Controls

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Background: Autism spectrum disorders (ASD) are characterized by atypical developmental trajectories in language and social domains. However, delays in non-verbal cognitive and in fine and gross motor domains are also common. Latent class analysis (LCA) may be useful to empirically identify potentially complex patterns of delayed development across domains.

Objectives: To empirically identify developmental classes characterized by shared patterns of delayed milestone achievement, using population-based data from subjects with autism and with typical development.

Methods: Data on the age at achievement for 21 developmental milestones with expected age at attainment between birth and 24 months were abstracted in Finland from well-child clinics for 846 cases with childhood autism identified in the Finnish Hospital Discharge Register and 925 controls matched on sex, date of birth, and place of birth. For each milestone, a dichotomous indicator of delay was coded as positive if the age at achievement was greater than the 90th percentile of control values. Latent class models with 2-10 latent classes were fit based on the dichotomous variables for each milestone and the optimum number of classes was selected based on the Bayesian Information Criterion (BIC). An LCA model with the optimum number of classes was then used to estimate the class membership probabilities for each individual and the item-

response probabilities for each type of delay. Subjects were classified based on their maximum probability of class membership, and the distribution of developmental class membership was compared between autism cases and controls using multinomial logistic regression.

Results: A 5-class model best fit the data based on the minimum BIC. 72.5% of subjects (61.5% of cases and 82.6% of controls) belonged to a "non-delayed" class with low probabilities of delay for all milestones. A class containing 10% of subjects had high probabilities of gross motor delays (crawling and standing). An "early delay/smile" class (6.7%) exhibited delays in early motor (i.e. lifting head) milestones and in smiling responsively, but not in later skills. A "late delay/interactive" class (4.5%) showed delays in social and receptive language milestones (i.e. pointing, collecting objects upon request, playing peek-a-boo). The remaining class was characterized by overall delays. All classes other than "non-delayed" were significantly associated with increased risk of autism. The highest odds ratios (ORs) for autism were associated with the "late delay/interactive" class (OR (95% CI)=7.13 (3.86, 13.2); p<0.0001) and the overall delays class (OR (95% CI)=6.38 (3.73, 10.9); p<0.0001), after adjustment for pre-term birth and low birth weight.

Conclusions: While the majority of cases with autism did not show apparent patterns of delay based on developmental milestones before age 24 months, specific patterns of delay were associated with highly increased autism risk relevant to a subset of cases. Characterizing the heterogeneity of autism based on shared patterns of early development may assist etiological and clinical research by identifying more homogenous groups of cases, for targeted early intervention and identification of correlations with other developmental events and neurobiological processes.

199 **240.199** Pediatric Autism Research Cohort (PARC): Towards a Learning Autism System

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Background: In 2017 the Government of Ontario, Canada launched the new Ontario Autism Program (OAP). The OAP aims to provide publically-funded, individualized, flexible, and family-centred services to children with Autism Spectrum Disorder (ASD). The Hamilton-Niagara Regional Autism Program (H-NRAP) is one of the largest regional programs delivering the OAP, serving 3,000+ children with ASD and their families. A major challenge in the successful implementation of the OAP is the use of empirical evidence to guide clinical practice to meet each child's unique needs. To address this challenge the program is working towards the implementation of a Learning Autism System (LAS) in which science, informatics, incentives, and culture are aligned for continuous improvement and innovation.

Objectives: The Pediatric Autism Research Cohort (PARC) Project is a pilot study testing the implementation of a Learning Autism System. The specific objectives are to: a) embed a standardized longitudinal research protocol within the regional program (clinic) and recruit 100 consecutive preschool children with ASD as they enter the OAP; b) describe the developmental trajectories (clinical pathways) in preschool children with ASD – at the individual, subgroup, and group levels – and identify individual and contextual factors contributing to variability in outcomes; and c) through a digital platform, create a 'feedback loop' with the clinic to help disseminate research findings to families and clinicians, allowing for enhanced communication and decision-making processes leading to more tailored and adaptive service plans.

Methods: The pilot phase of PARC includes recruiting and assessing newly-diagnosed preschool children with ASD. Data are collected in two stages: 1) accessing information collected as part of 'standard' clinical practice, and 2) administering a set of additional assessments on child, family, services, and community level variables of interest. Stage 1 includes measures of symptom severity, cognitive functioning, and adaptive behavior; Stage 2 includes measures of social communication abilities, community participation, quality of life, service use, and sociodemographic characteristics. Assessments are repeated at 6-month intervals over a 2-year period and data are synthesized and 'fed back' to the clinic on an ongoing basis.

Results: This pilot study is active and data collection is ongoing. To date 94 children with ASD and their families have been enrolled (mean age 3.81 years, SD 0.846, 79% male) in 8 months, with a 95% recruitment rate. The results of three-way clustering methods consisting of variables and observations over time will be presented, identifying homogeneous groups of children to inform service planning and adaptation. The developmental trajectories of social communication abilities and adaptive functioning will be mapped using longitudinal mixed membership models.

Conclusions: PARC represents a new type of longitudinal investigation in ASD, illustrating the feasibility of consecutive sampling with implications for representativeness. Within a Learning Autism System framework, research and clinical data are systematically collected and synthesized to inform clinical care as children move through the OAP. Findings will be discussed within the context of pragmatic, sustainable research that guides clinical practice and lays the foundation for the evidence base needed to inform programs and policies at a systems level.

200 **240.200** The Independent, Moderating, and Interaction Effects of Prenatal Exposure to Maternal Smoking and Ambient Fine Particulate Matter on Risk of Autism Spectrum Disorder

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Background: Recent estimates of autism spectrum disorder's (ASD) heritability range from 38%-87% indicating an important role for the environment in ASD's etiology. Among the many environmental factors that have been investigated, exposure to prenatal ambient fine particulate matter ($PM_{2.5}$) and maternal smoking have been independently, albeit inconsistently, linked to ASD. Although ambient $PM_{2.5}$ and maternal smoking exposure during pregnancy may engage similar biological mechanisms to incur ASD risk (e.g. inflammation), the moderating and interaction effects of these exposures on ASD risk have yet to be examined.

Objectives: Investigate the independent, moderating and interacting effects of prenatal ambient $PM_{2.5}$ and maternal smoking exposures on ASD

risk.

Methods: Children with ASD born from 2008-2010 in Salt Lake County, Utah (N=247) were identified by the Utah Registry of Autism and Developmental Disabilities and each matched to five population controls (N=1008) based on birth year and sex from the Utah Population Database. Exposure to maximum daily (split at ≤ vs >median concentration in each exposure window) and average daily (split at ≤ vs >12 µm) concentrations of ambient fine particulate matter was estimated separately for five exposure windows including the three months prior to conception, the first, second, and third trimesters, and throughout pregnancy. Prenatal maternal smoking (yes vs. no) and additional pregnancy-related covariates for ASD were acquired from birth certificates. A series of multivariable conditional logistic regression models were fit to determine the relationship between 1) prenatal maximum and average daily $PM_{2.5}$ exposures and ASD risk, and 2) prenatal maternal smoking and ASD risk. The $PM_{2.5}$ models were updated to include a prenatal $PM_{2.5}$ by maternal smoking interaction term.

Results: Average daily ambient $PM_{2.5}$ exposure was not associated with ASD risk during any of the pregnancy exposure windows. Maximum daily ambient $PM_{2.5}$ exposure during the first trimester was associated with decreased ASD risk (Odds ratio (OR): 0.743, 95% CI: 0.56-0.99). Prenatal maternal smoking exposure was associated with increased ASD risk (OR: 1.73, 95% CI: 1.05-2.84). The interaction between average daily $PM_{2.5}$ concentration throughout pregnancy and prenatal maternal smoking was associated with increased ASD risk with an OR of 4.38 (95% CI: 1.52-12.61) among children exposed to maternal smoking vs. an OR of 0.89 (95% CI: 0.635-1.24) for children not exposed to maternal smoking. (p=0.004). The relationship between maximum daily $PM_{2.5}$ exposure and ASD during the third trimester was moderated by prenatal maternal smoking exposure (OR: 2.66, 95% CI: 1.002-7.03 vs. OR: 1.21, 95% CI: 0.88-1.65 in children exposed vs. not exposed to maternal smoking), although the interaction was not significant (p=0.13).

Conclusions: Our results indicate that prenatal maternal smoking is independently associated with ASD, and suggest that the combination of prenatal maternal smoking and fine particulate matter exposure may yield interacting and moderating effects on ASD risk. Effect estimate precision is low, however, indicating that further investigation with a larger sample is warranted. Replication of study findings would suggest that interventions aimed at reducing prenatal maternal smoking might have a corresponding impact on the risk of ASD incurred through prenatal $PM_{2.5}$ exposure.

201 **240.201** Perspectives of Specialized Driving Instructors: Teaching Autistic Adolescents and Young Adults to Drive

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Background:

Limited access to transportation may curtail the transition to independent adulthood for autistic adolescents, potentially curtailing their ability to attend school, participate in employment, and engage in social activities. Despite documented challenges in the demands of working memory, multitasking, and executive functioning among autistic adolescents—which have been linked to poor driving performance observed in driving simulators—nearly one-third of autistic adolescents and young adults obtain a driver's license by age 21 (Curry et al., 2018). Given both the importance of safely encouraging independence and the potential for increased risk for adverse driving outcomes, research on driving among autistic adolescents and young adults is critical.

Objectives:

Our objective was to document driving instructors' unique experiences and perspectives regarding the autistic adolescents' training needs and recommendations for best practices to inform the development of tailored supports to optimize the safety of autistic adolescents as independent drivers.

Methods:

We conducted interviews with 17 driving instructors who possessed specialized training to teach autistic adolescents and young adults to drive. Participants were recruited through snowball sampling. The semi-structured interview guide investigated: family engagement; instructors' observations; educators' instructional strategies; and recommendations for improving the learning-to-drive process. A directed content analysis approach informed the development of a coding scheme. Coded transcripts were reviewed to identify emergent themes.

Results:

Participating driving instructors primarily identified as occupational therapists. Key themes included: (1) importance of parent engagement; (2) fostering independence; (3) the need for individualization of instructional strategies; and (4) recommendations for best practices to enhance the learning–to-drive process. Instructors emphasized that parent engagement is critical in preparing autistic students to undertake on-road instruction and supporting skill development throughout the learning-to-drive process. While some families paradoxically limit adolescents' independence in tasks of daily living despite wanting them to expand their independence by pursuing driving training, instructors believed that demonstrating independence through other activities (e.g., bike riding, directing a driver to school or work) was necessary for safely undertaking on-road instruction. Further, instructors shared how they extensively individualized their assessments and instruction, tailoring lessons over a prolonged period of time to promote safe driving and skill acquisition. Specific recommendations for enhancing the learning-to-drive process included standardizing educational approaches and refining clinical assessment tools to better support both specialized and non-specialized instructors in meeting the needs of autistic adolescents.

Conclusions:

These first-hand accounts may help to better prepare parents, non-specialized driving instructors, and adolescents for independent licensure. The experience of driving instructors in this study highlights the need for ongoing parental engagement to support the learning-to-drive process and to foster the independence necessary to undertake highly individualized driving instruction. Efforts to support families by increasing utilization of tools and resources to strengthen adolescent independence may help to better prepare youth for on-road instruction. These results also document the need to establish best practices and refine assessment tools and instructional strategies employed by educators. Future research to gather experiences with the learning-to-drive process among parents and autistic adolescents themselves is critical to improving our understanding of these families' needs.

202 **240.202** Population Disparities in Autism Diagnosis in South Israel.

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Background:
The rising incidence of autism spectrum disorder (ASD) has become a major public health concern. In Israel, ASD rates vary remarkably across geographic regions and ethnic populations, with one of the largest gaps observed between Jewish and Bedouin populations living in southern Israel.

Objectives:

To identify the reasons for the population disparities in ASD rates in southern Israel.

Methods: This study was conducted between March 2015 and January 2017 at 35 maternal child health centers (MCHCs) in southern Israel. A total of 3343 toddlers (996 Jewish and 2347 Bedouin at age 16-36 months were screened for ASD using the M-CHAT/F questionnaire. Toddlers who failed the M-CHAT/F were referred for further evaluation at the Soroka University Medical Center (SUMC). The diagnostic process at SUMC included several meetings with social workers, developmental psychologists, and expert physicians (a child psychiatrist or a child neurologist) who eventually provided a diagnosis according to DSM-5 criteria. Cox regression analysis was used to assess population differences in the diagnosis processes.

Results:

Overall, 39 Jewish (3.9%) and 70 Bedouin (3.0%) toddlers failed the M-CHAT/F (p=0.165 for population difference in failure rates). Jewish toddlers who failed the M-CHAT/F were significantly younger than Bedouin toddlers (20.15±3.38 vs. 23.77±5.01 respectively; p<0.001), and in both populations the male-to-female failure ratio was 2:1. Of the toddlers who failed the M-CHAT/F, 32 Jewish (82.1%) and 56 Bedouin (80.0%) started the diagnosis process at SUMC (p=0.795 for population difference). Notably, only 32 (57.1%) of the Bedouins that attended SUMC completed the diagnosis process compared to 27 (84%) of the Jewish toddlers (p<0.001). In addition, the time from referral until the first diagnosis meeting at SUMC was, on average, two months longer for Bedouins compared to Jewish toddlers (7.86 vs. 5.53; p=0.040). Consequently, the adjusted "risk" of Jewish toddlers who failed the M-CHAT/F to get a diagnosis of ASD was 2.8 higher compared to Bedouin toddlers (HR=2.8, 95%CI=1.01-7.75; p = 0.049), which explains the current ethnic differences in ASD prevalence in southern Israel (1.2% vs. 0.4% for Jewish and Bedouin toddlers respectively).

Conclusions:

The observed population disparities in ASD prevalence between Jewish and Bedouin toddlers in southern Israel are likely stemming from delayed diagnosis and higher loss to follow-up rates among the Bedouin population. Raising awareness and Better case management for toddlers with suspected ASD from the Bedouin population would help in reducing the gap in ASD prevalence between Jewish and Bedouin toddlers in southern Israel.

203 **240.203** Postnatal Acetaminophen: Contribution to Risk of Autism Spectrum Disorder Among Males

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Background: In rodents, large doses of acetaminophen early in life have been found to degrade neurotransmission, motor function, spatial memory, and social behavior in later life. Two retrospective case-control studies in humans suggest that postnatal acetaminophen exposure is associated with increased risk of autism spectrum disorder (ASD). Yet, acetaminophen is widely used as an antipyretic and analgesic in infancy and early childhood.

Objectives: Determine the contribution of postnatal acetaminophen exposure to risk of ASD among male children in the USA.

Methods: Using a retrospectively collected data set from a previous study that was derived from an Internet-based survey among parents of children ages 3 through 12 years old (n=1,515), calculate an adjusted odds ratio (aOR) and gender specific aORs for postnatal acetaminophen measured in doses consumed before age two relative to the outcome of ASD using logistic regression. For comparison, calculate an analogous set of aORs for postnatal ibuprofen measured in doses consumed before age two relative to the outcome of ASD. Also, calculate aORs in joint analyses that include both analgesic variables against the outcome of ASD. Akaike information criterion was used to select a consistent sets of covariates for these analyses.

A contribution to risk of ASD from postnatal acetaminophen among males was calculated using the aOR for postnatal acetaminophen among males, the distribution of the number of doses of acetaminophen consumed up to age two by male children later diagnosed with ASD, and data from the literature.

Results: In this data set, postnatal acetaminophen exposure, measured in number of doses consumed before age two, is associated with increased risk of ASD among males (aOR 1.023, CI 1.005 - 1.043, p=0.020*). While there is also a weak association between postnatal ibuprofen and ASD among males, it is not statistically significant and is completely dominated by the association between acetaminophen and ASD in the joint analysis. Thus, it is conceivable that the weak association observed between ibuprofen and ASD could merely be a result of ibuprofen use being correlated with acetaminophen use.

Covariates in the above analyses include age of the child, ethnicity, Midwest, South, maternal education, age of the mother at birth of the child, and relationship to the child. Gender was also included as a covariate in the regressions that were not gender specific.

Postnatal acetaminophen is associated with approximately 20.6% of the total risk of ASD among males in the USA. Alternatively, the incidence of ASD associated with postnatal acetaminophen consumption is approximately 5.5 per 1,000 males annually, which is equivalent to an estimated annualized incidence of 11,600 cases of ASD among male children in the USA. This data set also provides hints of gender specific effects of postnatal acetaminophen on risk of ASD, although the p-value for interaction of 0.253 is not statistically significant.

Conclusions: While there may be some measurement error, as this data set was collected retrospectively, this study suggests that postnatal acetaminophen is associated with a significant proportion of the risk of ASD among male children in the USA.

204 **240.204** Pregnancy Planning and Its Association with Autism Spectrum Disorder and Other Developmental Disabilities: Findings from the Study to Explore Early Development

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Background: Nearly half of all U.S. pregnancies are unintended at the time of conception. Previous studies demonstrate that women who have unintended pregnancies are more likely to delay prenatal care, smoke and drink during pregnancy, lack daily supplemental folic acid intake prior to pregnancy, and experience certain adverse perinatal outcomes such as preterm birth. Whether pregnancy planning is associated with risks for longer-term developmental disability (DD) outcomes such as autism spectrum disorder (ASD) is not well studied.
Objectives: To examine associations between pregnancy planning and the risk of ASD and other DDs.

Methods: Data for this analysis were obtained from the Study to Explore Early Development (SEED), a multi-site case-control study of ASD risk factors in children ages 30-68 months in 2007-2016. Study groups were children with ASD, children with other DDs, and population-based control children (POP). At enrollment, all children were screened for ASD symptoms with the Social Communication Questionnaire (SCQ); children with a positive screen and/or previous ASD diagnosis underwent further in-person assessments to determine final case status. Children with a DD who had a positive SCQ screen but did not meet ASD case criteria were classified as DD with ASD symptoms. Risk factor data were obtained via maternal telephone interview that included a pregnancy planning question ("At the time of your pregnancy were you trying to get pregnant?"). Mothers who responded yes were scored as having planned their pregnancy. We examined associations between pregnancy planning and 1) ASD (n=1275), 2) ASD or other DD with ASD symptoms combined (n=1743), and 3) DD without ASD symptoms (n=1212) (each vs. POP group [n=1716]). We computed odds ratios adjusted for maternal age, education, parity, and child sex (aORs) and 95% confidence intervals via logistic regression. We repeated analyses in a restricted sample that excluded participants who had certain health outcomes/behaviors possibly in the causal pathway: preterm delivery, multiple birth, pregnancy complications (hypertension, diabetes), smoking just before or during pregnancy, and no folic acid intake just before or during pregnancy.

Results: Initial analyses indicated differential associations by race-ethnicity; we thus conducted subsequent analyses within race-ethnicity strata. Among non-Hispanic white (NHW) mothers, 61.7%, 62.1%, 73.5%, and 80.1% in the ASD, ASD/DD with ASD symptoms, DD without ASD symptoms, and POP groups, respectively, reported they planned their pregnancy. Additionally, after adjustment, pregnancy planning was inversely associated with both ASD (aOR=0.67 [0.54-0.84]) and ASD/DD with ASD symptoms (aOR=0.71 [0.56-0.91]) but not DD without ASD symptoms (aOR=0.94 [0.76-1.17]). Restricting the sample to pregnancies without various health risks or adverse outcomes did not attenuate the findings. In other race-ethnicity groups (non-Hispanic black, Hispanic, and Asian mother-child pairs), pregnancy planning was less common than for NHW mother-child pairs and was not significantly associated with any ASD or DD outcomes.

Conclusions: Our findings suggest an inverse association between pregnancy planning and ASD in NHW children that is not explained by selected demographic, health behaviors, or pregnancy outcomes. Further research is needed on the health and/or behavioral characteristics underlying the observed association and the reasons findings varied by race-ethnicity.

205 **240.205** Prenatal Anemia and Neurodevelopmental Disorders in the Stockholm Youth Cohort: A Population-Based Cohort Study

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Background:
Autism spectrum disorders (ASD) often co-occur with attention deficit hyperactivity disorder (ADHD) and intellectual disability (ID), potentially as a result of shared etiologies. Given the critical role iron plays in development, a causal association between prenatal iron deficiency and later risk for neurodevelopmental disorders like ASD, ADHD, and ID is plausible.

Objectives:

The objective of this study was to assess the relationship between anemia diagnosed in mothers during pregnancy and risk of ASD, ADHD, and ID in offspring.

Methods:

Swedish health and population registry data from the Stockholm Youth Cohort (SYC) were used. 532 232 children born 1987 – 2010 were included. To assess potential critical windows of development, timing of anemia diagnosis was considered, categorized as occurring £30 or >30 weeks of gestation. We considered three potentially over-lapping outcomes (any ASD, any ADHD, and any ID) and five mutually-exclusive outcomes: ASD only (no ADHD or ID); ADHD only (no ASD or ID); ID without ASD (no ASD; not excluding ADHD); ASD with ID (not excluding ADHD); and ASD with ADHD (no ID). To model the associations between maternal anemia and offspring risk of these outcomes, we used generalized estimating equation (GEE) models with logit link clustered on maternal identification number to account for the clustering of siblings born to the same mother in our dataset. Since associations between maternal anemia and offspring risk of neurodevelopmental disorders may be confounded by unobserved factors such as shared genetic liability, we conducted a matched sibling analysis for risk of any ASD, any ADHD and any ID diagnoses using a conditional logistic regression model.

Results:

Anemia diagnosed £30 weeks of pregnancy was associated with increased risk for diagnosis of any ASD (OR 1.44, 95% CI 1.13-1.84), any ADHD (1.37, 1.14-1.64) and any ID (2.20, 1.61-3.01) in offspring, in models including socioeconomic, maternal and pregnancy-related factors. Early anemia diagnosis was similarly associated with risk for both ASD (2.25, 1.24-4.11) and ID (2.59, 1.08-6.22) in a matched sibling comparison. Considering mutually exclusive diagnostic groups, we observed the strongest association between anemia and ID without co-occurring ASD (2.72, 1.84-4.01). Risk for ASD with ID was also associated with anemia diagnosed early in pregnancy (1.74, 1.06-2.86), while the associations for ASD with ADHD (1.38, 0.94-2.03) and ASD only (1.35, 0.92-2.00) were weaker and confidence intervals included one. Associations of these disorders with anemia

diagnosed later in pregnancy were greatly diminished compared to the associations with anemia diagnosed earlier in pregnancy.

Conclusions: In contrast to maternal anemia diagnosed towards the end of pregnancy, anemia diagnosed earlier in pregnancy increased the risk for the development of ASD, ADHD, and particularly ID in offspring. Our findings regarding the timing of exposure to anemia indicate that exposure to anemia earlier in gestation may be more detrimental with regard to neurodevelopment of the child, emphasizing the clinical importance of early screening for iron status in antenatal care.

206 **240.206** Prenatal Metabolic Syndrome and Autism Spectrum Disorder: The Moderating Influence of Familial History

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Background: Established prenatal risk factors for autism spectrum disorder (ASD) include maternal conditions characterized by inflammation and/or steroid dysregulation, such as gestational/pre-existing hypertension, preeclampsia, and gestational/pre-existing diabetes. In combination, these risk factors are referred to as prenatal metabolic syndrome (PNMS). Both ASD and PNMS are known to have familial predispositions that are attributable, in part, to heritability.
Objectives: 1) To confirm increased ASD risk associated with PNMS exposure, and 2) investigate the interaction and moderating effects of ASD and PNMS familial predispositions on the association between PNMS exposure and ASD.

Methods: Index offspring of First and Second Trimester Evaluation of Risk (FASTER) study participants (N=6441) were linked to their birth certificate and genealogical records in the Utah Population Database. ASD case status was determined through linkage with research and population-ascertained ASD cohorts, including the Utah Registry of Autism and Developmental Disabilities. PNMS status was determined from birth certificates. Familial predisposition of PNMS and ASD was treated as a dichotomous variable based on the presence of at least one first through third degree relative with PNMS or ASD. A log-linear model assuming a Poisson distribution with robust error variances was fit to calculate ASD relative risk associated with PNMS exposure. The model was adjusted using inverse probability of treatment weights (IPTW). Two additional IPTW models were fit that included 1) PNMS familial predisposition and a PNMS exposure*PNMS familial predisposition interaction to test for effect moderation and interaction and 2) ASD familial predisposition and a PNMS exposure*ASD familial predisposition interaction.

Results: 168 offspring were identified with ASD resulting in a prevalence of 2.6% within the FASTER cohort. PNMS exposure (Overall 11%, n=684) was more frequent in offspring with versus without ASD (19%, n=32 vs. 10%, n=652, respectively; p=0.003). ASD relative risk (RR) associated with PNMS exposure was 1.72 (95% CI: 1.1-2.7, p=0.02). Familial predisposition of PNMS moderated ASD risk associated with PNMS exposure (RR=2.07, 95% CI: 1.22-3.51, p=0.007 in children having a familial PNMS predisposition vs RR=1.49, 95% CI: 0.66-3.33, p=0.33 in children without familial PNMS predisposition); however, no interaction existed between familial PNMS predisposition and PNMS exposure (p = 0.5). In contrast, a similar increased risk of ASD from PNMS exposure was identified in both children having familial risk for ASD (RR=2.20, 95% CI: 1.00-4.82; p=0.05) and those without familial ASD risk (RR=1.72, 95% CI: 1.04-2.84; p=0.03) suggesting no effect modification or interaction (p=0.6).

Conclusions: ASD risk increased by 72% in children exposed to PNMS and over 100% in children exposed to PNMS who shared a familial risk of PNMS. In contrast, while ASD risk was heightened in all children exposed to PNMS, a family history of ASD had an independent but not moderating or interactive effect on ASD risk. Whether PNMS impacts ASD's causal pathway or shares common etiologic factors with ASD, this association appears moderated by familial risk of PNMS, yet independent of familial risk of ASD. Study findings justify further investigation into the nature of this relationship as identifying shared preclinical precursors could establish prevention strategies for ASD.

207 **240.207** Prevalence and Clinical Characteristics of Social (Pragmatic) Communication Disorder in a Clinic-Referred Sample

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Background: Social (pragmatic) communication disorder (SCD) was only recently added to psychiatric nosology with the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Since it is a relatively new diagnosis, little is known about the clinical characteristics of those that receive it or how its symptomatology compares to that of autism spectrum disorder (ASD). SCD has been conceptualized as a milder form of ASD; an impairment in social communication in the absence of restricted and repetitive behaviors. Although there is evidence to support this characterization, the only studies to investigate the prevalence and characteristics of SCD have mapped data retrospectively on to the DSM-5 criteria. This is problematic because symptom definitions were expanded from the fourth (DSM-IV-TR) to the fifth edition of the DSM; therefore, clinicians using the DSM-IV-TR may not have fully assessed for symptoms in the DSM-5.

Objectives: The study objectives were to: (1) prospectively examine the prevalence of SCD in a sample of children referred for ASD evaluation, (2) describe the clinical characteristics of children with SCD, and (3) compare the characteristics of children with SCD to those of children with ASD and children with other diagnoses (clinic-referred comparison, CC).

Methods: Participants included 438 children and adolescents (2-17 years) referred for clinical evaluation for ASD who received diagnostic evaluations at one of six Autism Treatment Network sites. Assessments included review of records, diagnostic interview, Autism Diagnostic Observation Schedule-2ndEdition (ADOS-2), cognitive assessment, assessment of behavioral functioning (including Child Behavior Checklist, CBCL), and final determination of all relevant DSM-5 diagnoses.

Results: The prevalence of SCD was 1.4% (n = 6). Five males and 1 female received SCD diagnoses with a large range in both age (3-17) and IQ (86-115). For SCD cases, ADOS-2 Calibrated Severity Score (CSS) ranged from 1-7 (mean = 3.7), ADOS-2 Social Affect (SA) ranged from 1-9 (mean = 4.5), and ADOS-2 Repetitive Behavior (RRB) ranged from 1-7 (mean = 4.5). Mean ADOS-2 CSS, SA, and RRB scores were lower for the SCD than the ASD group (CSS = 7.3±1.9, SA = 7.3±1.9, RRB = 7.3±2.1), but higher for the SCD than the CC group (CSS = 2.9±1.9, SA = 3.5±2, RRB = 4±2.7). Mean CBCL Total, Internalizing, and Externalizing scores were lower for SCD cases than ASD and CC groups; however, range in the SCD group was large (e.g., 31-74 for Total score). Four SCD cases (66.7%) also met criteria for DSM-5 attention-deficit/hyperactivity disorder; three SCD cases (50%) also met criteria for DSM-5 generalized anxiety disorder.

Conclusions: This was the first large-scale prospective study to examine the prevalence and characteristics of SCD diagnoses in a clinically-

referred population. The results indicate that SCD diagnoses were rarely made across multiple sites and clinicians. Due to the small number of cases in this sample, it is difficult to make conclusions about clinical characteristics as a whole; however, it is notable that children and adolescents receiving SCD diagnoses demonstrated significant heterogeneity in terms of ASD symptomatology, cognitive functioning, and psychiatric comorbidity.

208 **240.208** Prevalence and Correlates of Medication Use in Youth with Autism and ADHD

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Background: Youth with autism spectrum disorder (ASD) may benefit from medication to treat symptoms of ASD and co-occurring conditions such as attention-deficit/hyperactivity disorder (ADHD) or anxiety. There are only two medications approved by the FDA for use in ASD - risperidone and aripiprazole (prescribed for irritability); there are no medications approved for the core symptoms of ASD (e.g. social communication and interaction deficits). Because prescribing guidelines based on impairment profile are lacking, clinical practice often takes a trial-and-error approach to prescription use. Research providing national estimates of medication use in youth on the autism spectrum is scant.
Objectives: Report nationally representative findings of the prevalence and correlates of ASD-specific medication use and behavioral medication use. First, we describe medication use in youth ages 6-17 with ASD-only, ASD and ADHD, and ADHD-only. Second, we examine correlates of medication use for youth in each group.

Methods: We used data from the National Survey of Children's Health (NSCH), combining data from study years 2016-2017. The NSCH is a cross-sectional, nationally representative survey designed to provide national estimates on the health and well-being of children from parent or caregiver report.

We estimated the prevalence of medication use for ASD symptoms based on parent report that their child was "currently taking medication for autism, ASD, Asperger's disorder, or PDD." We estimated the prevalence of behavioral medication use in the past 12 months for "difficulties with his or her emotions, concentration, or behavior." We then used logistic regressions to assess correlates of medication use.

Results: Youth with ASD-only were more likely to be male, Hispanic, and living in two-parent households than children with ASD and ADHD or children with ADHD-only. Youth with ASD and ADHD were the most likely to be taking medication for ASD symptoms (47% compared to 14% of youth with ASD -only), and behavioral needs (74% compared to 63% of youth with ADHD-only and 20% of youth with ASD-only).

For children and youth with ASD-only, older age and having a diagnosis of a mental, behavioral, or developmental disorder (MBDD) other than ASD or ADHD were both associated with significantly higher odds of medication use for both medication types. For children and youth with ASD and ADHD, use of both medication types was significantly higher among males and those with serious difficulty concentrating. For children and youth with ADHD-only, behavior medication use was more likely in those diagnosed with a MBDD or had difficulty concentrating.

Conclusions: Three quarters of youth with ASD and ADHD use medication for behavioral needs, more than youth with ADHD-only and ASD-only. About half of youth with ASD and ADHD used medication to treat ASD symptoms. There were only differences in medication use by age group for youth with ASD-only. This study highlights medication use for youth with ASD, providing a recent estimate of medication use in this population.

209 **240.209** Timing of Autism Spectrum Disorder Identification in the U.S. from the Autism and Developmental Disabilities Monitoring Network 2006-2012

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Background: Timely identification of autism spectrum disorder (ASD) is one of the critical factors determining whether children have access to early intervention services. The most recent estimate of median age at ASD diagnosis among those with a diagnosis by the age of 8 years from the 2016 Autism and Developmental Disabilities Monitoring Network (ADDM) cohort in the U.S is 4.3 years. Prior work in the ADDM network, as well as in smaller community-based studies suggests that age at ASD identification varies across subgroups by factors such as sex, race, ethnicity, geographic location, and socioeconomic status.
Objectives: Examine influence of socio-demographic characteristics on timing of ASD identification during 2006-2012 within the ADDM network.

Methods: The ADDM Network is an active surveillance system that provides ASD prevalence estimates among children age 8 years in parts of the U.S. Data for this analysis come from ADDM surveillance years (SY) 2006, 2008, 2010, and 2012 from communities in Alabama, Arkansas, Arizona, Colorado, Georgia, Maryland, Missouri, North Carolina, New Jersey, and Utah. Children were included in this analysis if they had an ADDM determined ASD case status, information from birth certificates and neighborhood level census data. Median age at ASD identification (AAI) was assessed for the full sample with ASD status as well as across socio-demographic, developmental, site, and surveillance subgroups. Nested, multivariate survival analyses examined how AAI associated with covariates of interest. A series of increasingly complex mixed-effects models were fit nesting child, family, surveillance characteristics clustered on census-tract level poverty and study site.

Results: 13,731 children with ASD case status were analyzed, 30% of whom were not identified as having ASD prior to ADDM abstraction and review at age 8. Compared to those with a documented AAI, children without a documented AAI were more likely to belong to a non-white racial/ethnic group and live in areas with >= 20% of the households below the federal poverty line, or "poverty areas". Incorporating the traditionally censored not-yet-identified children back into the sample with an ADDM-identification age of 8 years yielded a median AAI of 5.8. From SYs 2006 to 2012, median AAI decreased from 6.3 to 5.3 and there was a statistically significant trend towards earlier AAI across SYs. This trend towards earlier AAI was more pronounced in non-white racial/ethnic groups, as the gap in AAI was reduced from 2006-2012. The percentage of children not-yet-identified decreased across SYs from 35% to 25% between 2006 and 2012. The nested multivariate survival models showed that a later AAI was significantly associated with African-American or Hispanic race/ethnicity, lower maternal education, earlier cohort year, and single-surveillance

record source. Earlier AAI was significantly associated with having below average or missing data on IQ, higher maternal education, or being a member of a later birth cohort. Non-substantial variation was found across poverty level and study site variables.

Conclusions: Further examination of the role socio-demographic factors play in the ASD identification timing will help to inform and strengthen current identification infrastructure.

210 **240.210** Prevalence and Prediction of ASD in Non-Hispanic White and Non-Hispanic Black Children: Results from the 2017 National Survey of Children's Health

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Background: Despite the increasing rates of ASD prevalence in the United States, data from 2014-2016 reports that black children are less likely to be identified with ASD than white children (Baio et al., 2018; Xu et al., 2018). This difference in ASD prevalence may be because over 50% of black children with ASD are initially misidentified with another developmental condition (Mandell et al., 2007). Race may also influence when children are identified with ASD, although findings on this topic are mixed (Daniels & Mandell, 2014), suggesting that other demographic variables play a role in age of ASD identification.

Objectives: This study utilized data from the 2017 National Survey of Children's Health (NSCH) to calculate prevalence rates of ASD and related developmental conditions in Non-Hispanic White (NHW) and Non-Hispanic Black (NHB) children, and to determine which commonly-studied demographic variables independently predict age of ASD identification.

Methods: Primary caregivers living within the United States were randomly selected to complete demographic items about their families. The total sample included 14,593 NHW children (7,529M; 7,064F) and 1,290 NHB children (652M; 638F), ages 0–17 years. Caregivers reported whether a doctor, health care provider, or educator had ever told them that their child has ASD, and how old their child was at time of ASD identification. Based on this item, 422 NHW children (334M; 88F) and 35 NHB children (28M; 7F) were identified with ASD. Caregivers also reported whether their child had ever been identified with another developmental condition.

Results: Calculated rates of ASD prevalence showed that NHW children were more likely to be identified with ASD (3,028/100,000) than NHB children (2,713/100,000). However, NHB children were more likely to be identified with another related developmental condition, such as ADHD/ADD, speech disorder, conduct/behavioral problems, developmental delay, or intellectual disability, than NHW children (Figure 1). A linear hierarchical regression model demonstrated that when controlling for current age, having mild ASD symptoms, being female, and not having health insurance significantly predicted later age of ASD identification. Race, socioeconomic status, and geographical location did not significantly predict age of ASD identification (Table 1). Overall, the model accounted for 22.7% of variance in age of ASD identification.

Conclusions: Differences in ASD prevalence by race may reflect racial biases in identification, as NHB children are more likely to be identified with a related developmental condition instead of ASD. However, results of the regression model imply that race does not independently predict age of ASD identification. Other demographic variables (sex, ASD symptom severity, health insurance status) may have greater influence on age of ASD identification. Because this model only accounted for a portion of variance in age of ASD identification, future studies should continue to investigate which variables predict delayed ASD identification so that they can be targeted in public health program design. Additionally, these results should be interpreted with caution due to the low sample size of NHB children. Further efforts should be made to recruit more NHB children in the 2018 NSCH so that results better reflect the United States population.

211 **240.211** Prevalence of Autism Spectrum Disorders in Qatar: A National Epidemiological Survey

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Background: Few epidemiological data on autism spectrum disorders (ASD) exist for Arabic countries. In response to heightened public awareness and concerns about ASD, we conducted the first survey of autism in Qatar, a population with high level of consanguinity.

Objectives: To generate a first estimate of the prevalence of ASD among school age children in Qatar, using a whole population-based approach; and to evaluate correlates of ASD in a large representative sample of cases.

Methods: We surveyed the population of children age 5 to 12 (N=176,960) residing in Qatar in 2015. Children of Qatari and resident families were included. Case ascertainment relied on two complementary approaches. First, eligible children attending medical/special needs centers and schools providing diagnostic and treatment services for children with ASD were screened. Records of eligible children were abstracted and supplemented by parental interviews. Second, we performed a two-stage survey for regular primary school children. Following a screening with the locally validated version of the Social Communication Questionnaire (SCQ), random samples of screen positive and negative children were further evaluated to determine ASD case status. Prevalence among children age 6 to 11 was estimated after taking into account different sampling fractions and participation rates at each survey phase. Medical, developmental, educational and behavioral data were collected on all ASD cases and analyzed to describe trajectories of ASD children.

Results: 1,393 children already diagnosed with ASD were identified through the medical and educational centers. Among 9,074 participants in the school survey, 773 (8.5%) were screened positive. In the diagnostic confirmation phase, 163 screen positive and 760 screen negative children were evaluated; 17 were confirmed to have ASD, including 5 children newly diagnosed. Combining data from the two samples, prevalence was estimated to be: 1.14% (95% CI: 0.89-1.46) among 6 to 11 year olds, 1.81% (95% CI: 1.41-2.31) among boys, 0.44% (95% CI: 0.35-0.57) among girls, and 1.52% (95% CI: 1.19-1.94) among 8 year olds. Analysis of detailed information on 844 ASD cases (mean age: 7.2 years; 81% male) showed ASD recurrence in 5.9% full siblings and 9.65% relatives. Most children had experienced language delay (75.1% for words; 91.4% for phrase speech), and 19.4% reported developmental regression. At the time of the survey, a substantial minority of subjects had persisting deficits in expressive language (19.4%), peer interactions (14.0%), behavioral problems (ADHD: 30.2%; anxiety: 11.0%) and 20.5% required behavioral support at school. About 25% of the sample scored high on a composite indicator of severity. In multivariate logistic regression, ASD severity was associated with parental consanguinity, gestational diabetes, delay in walking, and developmental regression.

Conclusions: This study provides the first estimate of ASD prevalence in Qatar which is consistent with recent international studies. The instruments and methods employed should help in designing comparable surveys in the region. We estimated that 50,500 children under age 5

and 187,000 youths under age 20 have ASD in the Gulf countries. This estimate should guide planification of health and educational services in the Gulf countries for a population that is young and growing fast.

212 **240.212** Prevalence of Co-Occurring Mental Health Diagnoses in the Autism Population: A Systematic Review and Meta-Analysis

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Background: Autism spectrum disorder (hereafter 'autism') is a neurodevelopmental condition characterized by social-communication difficulties and repetitive/stereotyped behaviours. Autism has a prevalence of around 1% worldwide, and co-occurring mental health/psychiatric conditions (CMHCs) are common, where it is estimated that as many as 70% of individuals with autism have at least one CMHC, and almost 50% are diagnosed with multiple CMHCs. For autistic people, having CMHCs impedes quality of life and leads to poorer long-term outcomes. Accurate pooled prevalence estimates for CMHCs in autistic individuals are needed to enhance recognition and care. However, prevalence estimates in the current literature vary greatly across studies.

Objectives: (1) To determine the best estimates of CMHC in autism and; (2) to identify moderators that account for heterogeneity across studies.

Methods: We conducted a systematic review and meta-analysis according to MOOSE and PRISMA standards. Published studies from 1993 to September 2018 were screened, and articles were included if they were (1) published in English or French, (2) reported on the prevalence rates of CMHCs in individuals with autism and (3) reported confirmed clinical diagnoses of CMHC and autism using DSM, or ICD-based criteria. Abstracts and full-text articles were reviewed, and risk of biases was assessed. The overall pooled estimate of prevalence for different CMHCs in autism was determined using a random-effects model, and reported as a percentage with 95% confidence intervals. Estimates were then stratified by study design (population/registry vs. clinical sample based). Heterogeneity was investigated using random-effects meta-regression models.

Results: Out of 9,515 unique studies, 420 were selected for full text review. CMHCs with sufficient data for meta-analysis (83 studies) showed overall pooled estimates of: ADHD 33% (95%CI 29-37%), anxiety disorders consistent with DSM-IV, DSM-5 or ICD-10 classification 23% (19-27%), anxiety disorders consistent with DSM-5 classification only 22% (17-27%), sleep-wake disorders 13% (7-20%), depressive disorders 12% (9-14%), obsessive-compulsive disorder 10% (8-13%), disruptive, impulse control and conduct disorders 10% (8-13%), schizophrenia spectrum disorders 5% (4-7%), and bipolar disorders 5% (3-7%). Estimates in clinical studies were higher than population/registry-based studies for most CMHCs. Age, gender, intellectual disability and country of origin were associated with heterogeneity across studies.

Conclusions: Given that evidence-based interventions are available, careful assessment of mental health concerns is an essential component of care for all autistic people.

213 **240.213** Regional Variations in the Prevalence and Median Age of Diagnosis of Autism Spectrum Disorder in Arkansas

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Background:
The Autism and Developmental Disabilities Monitoring (ADDM) Network gathers data on Autism Spectrum Disorder (ASD) and other developmental disabilities in multiple sites, including Arkansas (AR), in the United States. The AR ADDM data shows a higher median age of diagnosis (SY 2002, 2010 and 2014) and a lower identified prevalence of ASD compared to the ADDM Network average 2014.

Objectives: Given that AR is a largely rural (non-urban) state, we suspect that children living in non-urban areas have more difficulty accessing healthcare resources compared to urban areas. We hypothesize that the identified prevalence of ASD is lower for children in non-urban areas and the median age of diagnosis is higher for children in non-urban areas.

Methods: AR ADDM data was collected statewide for study years (SY) 2002, 2010 and 2014. The methodology is modeled on a standardized retrospective record review created by the CDC's Metropolitan Atlanta Developmental Disabilities Surveillance Program (MADDSP). Counties were then categorized into urban versus rural (non-urban) areas for comparison based on U.S. Census Data. Data analyzed included prevalence (subdivided by race and ethnicity) per 1000 of 8-year-old children diagnosed with ASD and the median age (in months) at earliest evaluation confirming an ASD diagnosis.

Results: The identified prevalence of ASD was significantly higher in urban areas compared to non-urban areas for the total population in SY 2010 and 2014. When looking at the different racial/ethnic groups, this trend is also true for Non-Hispanic Whites in SY 2010 and 2014 but not for other racial/ethnic groups. There was no significant difference in identified prevalence between Black Non-Hispanics and Hispanics (of any race) living in urban and in non-urban areas for any study year. There was no significant difference in median age of diagnosis in non-urban versus urban areas for 2002, 2010 and 2014 for the total population.

Conclusions: The data supports the hypothesis that there is a lower identified prevalence for children in non-urban areas compared to urban areas overall in 2014 (but not in 2010). This is likely due to differences in identified ASD prevalence in non-urban versus urban areas in the White population. The majority of children in Arkansas (as well as this study) are White. This would explain why differences in non-urban versus urban areas in this group greatly impact the total population. Furthermore, there was a much smaller number of Non-Hispanic Black and Hispanic children in the study which may affect why a significant difference was not observed. The data does not show a difference in median age of diagnosis for children in non-urban areas versus non-urban areas for the total population. This study is limited by incomplete race/ethnicity data for SY 2014 (Approx. 15% in Other, Missing, Unknown) and incomplete access to educational data in non-urban counties (but not urban areas) for SY 2014. Further studies are needed to determine contributors to the regional differences, such as migration patterns and limited access to healthcare providers, noted in this study.

214 **240.214** Suicidality in Autism Spectrum Disorder Comorbid with ADHD Symptoms in a Non-Clinical School-Aged Population

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Background: Recent studies have indicated an association between autistic traits and suicidality in clinical and non-clinical cohorts (Cassidy et al., 2014; Pelton & Cassidy, 2017). Attention deficits and hyperactivity disorder (ADHD), which are highly comorbid with autism spectrum disorder (ASD), were also reportedly associated with suicide (Impey & Heun, 2012).
Objectives: However, to our knowledge, no studies have yet examined the relationship between ASD and suicidality considering the comorbidity of ADHD symptoms.Therefore, this study examined how ASD and ADHD symptoms interact with suicidal ideation in non-clinical school-aged population.

Methods: A 1-year, prospective school survey including 8,669 children aged 6–14 years at baseline and their parents was conducted in 2016 (time 1) and 2017 (time 2). At time 1, we administered parent-reported ASD and ADHD traits scale (ASD: Autism Spectrum Screening Questionnaire, ADHD: ADHD-Rating Scale)- and self-reported depression scale (Depression Self-Rating Scale for Children: DSRS-C)-based questionnaires, which included items of suicidal ideation. At time 2, DSRS-C was re-administered. For group comparison, participants were divided into eight groups according to the combination of ASD and ADHD traits: (1) non-risk, (2) ASD at risk, (3) inattention (IA) at risk, (4) hyperactivity (HA) at risk, (5) ADHD at risk, (6) ASD + IA at risk, (7) ASD + HA at risk, and (8) ASD + ADHD at risk. Kruskal–Wallis tests were performed with groups as an independent variable and suicidal ideation scores at time 2 as a dependent variable. Subsequently, a series of pass models was computed to examine whether ASD and ADHD traits predict suicidal ideation. Cross-sectional associations at time 1 and longitudinal associations at time 2 were examined.

Results: Kruskal–Wallis tests revealed that ASD and ADHD traits were risk factors for suicidal ideation. Pair-wise comparison revealed that suicidal ideation was significantly higher in the ASD + IA group than in the other groups (ASD + IA > ASD at risk, IA at risk, HA at risk, ADHD at risk, $p < .01$). Results of the path analysis revealed that higher ASD and IA traits were associated with higher levels of suicidal ideation at time 1 (ASD: $b = .076$ BCa, CI [.048, .103], $p < .001$; IA: $b = .120$ BCa, CI [.085, .155], $p < .001$). There was a significant indirect effect of ASD and IA traits on suicidal ideation at time 1 through suicidal ideation at time 2 (ASD: $b = .040$ BCa, CI [.025, .054], $p < .001$; IA: $b = .062$ BCa, CI [.044, .081], $p < .001$). These results indicate that higher ASD and IA traits predict a higher risk for suicidal ideation at time 2 by mediating suicidal ideation at time 1. HA traits consistently showed no significant association with depression and suicidal ideation.

Conclusions: The results of this study suggested that autistic and inattentive symptoms were risk factors for suicidality. Individuals with inattentive symptoms of ASD have a higher risk for suicide.

215 **240.215** The ABA in PA Initiative's Analysis of ABA Providers in the Commonwealth of Pennsylvania

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Background: Pennsylvania's Department of Human Services was not ensuring appropriate availability or quality of Applied Behavior Analysis (ABA) for children with Autism Spectrum Disorder (ASD). This left individuals throughout the state unable to access this medically necessary intervention. ABA therapy is an evidence-based intervention proven to significantly help children with ASD in many developmental domains. The ABA in PA Initiative, a 501(c)(3) advocacy organization, supported the Disability Rights Network of Pennsylvania in a class action lawsuit (Sonny O. v. Dallas) filed in 2014 to hold the Pennsylvania Department of Human Services accountable. While the lawsuit was decided favorably, the terms of the settlement are now being implemented. As a result of the lawsuit, ABA must meet evidence based standards that are published by the Behavior Analyst Certification Board. This settlement opened the door for a large number of behavior analysts to move into the state. However, there is very little information currently known about the availability and quality of care delivered by provider agencies.
Objectives: We seek to evaluate changes in the landscape of ABA provider agencies over the years following the Sonny O v Dallas lawsuit settlement by measuring key agency and provider metrics.

Methods: The ABA in PA Initiative has maintained a directory of ABA providers for Pennsylvania since 2014. This directory is voluntary and agencies are added based on our own web-search for provider agencies and by an agency reaching out to us to be added. We use social media platforms (e.g., Facebook, Twitter, LinkedIn) for outreach purposes. Agencies qualify if they provide ABA services to children in PA. To learn about provider qualifications and availability, agencies will be queried via survey on a variety of agency characteristics.

Results: To date we have collected simple demographics (e.g., contact information, counties served) for 105 agencies. Cursory analysis indicates that 48% currently take Medicaid and 52% do not. All agencies indicate that they employ at least 1 BCBA/BCBA-D (Board Certified Behavior Analyst), 17% indicate they employ BCaBA's (Board Certified Assistant Behavior Analyst) and 49% indicate they employ RBTs (Registered Behavior Technicians). An 11-item survey was developed to capture key additional information including 1) agency size, 2) number of providers that hold the BCBA, BCaBA or BCBA-D certification as well as those who hold the RBT credential, 3) The percentage of cases staffed with certified and credentialed providers, 4) payer mix to include Medicaid, and 5) hiring and staffing strengths and barriers. Survey questions have been created and a link embedded in an email will be used to request agency input. Participation is voluntary but each agency that responds will be entered to win a gift card. Surveys will be emailed every 6 months for 18 months and all responses will be kept confidential in REDCap.

Conclusions: While the Sonny O. v. Dallas class action lawsuit opened the door for behavior analysis in Pennsylvania, characterizing changes to ABA provider agencies using key provider metrics will be important to understanding the needs of children with developmental disabilities in the years ahead.

216 **240.216** The Association of Eating Behavior in Infancy and Later Autistic Traits: Results from a Population-Based Study

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Background: A recent review indicates that breastfeeding may protect against later autism but also emphasized the lack of prospective studies evaluating this association.It remains unknown whether, besides feeding mode, eating behavior of infants is associated with autistic traits, while recent evidence points at a link between eating behavior and autistic traits across childhood. Knowledge about whether early-life feeding and eating behavior predict later autistic traits can be useful to enhance the detection of autism at an early stage.

Objectives: To investigate the association of breastfeeding and eating behavior in infancy with later autistic traits, and the sex-specificity of this association, in the general population sample Generation R.

Methods: We included 3546 mother-child dyads with maternal reports on feeding and eating at two months and autistic traits at six years. We assessed eating behavior with seven specific eating habits. The Social Responsiveness Scale was used to assess autistic traits. Covariates included child gender, maternal psychopathology and maternal autistic traits.

Results: Breastfeeding at two months was associated with a lower autistic trait score at six years (adjusted B=-0.07; 95% CI, -0.14 to -0.00). Children who were drinking only small quantities (adjusted B=0.17, 95%CI, 0.04 to .030) and being hungry/not satisfied (adjusted B=0.23, 95%CI, 0.08 to 0.39) at two months had more autistic traits at six years. No interactions with gender or breastfeeding were found. Drinking slowly or very greedily, spitting up a lot, regurgitating, or refusing breastfeeding in infancy and was not significant related to later autistic traits.

Conclusions: Breastfeeding and eating behavior during infancy are related with autistic traits later in childhood. Although associations were fairly small, these findings suggest that autism screening instruments mighty benefit from an assessment of early-life eating problems.

217 **240.217** Perinatal Factors Associated with Autism Spectrum Disorder in Jamaican Children

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Background: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder with no well-defined etiology, mostly believed to stem from complex genetic-environmental interactions. Many environmental exposures during the crucial stages of neurodevelopment, which begins in the first few weeks of gestation and continues into early childhood, have the potential to contribute to ASD. Perinatal exposures such as mode of delivery and suboptimal characteristics at birth, including preterm birth and low birth weight as indicators of intra-uterine development, are thought to be associated with neurodevelopmental disorders such as ASD.

Objectives: To investigate the possible association of three perinatal factors, mode of delivery (cesarean vs. vaginal), low birth weight (<2500 gram), and preterm birth (before 37 weeks of gestational age) with ASD in Jamaican children.

Methods: We used data from the Epidemiological Research on Autism in Jamaica (ERAJ) and ERAJ-2 studies, which enrolled 343 pairs of age-(± 6 months) and sex-matched ASD cases and typically developing controls, collected during 2009-2018. We performed conditional logistic regression analyses to assess the possible association of each perinatal factor with ASD while controlling for potential confounders. Additionally, we explored potential interactions between the perinatal exposures and other covariates in relation to ASD in the multivariable conditional logistic regression models. Matched odds ratios (MORs) and their 95% confidence intervals (95% CIs) were calculated.

Results: Our findings suggest a significant unadjusted association between cesarean delivery and ASD [MOR (95% CI): 1.79 (1.23-2.60), *P* = 0.002]. In the multivariable analysis, we found that the parish of residence may be an effect modifier for the association between cesarean delivery and ASD in Jamaican children. Specifically, for children who lived in Kingston parish which has mainly urban residents, cesarean delivery was significantly associated with ASD after adjusting for the age of the parents at the child's birth [adjusted MOR (95% CI): 2.34 (1.19-4.61), *P*=0.013], whereas this association was not significant for children from other parishes with a higher percentage of rural residents [adjusted MOR (95% CI): 0.94 (0.52-1.69), *P* = 0.824]. Additionally, although not statistically significant, the association between low birth weight and ASD appeared to be modified by car ownership of the parents as a measure of the household socioeconomic status (SES) in Jamaica, after adjusting for the age of the mother at the child's birth [adjusted MOR (95% CI): 1.79 (0.89-3.64), *P* = 0.10 for low SES (i.e., families who did not own a car), and 0.64 (0.30-1.36), *P* = 0.248 for high SES (i.e., families who owned a car)]. Our findings do not support a significant association between preterm birth and ASD after adjusting for the age of the parents at the child's birth and SES [adjusted MOR (95% CI): 1.21 (0.66-2.20), *P* = 0.539].

Conclusions: Our findings suggest that the parish of residence may be an effect modifier of the association between cesarean delivery and ASD in Jamaican children. Also, SES may be an effect modifier of the association between low birth weight and ASD in Jamaica. These findings require replication in future studies.

218 **240.218** The Possible Modifying Effect of Maternal Age on the Association between Breastfeeding and Autism Spectrum Disorder in Jamaican Children

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Background: Breastfeeding, especially for longer than 6 months after birth, has been shown to have medical, developmental and cognitive benefits in children. Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that occurs in early childhood and has long-term consequences throughout life. Several studies have investigated the possible role of breastfeeding in susceptibility to ASD but some of the findings are conflicting. This could be due to lack of attention to the possible synergic effect of breastfeeding and maternal age in ASD. Since neurodevelopment begins in the first few weeks of gestation and continues into early childhood, and breastfeeding practices may depend on maternal age, it is important to investigate the possible role of maternal age as an effect modifier of the possible association of breastfeeding or its duration and ASD.

Objectives: To investigate the possible role of maternal age as a modifier of the effect of breastfeeding, and its duration in ASD in Jamaican children.

Methods: We used data from the Epidemiological Research on Autism in Jamaica (ERAJ) and ERAJ-2 study, which enrolled 343 pairs of age-(± 6 months) and sex-matched ASD cases and typically developing controls. Conditional logistic regression analyses were performed to assess the possible association of breastfeeding, and its duration with ASD while controlling for potential confounders. Additionally, interactions between maternal age and breastfeeding were explored in relation to ASD. Matched odds ratios (MORs) and 95% confidence intervals (95% CIs) are reported for each of the two levels of the maternal age (i.e., <35 and ≥35 years).

Results: In univariable analysis, we did not find any significant association of being ever breastfed with ASD [MOR = 1.22, 95%CI (0.66-2.28), *P* =0.528]. Similarly, no significant univariable association was observed between the duration of breastfeeding and ASD when breastfeeding for >3-6, >6-12, and >12 months were compared to ≤3 month of breastfeeding [Overall Wald test *P* = 0.712, MORs (95% CI): 1.05 (0.68-1.63), 1.17 (0.74-1.86), 0.90 (0.59-1.38), respectively]. However, in the multivariable model, maternal age appeared to be a possible effect modifier for the association between breastfeeding duration and ASD. Specifically, among mothers who were ≥ 35 years of age, the association between breastfeeding duration and ASD was marginally significant when breastfeeding for >3-6, >6-12, and >12 months were compared to ≤3 months of breastfeeding [MOR (95%CI): 0.30 (0.09-1.09), *P* = 0.067; 0.44 (0.14-1.38), *P* = 0.159; and 0.35 (0.11-1.12), *P* = 0.076, respectively]. Whereas, among mothers who were <35 years of age, no statistically significant associations were observed when breastfeeding for >3-6, >6-12, and >12 months were compared to ≤3 months of breastfeeding [MOR (95% CI): 1.19 (0.73-1.94), *P* = 0.475; 1.23 (0.72-2.09), *P* = 0.449; and 0.94 (0.59-1.50), *P* = 0.805, respectively].

Conclusions: Findings from this study imply that Jamaican children whose mothers are 35 years or older may potentially benefit more from breastfeeding for a duration of more than 3 months to protect against ASD compared to those whose mothers are younger than 35 years. These findings require replication in future studies.

219 **240.219** Prevalence and Expression of ASD Among Preschool Age Children in New Jersey: 2010-2014

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Background:

Autism Spectrum Disorder (ASD) surveillance of 4-year old children by a population-based method may offer an opportunity to observe shifts in ASD prevalence early and provide timely information on progress toward early identification goals.

Objectives:

The objectives were to estimate ASD prevalence and describe the expression of ASD in three complete birth cohorts (birth years: 2006, 2008, 2010) at age four, residing in a well-defined metro region and to describe changes in the distribution or expression of ASD, during the period.

Methods:

Case-specific information was from three cycles of active ASD surveillance, according to the Centers for Disease Control and Prevention (CDC) multiple source ascertainment method, reflecting retrospective review and independent analysis of information contained in health and education records. Surveillance confirmed and described individuals with ASD (age 4 years) from the 2010, 2012 and 2014 cycles of ASD monitoring in Essex and Union counties New Jersey and provided demographic data as well as information on the distribution by sex and race/ethnicity and case characteristics, including level of impairment due to ASD, age at first (professional) evaluation, age of ASD diagnosis, cognitive functioning level as indicated by intelligence quotient (IQ) scores. Confidence intervals were based on Poisson sampling distribution. Group differences were compared by Pearson Chi-Square and Fisher's Exact Tests.

Results:

One thousand, two hundred and seventy four year-old children with ASD were identified in the two county New Jersey surveillance region. ASD prevalence was 19.7 per 1000 (95% CI 17.7, 21.9) in 2010, 22.0 per 1000 (95%CI 19.9, 24.2) in 2012, and 28.3 per 1000 (95%CI 25.9,30.9) in 2014, reflecting a 44% increase. Males with ASD outnumbered females 4:1 but ASD prevalence estimates for white, black and Hispanic children were similar. Intellectual Disability (ID) was identified in a significant but consistent portion of ASD preschoolers (37-41%). Thirty-five to forty percent of surveillance determined ASD cases had an ASD diagnosis by a community provider. Over the four-year period, an increasing proportion of children received an autism test (2010 = 28%, 2012 = 39%, 2014=38%; p<.01). The proportion of ASD children with severe impairment increased (2010 = 19%, 2012 = 20%, 2014 = 23%; p<.001). The proportions of ASD children receiving their first professional evaluation by 24 months and 36 months decreased significantly between 2010 and 2014 (p<0.001).

Conclusions:

Our findings show a 43% increase in ASD prevalence in a young cohort (4 year-olds) from 2010-2014. During this period and in the same region, ASD prevalence increased by 26% in an older cohort (8 year-olds) of individuals, suggesting that ASD prevalence has not peaked and that future peak ASD estimates will be higher. Unexpectedly, our findings disclose that the age of first evaluation is increasing and that fewer ASD children are receiving evaluations by 24 and 36 months.

220 **240.220** Title: Sex-Based Differences in the Diagnosis and Expression of Autism Spectrum Disorder (ASD) Among Preschool-Age Children: Findings from Population-Based Surveillance in New Jersey

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Background:
There are few studies of ASD in the preschool period based on detailed information derived from active surveillance of large, population-based, cohorts. While Autism Spectrum Disorder (ASD) prevalence estimates have increased from 6.5 per 1,000 in 2000 to 1.7 per 1,000 in 2014, one finding has remained consistent overtime, the male to female ratio. Males are four times more likely than females to be diagnosed with ASD.

Objectives:

The purpose of this study is to identify sex-based differences in the diagnosis and expression of autism among preschool age children in a large, multi-cohort, population-based sample.

Methods:

Children with ASD born in 2006, 2008 and 2010 and residing in Essex and Union counties New Jersey in 2010, 2012 and 2014, respectively, were identified from successive cycles of active (multiple source) surveillance, using a Centers for Disease Control and Prevention (CDC), ascertainment method, based on retrospective review and analysis of information contained in health and education records. Information on the expression of ASD according to DSM criteria, associated features, level of cognitive functioning, previous ASD diagnosis and ASD tests provided, as well as demographic information was systematically abstracted and analyzed. Group differences were compared using Pearson Chi-Square and Fisher's Exact Tests.

Results:

A total of 1,270 four-year-old children with ASD were confirmed across three cycles of surveillance. Boys with ASD outnumbered girls with ASD 4 to 1 (boys = 1,012, 80%; girls = 258, 20%). Boys and girls with ASD had similar proportions of cognitive impairment (boys = 39%; girls = 34%). Overall, 57% had a previous ASD diagnosis from a community-based provider and the proportion of ASD-diagnosed children did not differ by sex. Boys were more likely to be administered an Autism test than girls (37% vs 31%, $p<0.05$). Boys and girls with ASD manifested differently. With regard to DSM criteria, boys were more likely to exhibit deficits in nonverbal communication, such as eye contact, than girls (90% vs 85%, $p<0.01$). In addition, boys were also more likely to exhibit restricted patterns of interest (48% vs 34%, $p<0.001$) and inflexible adherence to nonfunctional routines (78% vs 70%, $p<0.1$). Boys demonstrated sensory processing deficits more frequently (47% vs 37%, $p<.01$) than girls and boys were more likely to exhibit the associated features: aggression, opposition and hyperactivity than girls ($p<0.05$).

Conclusions:

The expression of ASD in preschool age boys with ASD is more likely to include deficits in non-verbal communication, as well as to show restricted patterns of interest and non-functional routines than girls with ASD. In addition, young boys with ASD are more likely to express a number of additional, salient, associated features such as hyperactive, oppositional and/or aggressive behavior. Satisfying DSM-5 ASD criteria requires key social communication deficits including deficits in nonverbal communication, presence of restricted and/or repetitive behaviors and/or sensory processing deficits that are manifest in young boys more frequently than girls with ASD, thereby raising the possibility that preschool age girls with ASD will be diagnosed later than boys in the DSM-5 era.

221 **240.221** Trends in Birth Prevalence of Autism Spectrum Disorders (ASD) in California from 1990 to 2010, By Race-Ethnicity and Income

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Background: An increase in the prevalence of autism spectrum disorders (ASD) has been noted worldwide over the past 50 years, leading to efforts to identify the reasons. At least some of the increase has been attributed to increased awareness and changes in diagnostic practices or tools. However, access to diagnosis may differ depending on familial sociodemographic factors.
Objectives: To characterize trends in ASD birth prevalence in California over two decades by race-ethnicity and income.

Methods: Data on ASD diagnoses were obtained using statewide Department of Developmental Services (DDS) data of clients receiving services for autism as of February 2018. DDS data were linked to birth certificate data for live births to California resident mothers from 1990 to 2010, excluding infant deaths. The linked data therefore represent children who were at least 7 years old at the time of entry into the DDS system. Annual ASD birth prevalence (cases per 1,000 births) was calculated overall and for non-Hispanic white, non-Hispanic black, and Hispanic mothers, and further stratified by insurance type during pregnancy or delivery, with public insurance used as a marker of low income. Average annual percent change (AAPC) in birth prevalence and change in AAPC were assessed using Poisson regression.

Results: A total of 89,107 cases were identified from 13,014,703 births. ASD birth prevalence increased from 1.9 to 11.7 between 1990 and 2010, or 7.5% annually. The AAPC was highest for children of Hispanic mothers (9.2%, vs. 8.0% for blacks and 6.3% for whites; $p<.001$) and for low-income (publicly insured) families regardless of race-ethnicity (10%, vs. 6.1% for privately insured; $p<.001$). Trends in ASD birth prevalence differed by time period. For children born from 1990 to 2000, ASD prevalence was similar for children of white and black mothers, and lower for Hispanics, with annual increases of 11.2%, 9.5% and 14.2%, respectively. Over the next decade, the AAPC in ASD prevalence decreased to 3.5%, 7.1% and 7.0% among children of white, black and Hispanic mothers, respectively. The largest decrease in the AAPC between decades was for white mothers who were privately insured (AAPC from 10.1% to 1.8% after birth year 2000; $P<.001$). By 2010, ASD prevalence among children of black mothers was significantly higher than among children of white mothers (14.9 vs. 10.7), and Hispanic prevalence (11.4) was similar to white prevalence.

Conclusions: In this large, population-based analysis over 21 years, ASD prevalence increased for white, black and Hispanic children in California, but at different rates so that Hispanic prevalence matched that of whites, and black prevalence exceeded that of whites. Increases were particularly noteable among low-income families. These increases may reflect improved access to screening, diagnosis and/or services.

222 **240.222** Use of Psychotropic Drugs Among Children and Adolescents with Autism Spectrum Disorders in Denmark: A Nationwide Drug Utilization Study

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Background: Children with autism spectrum disorder (ASD) have a considerable use of psychotropics, although no pharmacological agent has proven to be effective against the core symptoms of ASD.
Objectives: We aimed to describe the use of ADHD medication, antidepressants, antipsychotics and melatonin in children and adolescents with ASD in Denmark. More specifically, we wanted to explore changes in prevalence of medication use over time and the duration of drug use. Based on the most recent data, we further explored how medication use is affected by age, sex and psychiatric comorbidities.

Methods: Using the Danish nationwide health registries, we identified all children and adolescents born between 1992 and 2011 with a diagnosis of ASD after the age of three and before the age of 18. We extracted data on all their psychotropic prescriptions and psychiatric hospital diagnoses from birth and until the end of 2017.

Results: The study population comprised 23,935 Danish children and adolescents born in 1992–2011 with an ASD diagnosis. Use of melatonin and attention-deficit/hyperactivity disorder (ADHD) medication increased from 2010 to 2017, while there were limited changes in use of antidepressants and antipsychotics. Thirty percent of the identified children used psychotropics in 2017 most commonly ADHD medication (17%) and melatonin (13%). Methylphenidate, sertraline and risperidone were most often prescribed. Most children filled more than one prescription and, across drug classes, at least 38% received treatment two years after treatment initiation. Use of psychotropics followed psychiatric comorbidities. Comorbidities did not affect age at treatment initiation. Use of psychotropics varied according to age and sex with limited use in the youngest children.

Conclusions: In summary, psychotropic drug use has increased in children with ASD mainly due to an increase in the use of ADHD medication and melatonin. In accordance with previous studies, use seems to follow comorbidities. The long treatment duration underlines the need to investigate long-term effects of psychotropic drug use in children with ASD.

223 **240.223** Wandering Among Preschool Children with and without Autism Spectrum Disorder: Occurrence and Association with Injuries

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Background: Research suggests that children with autism spectrum disorder (ASD) may wander from safe environments, which places them at increased risk of sustaining injuries. Wandering is moving about from place to place with or without a fixed plan. Wandering is most often studied in samples of children 48 months and older since it is common among toddlers learning to explore their environment and assert independence.
Objectives: The objectives of this study were to:

1. Compare the occurrence of wandering among children 48 months and older in three study groups: ASD, other (non-ASD) developmental delay (DD), and population comparison (POP); and
2. Assess the association between wandering and injuries in each of the three study groups.

Methods: Participants were children 48 months and older enrolled in the Study to Explore Early Development Phase-1 (SEED1). SEED1 is a multisite, community-based study of preschool children designed to investigate the development and risk factors of ASD. The Social Communication Questionnaire (SCQ) assessed symptoms of ASD for all children upon study enrollment. Those with an SCQ score of 11 or higher or a previous diagnosis of ASD received a comprehensive evaluation that consisted of the Mullen Scales of Early Learning (MSEL) and Autism Diagnostic Observation Schedule (ADOS). Parents were interviewed with the Autism Diagnostic Interview – Revised (ADI-R). Results of the ADOS and ADI-R determined ASD status. All other children received a limited developmental evaluation that consisted of only the MSEL.

We examined two injury outcomes. For all children, parents responded during a telephone interview whether their child ever had an injury that required medical attention (yes/no). Parents also completed the Child Behavior Checklist (CBCL), which included items on the frequency of their child getting hurt or being accident-prone (never or sometimes/often) and the frequency of wandering (never/sometimes or often). Attention deficit/hyperactivity (ADHD) problems (yes/no) also was determined from the CBCL; intellectual disability (ID, yes/no) was determined from the MSEL. Associations were assessed for each study group between wandering and being hurt/accident-prone and sustaining an injury that required medical attention. Regression models included ADHD risk, child sex, ID, and maternal education as potential confounders.

Results: The analytic sample included 2,215 children: 610 ASD, 842 DD, and 763 POP. There were significant differences in parental report of wandering based on study classification (χ^2=354.82, p<.001): 57.9% of children with ASD wandered compared to 25.1% of children with other DDs and 12.1% of POP group children. Children reported to wander were more likely than those reported not to wander to get hurt or be accident-prone (ASD odds ratio (OR)=1.55 (1.01,2.25); DD OR=2.51 (1.71,3.68); POP OR=2.52 (1.51,4.22). However, wandering was not associated with injuries that required medical attention in any study group.

Conclusions: Children with ASD wander significantly more than other children do in the SEED1 sample. Parent-reported wandering was associated with getting hurt or being accident-prone but not with sustaining an injury that required medical attention. Future research could explore the antecedents and consequences of wandering in children with ASD and influence on family functioning and child health outcomes.

Poster Session
241 - Ethics
11:30 AM - 1:30 PM - Room: 710

224 **241.224** Examining the Engagement of Community Partners in Autism Research within the Autism CRC

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Background: Participatory approaches to research are gaining increased popularity as efficacious methods for conducting health research and research with minority populations. Recently, there has been growing recognition within the research community of the need to engage with the autistic community and other stakeholders not only as research participants, but as active and equal partners in the research process. In Australia, the Cooperative Research Centre for Living with Autism (Autism CRC) has been at the forefront of this movement with their commitment to investing in inclusive and participatory autism research, and have implemented strategies to encourage research co-production. However, to date it has been unclear whether the Autism CRC's goal of inclusive research practice has translated into genuine engagement with community partners throughout the process of Autism CRC funded research projects.

Objectives: This study aimed to examine the nature and extent of community partner engagement within research projects funded by the Autism CRC, by gathering perspectives from both academic and community partners involved in Autism CRC research. We investigated questions such as: are Autism CRC researchers engaging with community partners? If so, how often, and with which community stakeholders? How effective do they perceive this engagement to be? In addition, we aimed to examine whether community and academic partners hold similar or differing perspectives of the nature and extent of community engagement within Autism CRC research.

Methods: Autism CRC Project Leaders (n = 31) were asked to nominate all academic partners (research professionals and research students) and community partners (autistic people, family members, service providers etc.) involved in their Autism CRC-invested research projects. All nominated partners were then invited, via email, to participate in an anonymous online survey. The online survey was designed to measure key elements of participatory research, and was adapted from a measure designed by Oetzel et al. (2018).

Results: Nineteen Autism CRC Project Leaders nominated a total of 163 potential participants, including an estimated 35 community partners and 128 academic partners. Data collection is ongoing, with a total of 21 survey responses (17 academic partners and 4 community partners) gathered to date. Preliminary data indicate that Autism CRC research partners are generally supportive of community engagement in autism research (M = 4.05, SD = 0.67, where 1 = preference for no community engagement and 5 = preference for extensive community engagement). Community engagement was perceived by participants as generating outputs that were more relevant to the autistic community, however efforts to engage with community partners were felt to be hampered by short timeframes, limited resources, and lack of cohesion within the autism community.

Conclusions: Based on preliminary findings, it appears that Autism CRC community and academic partners endorse the organisation's commitment to produce inclusive autism research. Despite the Autism CRC's efforts to implement participatory research approaches, however, there may well be substantial barriers limiting genuine and meaningful community engagement.

225 **241.225** Family Response to Autism Recurrence Risk: Implications for Early MRI Prediction

K. E. MacDuffie[1], *L. Turner-Brown*[2], *J. Pandey*[3], *A. Estes*[4], *S. R. Dager*[4], *J. Pruett*[5], *J. Piven*[6], *H. Peay*[7] *and .. The IBIS Network*[8], *(1)Speech and Hearing Sciences, University of Washington, Seattle, WA, (2)UNC TEACCH Autism Program, University of North Carolina at Chapel Hill, Chapel Hill, NC, (3)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (4)University of Washington, Seattle, WA, (5)Washington University School of Medicine, St. Louis, MO, (6)*Co-Senior Authors, IBIS Network, University of North Carolina, Chapel Hill, NC, (7)Research Triangle Institute International, Durham, NC, (8)University of North Carolina, Chapel Hill, NC*

Background: Emerging MRI-based predictive testing approaches have been developed to predict the diagnosis of Autism Spectrum Disorder (ASD) at 24 months from classification of 6-month structural and functional MRI data in high-risk infants (Emerson et al., 2017; Hazlett et al., 2017). Although this type of predictive testing is not yet available outside of the research context, it is critical to understand parent motivations for such testing prior to disclosing predictive risk information to families.

Objectives: We investigated perceptions of risk for ASD in a cohort of parents involved in an MRI study of infants at high familial risk. The goal was to explore parent reactions to perceived autism recurrence risk as a first step towards understanding motivations to seek early predictive testing.

Methods: 37 interviews were conducted with parents enrolled in the Infant Brain Imaging Study (IBIS), a longitudinal, multi-site study of early brain and behavioral development in infants at high and low familial risk for ASD. High-risk families had at least one older child with ASD, and an infant aged 3-15 months enrolled in IBIS. A codebook was developed, tested, revised by consensus, and applied to the interview data. Coding reports were reviewed and used to develop a set of emerging themes, informed by the Common Sense Model (Fig. 1; Diefenbach & Leventhal, 1996).

Results: Parents were aware that their infants were at increased risk of ASD, and most who provided quantitative estimates overestimated the risk. Parent perceptions of their infant's vulnerability to ASD were heterogenous, and informed by comparisons made to their affected child. Noted similarities to the older sibling were associated with increased worry, while differences tended to relieve worry. Parents reported a variety of emotional responses to perceived vulnerability, including worry, fear, and sadness. Behaviorally, many parents reported being watchful or vigilant for early signs of ASD. Some parents reported that their knowledge of recurrence risk affected their reproductive decisions (though an approximately equal number reported no impact on family planning), and a few parents reported effects on other healthcare decisions (e.g., choosing to not vaccinate). Parents also described cognitive efforts to cope with uncertainty, such as perceiving ASD risk as out of their control, or reflecting on how prior experience has prepared them to accept and/or manage another ASD diagnosis.

Conclusions: As the field of autism research moves towards earlier identification via brain-based biomarkers, this study provides novel insights into the perspectives and motivations of families who might seek predictive MRI testing. Among this group of parents—"early adopters" of infant MRI in the research setting—enrolling in research and obtaining regular developmental testing appears to be an active coping effort in response to perceived vulnerability. Parents are looking for ways to manage the uncertainty associated with their infant's increased risk, and MRI testing could provide a more precise estimate of that risk. Future studies will build upon these results and investigate potential strategies for supporting parents before and after the receipt of predictive risk information.

Poster Session
242 - Family Issues and Stakeholder Experiences
11:30 AM - 1:30 PM - Room: 710

226 **242.226** Relation between Child's Age of Autism Diagnosis and Parents' Stress, Perceived Quality of Life, and Empowerment Status

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Background: It is well understood that a diagnosis of autism spectrum disorder (ASD) impacts not only the child, but the entire family unit. In fact, prior research has indicated that parents of children with ASD experience more parenting stress, compromised quality of life, and increased need for support compared to parents of children who have another disability or are typically developing (Hayes & Watson, 2013). Given the persistent gap between the age at which ASD can be reliably diagnosed and the median age of diagnosis, an important next step in this line of research is to consider the role of child's age of diagnosis on parenting experience. Considering that children diagnosed after the age of three miss the window of opportunity for early intervention services, we hypothesized that parents of these children would demonstrate higher stress levels and reduced quality of life and empowerment.

Objectives: To compare parenting stress, perceived quality of life, and empowerment status in parents of children who received an early and delayed diagnosis.

Methods: Participants included 71 parents (mothers, *n*=44; fathers, *n*=27) who enrolled in a parent education program designed to teach families about ASD. The children of enrolled parents ranged in age from 2-16 years and were classified as receiving either an early (i.e., first 3 years; *n*=35) or delayed (i.e., 4 years or older; *n*=36) diagnosis. Parents completed the Family Empowerment Scale (FES; Koren et al., 1992), Parenting Stress Index–Short Form (PSI-4-SF; Abidin, 2012), and Family Quality of Life Scale (FQOL; Beach Center on Disabilities, 2006). The FES measures empowerment in three domains: Family, Service System, and Community. The PSI is comprised of three subscales: Parental Distress, Parent-Child Dysfunctional Interaction, and Difficult Child. The FQOL measures five domains: Family Interaction, Parenting, Emotional Well-Being, Physical Well-Being, and Disability-Related Support. Mann-Whitney U tests were used to examine differences between parents of children who received an early and delayed diagnosis.

Results: With regard to empowerment, results revealed that delayed diagnosis parents felt less empowered with respect to the family (*U*=459, *p*<.05), service system (*U*=401, *p*<.01), and larger community (*U*=395, *p*<.01). With regard to parenting stress, delayed diagnosis parents perceived their child as more difficult (*U*=394, p<.01) than early diagnosis parents, but no differences emerged on the Parental Distress (*p*=.80) or Parent-Child Dysfunctional Interaction subscales (*p*=.13). With regard to quality of life, delayed diagnosis parents perceived their child as having fewer disability related supports (*U*=423, *p*<.05), but no differences emerged on the Family Interaction, Parenting, Emotional Well-Being, or Physical Well-Being domains (*p*'s=.27-.70)

Conclusions: Parents of children who received a diagnosis after the age of three felt less empowered and perceived their child as more difficult and with fewer disability-related supports. The implications of these findings are two-fold. First, the results provide additional evidence supporting the importance of early detection of ASD from a family perspective. Second, the results suggest that children diagnosed after the age of three and their families may require extra support. Incorporating forward planning into the diagnostic process may be one avenue to consider.

227 **242.227** Relationships Matter: The Association between Parent-Teacher Alliance, Parent Stress, and Student Outcomes

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Background:

Positive parent-teacher relationships are critical for student success generally (Garbacz, McIntyre, & Santiago, 2016) and are paramount for students with autism spectrum disorders (ASD) who require coordinated plans that promote generalization of skills across home and school (National Research Council, 2001). Parents and teachers agree that collaboration and communication are critical for the education of students with ASD (Syriopoulou-Delli, Cassimos, & Polychronopoulou, 2016). Furthermore, stronger parent-teacher alliance has also been associated with lower stress for parents of younger children with ASD (Krakovich, et al., 2016). For transition age youth (TAY) with ASD, collaboration and coordination may be especially important given their poor outcomes (e.g., employment, friendships, community engagement) compared to peers with other disabilities (Anderson, et al., 2014) and the increased parental demands when navigating new systems. Thus, successful interventions for TAY may work in part through establishing and leveraging a stronger parent-teacher alliance. Accordingly, as part of a randomized controlled trial of an adaption of Collaborative Model for Promoting Competence and Success (COMPASS) for transition age youth with ASD we examined intervention impacts on alliance and the association between alliance and student and parent outcomes. COMPASS is a student-centered, teacher coaching intervention that results in improved IEP outcomes (Ruble et al., 2018) and encourages collaboration by bringing together the student's parent and teacher.

Objectives:

The goals were to examine the relationships between parent-teacher alliance and IEP goal achievement and parenting stress respectively and to examine whether COMPASS results in measurable improvements in parent-teacher alliance.

Methods:

Participants included 20 students with ASD (n_{female} = 18, n_{male} = 2), their parent/caregiver (n_{female} = 18, n_{male} = 2), and their primary special education teacher. The mean age of students was 18.2 years (*SD* = 1.1; range: 17-20 years). Seventy percent of students were White. Participants completed baseline assessments before random assignment to one of two groups: COMPASS intervention (*N* = 11) or placebo control (*N* = 9). The Parent Teacher Alliance Questionnaire (PTAQ) and the Parenting Stress Index – Fourth Edition Short Form (PSI-4 SF) were completed by the parents/caregivers to measure parent-teacher alliance and parenting stress, respectively. Parents also completed a brief questionnaire about student's progress on IEP goals.

Results:

Based on parental reports, stronger parent-teacher alliance was related to higher IEP goal achievement (r = -.62, p < .01) and decreased parenting stress (r = .50, p < .05). A one-way analysis of covariance (controlling for baseline alliance scores) indicated a trend toward significance between the two groups on post-intervention alliance [$F(1,14) = 2.87$, p = .11], with a medium effect size (η^2 = .17). Also at a trending level, the level of alliance improved from Time 1 (*M* = 41.44, *SD* = 13.36) to Time 2 (*M* = 35.56, *SD* = 9.32) for the intervention group, $t(8) = 1.94$, p = .088.

Conclusions:

Stronger parent-teacher alliance is associated with greater student improvements and lower stress as perceived by parents. The findings also

suggest that COMPASS may improve parent-teacher alliance. Further research with larger samples is necessary.

228 **242.228** Relationships between Child Factors and Parental Mental Health Symptoms

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Background: Parents of children with developmental disabilities present with higher rates of anxiety, depression and stress than parents of typically developing children. Furthermore, there is a higher prevalence of these mental health symptoms in parents of children with autism spectrum disorder (ASD) than in parents of children with other developmental disabilities (Dumas, Wolf, Fisman & Culligan, 1991; Sanders & Morgan, 1997; Taylor & Warren, 2012). We aimed to explore relationships between parental symptoms and behavioral characteristics of children with ASD.

Objectives: In a sample of children with ASD and their mothers, we examined possible relationships between child and parent symptoms and behaviors.

Methods: Participants included thirty-three 5- to 8-year old children with ASD (*M* = 72.1 months, *SD* = 15.6 months) and their mothers. All children had an ASD diagnosis as confirmed by the Autism Diagnostic Observation Schedule (ADOS). Parents reported on their children's behavioral and emotional symptoms using the Child Behavior Checklist—Preschool and School Age (CBCL/1.5-5 and CBCL/6-18). Parents also completed the Repetitive Behavior Scale—Revised (RBS-R) to assess children's repetitive behaviors. Additionally, mothers reported their own depression, anxiety, and stress symptoms using the Beck Depression Inventory-II (BDI-II), Beck Anxiety Inventory (BAI), and the Parenting Stress Index—Fourth Edition (PSI-4), respectively.

Results: Scores for maternal anxiety on the BAI were positively correlated with child ritualistic behaviors on the RBS-R Ritualistic Behavior subscale (r = .376, p = .034, n = 32). For children ages 6 and above (n = 15), somatic complaints on the CBCL also correlated with maternal anxiety (somatic complaints: r = .597, p = .019). Additionally, higher BDI-II scores and higher scores on the Parental Distress subscale of the PSI-4 correlated with lower rates of child participation in extracurricular activities as reported on the CBCL/6-18 (depression: r = -.575, p = .025; parental distress: r = -.587, p = .021).

Conclusions: Maternal mental health symptoms correlated with a number of child factors. Children of mothers with higher levels of anxiety showed higher rates of somatic symptoms compared with children of mothers with lower levels of anxiety. Additionally, maternal anxiety was correlated with child ritualistic behavior. Given that anxiety symptoms have a genetic component, it is possible that children of anxious mothers also have greater symptoms of anxiety, which in these young children may manifest as somatic complaints and/or heightened ritualistic behaviors. Children's involvement in extracurricular activities was negatively correlated with maternal depression and parenting distress, meaning that children whose mothers showed higher levels of depression or distress were less likely to be involved in activities. Further work is needed to determine the directionality of these relationships and consider the possibility of bidirectional interactions. Further understanding can help inform future interventions to best support both children with ASD and their parents.

229 **242.229** Respite Care Among Parents of Children, Adolescents and Adults with ASD

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Background: Parents of children with autism spectrum disorder (ASD) face a considerable amount of caregiving stress. While many families rely on informal supports such as friends and family, others use formalized supports such as respite care. Respite care is similar to other forms of child care, however the intention is explicitly to provide parents with a temporary relief of caregiving responsibilities. Although there was a great deal of research on the impacts of respite care when it was first introduced after deinstitutionalization, few recent studies have examined respite care use among parents of children with ASD.

Objectives: The purpose of this study is to examine use of respite care among parents of children with ASD. This study aims to identify barriers to accessing respite care among those who have not yet used this service. This study also aims to better understand the experiences of parents who have used respite care.

Methods: Parents of children, adolescents and adults with developmental disabilities were invited to complete an online survey on respite care through community newsletters and events. The present study focuses on 38 parents of children with ASD. Most caregivers were biological mothers (84%). On average, parents were 31.08 years old (*SD* = 9.55). Most (84.2%) identified as white, non-Hispanic and approximately half (55%) were married. The median annual family income was $60,000-69,999. Ten parents had two children with ASD. For these parents, analyses focused on their older child with ASD. The target children with ASD ranged in age from 7 to 27 years old (*M* = 16.73, *SD* = 5.82). The majority were male (78%) and most (84%) lived with the participating parent full time.

Results: Over half (58%) of parents had used respite care. Among those who had never used respite care, half had inquired or applied for respite care. The most common reason for not using respite care was difficulty finding a provider (85%), followed by an inability to pay for a provider (68%). Few participants felt they did not need respite care (42%) Among those who used respite care services, most (63%) received services in the home. Few (12%) never paid out of pocket for services. When receiving respite care, parents were most likely to engage to activities related to managing the house, such as running errands (78%), cleaning (78%), and cooking (72%). Much more infrequent was engaging in leisure activities (47%) or socializing with friends (44%). Related to their child with ASD, parents were most likely to complete school paperwork (76%), make appointments (67%), and contact their child's providers (67%). Of all members of the family, participants perceived the greatest benefit of respite care to be for themselves, with most (67%) caregivers reporting that it benefited them a lot or a great deal.

Conclusions: Parents of children with ASD find respite care to be beneficial, but not all parents are accessing this service. Additional work is needed to reduce barriers related to finding providers and paying for services.

230 **242.230** Retrospective Case Study on Advocate Latina Mothers and Their Educational Journey with a Child with Autism Spectrum Disorder

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Background: Latinx children are more likely to receive a late diagnosis of autism, delaying critical early intervention services. Any delay jeopardizes long term outcomes in children with ASD. Capturing and understanding the experiences of underserved Latinx communities is needed in order to address this diagnosis gap. Parents play a critical role in the early diagnosis of treatment of children. Hence, exploring Latinx parents experiences as community advocates sheds light into potential solutions to the ASD diagnosis gap for Latinx families.
Objectives: The study's aim is to explore the experiences of Latina mothers as they become active advocates for their children and other families in a community-based setting in Southern California. Specifically, the study research questions were RQ1: What are the experiences of Latinx mothers of a child with autism as they advocate for services for they child within the U.S. school system? RQ2: What previous experiences have helped Latina mothers of a child with autism become active parent mentors to other parents?

Methods: This retrospective case study analysis employed a qualitative approach that specifically targeted three Latina mothers of a child with ASD through convenience sampling and who were recruited within a community-based organization focused on parent advocacy. Participants were interviewed one-on-one in a semi-structured format. Interviews lasted between 1 hour to 2 hours and 25 minutes. All three interviews were audio recorded and destroyed after transcribed. The interview included 14 questions that were based on four areas (i.e., Background, child Information, school experience, and advocacy). The settings of the interviews were a public library, community organization center, and a participant's home. In order to conduct data analysis, researchers used open-coding techniques and application of labels to find similar themes across all of the three interviews.

Results: Findings were organized into five broad themes that came across the three interviews in relation to the mother and her community-based advocacy experience. These themes included parent personality qualities, actions, unresolved concerns or events, understanding of the special education process, and obstacles in acquiring services.

Conclusions: Within an underserved community, the lack of direct resources may encourage Latinx mothers to seek information and resources available in the community needed in order to navigate the special education system. Likewise, while in their parent advocacy educational journey, Latinx parents are able to get informed and at the same time help other parents with education and advocacy. The results from this study suggest that previous life experiences that parent advocates go through make them ideal candidates to educate other parents.

231 **242.231** Returning Home after Hospitalization - Insights from Parents of Adolescents with Autism Spectrum Disorder and Intellectual Disability

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Background: Adolescence is a difficult period in one's life, particularly for adolescents with Autism Spectrum Disorder (ASD) and their family. It is in this period of their lives that youth with ASD are the most likely to be hospitalized in a mental health unit, especially if they have intellectual disability (ID). Disruptive and aggressive behaviors, which include self-injury, are the leading reason for hospital admission and emergency department visits. Moreover, studies show that the inaccessibility or lack of specialized services cause these adolescents to consult emergency services on more occasions than youth without disabilities. Along the same line, repeated hospital admission can occur due to the lack of appropriate services, even with well-planned discharges.
In Canada, several services are currently offered to children with ASD and their family. More specifically in the province of Quebec, those services are divided as primary (first-line), specific (second-line) and specialized (third-line) services. However, literature on the effectiveness of these services after hospitalization is sparse, and no study has yet explored the experience of parents using those services for their children in Quebec. Therefore, to adjust services and reduce re-hospitalization rates, it is important to assess the experience of parents of adolescents with ASD and ID after hospitalization throughout first-, second- and third-line services.

Objectives: To explore the experience of parents of adolescents with ASD and ID after hospitalization in a child psychiatric unit across the first-, second- and third-line services.

Methods: In this qualitative research, a descriptive and exploratory form was used. A total of six face-to-face semi-structured interviews were conducted with nine parents (six mothers and three fathers) of six adolescents (five boys and one girl) with ASD and ID. To be eligible, each participant had to live in the greater region of Montreal, speak French and have a child with ASD and ID who was hospitalized in a child psychiatric unit between the age of 12 and 17 years old.

Results: Results show that the experience of these parents consists of a succession of disappointments as the offered services were unable to address their needs and expectations. Indeed, their biggest desire —keeping their children at home— could not be met as five out of six adolescents were separated from their families and put in a residential or institutional placement. Their struggles can be summarized in four main themes: 1) the expectations expressed, 2) the encountered difficulties, 3) the solutions put in place, and finally 4) the feeling of failure, which is related with the out-of-home placement.

Conclusions: In light of these findings, changes need to be made in the follow-up services offered to these families after the discharge of their adolescent. Among other things, the return home must be better prepared by appointing a health care professional as a reference person to each family and by offering uninterrupted services across the lifespan based on the true needs of these families and their adolescent.

232 **242.232** Having a Second Child, When Your First Has Autism: A Qualitative Study of Parental Experiences

ABSTRACT WITHDRAWN

Background: Around 20% of infants who have an older sibling with Autism Spectrum Disorder (ASD) develop ASD themselves (Ozonoff et al., 2011), and a further 20–30% develop broader developmental difficulties (Messinger et al., 2013). It is known that the diagnosis of a child with ASD has short- and long-term impacts on family functioning, including on family planning (Navot et.al, 2016). However, research has yet to explore the lived experience of parents having a second child when they already have a child diagnosed with ASD, and how this situation impacts parents' decision to have another child as well as their perinatal experiences.
Objectives: This study sought to better understand the impact of this familial risk on parents, and the experiences of parents of a child diagnosed

with ASD around the conception, pregnancy and early developmental period of a subsequent child.

Methods: The current ongoing study involves in depth interviews with (1) parents of a child diagnosed with ASD, who have a subsequent child (with or without ASD); and (2) parents of two typically developing children. Current recruitment of 8 parents in each group are approaching thematic saturation, however, the analysis and potential data collection are ongoing, with expected completion in the next two months. Interviews with parents involved a set of open-ended questions developed to explore parental experiences around the pregnancy and early developmental periods of the subsequent child. A minimal number of broad, data-generating questions were asked as recommended in phenomenology (Brod, Tesler, & Christensen, 2009; van Manen, 2016), allowing participants to speak about the experiences that were most salient to them, with prompts from the interviewer given to facilitate their storytelling. Interviews lasted between 1-1.5 hours and were transcribed verbatim. Data analysis has been concurrent with data collection, and involves a thematic analysis of the data conducted using NVivo (QSR International Pty Ltd. Version 11, 2016).

Results: Preliminary analyses have found three main themes. The first of these focuses on parents' experiences of 'uncertainty'; exploring parents guilt and stress over the potential of subsequent children being diagnosed with ASD, alongside positivity for any future children, regardless of their potential diagnostic status. The second of these focuses on 'balancing roles'; exploring the impact of a diagnosis on the management of a family during pregnancy and with a newborn. The third theme 'getting through' explores parents' methods of supporting their children and finding support for themselves.

Conclusions: Identifying the unique experiences of parents around the pregnancy and early development of a subsequent child when the first has ASD include the identification of psychoeducational focuses and resources that would be important for future parents. The results of this study will be used to inform a parent-mediated intervention for siblings at risk of developing ASD, but have broader implications for clinicians and researchers working with the parents of children with ASD.

233 **242.233** Service Needs and Barriers for Children and Adults with ASD

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Background: Research on children with ASD has shown that appropriate interventions, delivered at appropriate developmental periods, can lead to marked increases in functioning across a range of domains (for review, Warren et al., 2011). The ability to access appropriate services and supports also leads to a number of benefits for families, including alleviating financial burdens and reducing family distress (Bradford, 2010). Given the far-reaching effects of receiving services, it is important to ensure care is as accessible as possible. However a survey of caregivers of children and adults with ASD in Ontario found that a majority of individuals continue to face a number of barriers to accessing services. Given the importance of timely and effective supports, it is important to determine the specific needs and experiences of service delivery across the lifespan in order to tailor appropriate systems of care.

Objectives: To explore the experiences of service delivery for individuals with ASD across the lifespan by examining identified service needs and subsequent barriers to service for individuals aged 2 to 29.

Methods: Autism Ontario conducted an online survey for caregivers in May, 2018. It was distributed across our network, via partner organizations and Ontario's regional autism providers. It was available in English and French, and focused on various aspects of service and support.

Results: There was a total of 1,475 respondents. The majority of respondents cared for male children (79.7%) and 16.7% indicated that they cared for more than one child with ASD. Children ranged in age from 2.0 years to 29.10 (M = 11.8, SD = 5.9). Respondents rated potential barriers to service on a 5-point likert scale. The largest barrier to service for all age groups was long waitlists, the second largest barrier to service differed by age group as did individuals' top service need. See table 1 for details on service needs by age.

After controlling for child's gender and region, affordability was rated as a significantly larger barrier to service for caregivers of children aged 12 and below compared to children 13 to 29 (F (4, 1,320) = 3.70, p = 0.005), while a lack of professionals who understand ASD and a lack of needed services were rated as significantly larger barriers to service for caregivers of children aged 9 to 29 compared to children below 9 years of age (Fs > 4.59, ps < 0.001). Factors including, difficulty getting to appointments, long waitlists, not knowing where to go to access services and services in non-preferred language were not significantly different across age groups (Fs < 1.21, ps > 0.05).

Conclusions: Individuals with ASD require different services and experience different barriers to accessing said service at different time points in their life. We will discuss the implications of these findings in regards to the tailoring of services and supports for individuals across the lifespan.

234 **242.234** Sharing Their Child's Autism Spectrum Disorder Diagnosis in Community Programs: Influencing Factors and Parents' Perceived Outcomes on Experiences and Participation

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Background: Children with autism spectrum disorder (ASD) participate in significantly fewer mainstream (inclusive) community-based programs than their peers. This matters because social participation, including in one's community, is vital to health, development, and quality of life. Our previous research found that many parents grapple with whether sharing their child's ASD diagnosis will increase understanding, acceptance and inclusion, or increase exclusion, in community-based programs.

Objectives: This study aims to (1) identify factors associated with whether a parent shares a child's ASD diagnosis in community-based programs, and (2) explore parents' perceptions of how sharing this information influenced their child's experiences and participation in community programs.

Methods: Parents of children with ASD from Canada and the United States completed an online survey hosted through REDCap. The survey included child and family demographics (e.g., child age, communication ability, presence of disruptive behaviours, size of community, identified culture, etc.), the number and types of mainstream community programs in which the child with ASD participated (past and present), what information was provided about a child's ASD diagnosis and by whom, and open-ended questions, including, "How did sharing this information influence your child's experience in this program?". Multiple logistic regression analysis will be conducted to identify child, family, and/or program factors associated with whether diagnosis was shared. Qualitative responses to the open-ended question will be thematically analyzed.

Results: To date, n=82 parents, with n=92 children with ASD (mean = 8.97 years, range 2-20 years) have completed the survey (closes December 31, 2018). Most parents chose to share their child's ASD diagnosis within community-recreation programs; however, 17 (22%) participants did not disclose their child's ASD diagnosis.

Conclusions: Findings will increase understanding of factors associated with, and parents' perceived outcomes of, sharing (or not sharing) their child's ASD diagnosis, including outcomes related to social participation and inclusion. This knowledge may inform future research and community practices on how to improve inclusion and participation in community-based programs for children with ASD.

235 **242.235** Sibling Contact and Young Adults' Well-Being: The Moderating Role of the Broader Autism Phenotype

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Background:

Siblings who have more contact with each other during young adulthood report greater well-being (Sherman et al., 2006). Contact may be particularly important for those with developmental disabilities. Past work, however, highlights that in some cases the positive benefits of social relationships are lessened for those who are higher in Broader Autism Phenotype (BAP) characteristics (Jobe & White, 2007).

Objectives:

The aim of this study was to examine how contact between siblings through traditional (e.g., in person) and technological (e.g., social media, texting) means was associated with young adults' well-being (depressive symptoms and general health). Further, we examined if links between contact and well-being varied by young adults' and their siblings' BAP characteristics.

Methods:

The data came from a study on sibling influence and young adulthood collected through self-reports from Amazon Mechanical Turk. The data collected resulted in 866 responses to the survey. Participants ranged between 18 and 29 years old (*M age* = 25.43, *SD* = 2.54) and lived in the United States. The sample was mostly female (58%) and Caucasian (73%). The 866 participants reported on their own BAP characteristics and those of their closest aged sibling using the Autism Spectrum Quotient questionnaire (Baron-Cohen et al., 2001). Depressive symptoms were assessed with the DASS (Lovibond & Lovibond, 1995) and general health with one item.

Results:

Analysis was conducted in a hierarchical ordinary least squares regression. Models were tested separately for each dependent variable: depressive symptoms and general health. In the first step, each model included family demographics, sibling relationship quality, the participant's and their sibling's BAP characteristics, traditional contact, and technological contact. In the second step, four two-way interactions were included: traditional contact X participant BAP, traditional contact X sibling BAP, technological contact X participant BAP, technological contact X sibling BAP.

Results revealed that when participants and/or their sibling were higher in BAP characteristics, the participant reported more depressive symptoms. In the second step, the analysis revealed a significant interaction of technological contact X sibling BAP. Testing of the simple slopes (Figure 1) revealed that for high sibling BAP there was no association between technological communication and depressive symptoms, but for low sibling BAP the association was negative (b = -.05, se = .02, p < .01, β = -.17).

Results for general health revealed that participant's with higher levels of BAP reported significantly lower health. In the second step, the analysis revealed a significant interaction of technological contact X participant BAP. Testing of the simple slopes (Figure 2) showed that for low participant BAP there was no association between technological communication and general health. For high participant BAP, however, there was a positive association (b = .08, se = .03, p < .05, β = .15).

Conclusions:

Overall, these results suggest a nuanced role of BAP for the link between sibling contact and well-being. In particular, technological communication may be more important than traditional communication. In some cases, higher levels of BAP characteristics may minimize the role of communication and in others, it may heighten it.

236 **242.236** Sleep Problems in Children with ASD: Effects on Parental Employment

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Background:

Sleep problems are a frequent co-occurring medical condition in individuals with autism spectrum disorder (ASD), with reported prevalence up to 80%. Co-occurring sleep problems affect family quality of life. However, the mechanisms by which co-occurring sleep problems have this impact are not clear.

Objectives:

To examine the relationship between sleep problems in children and adolescents with ASD as measured by the Composite Sleep Disturbance Index (CSDI) and parental decision to work outside the home.

Methods:

U.S.-based parents of children with ASD were recruited from a validated and verified national autism registry. Parents completed an online survey on co-occurring conditions that incorporated family and child demographic information including the CSDI, a validated tool that scores the frequency and duration of six sleep habits (scored 0-2) over the previous month; total score range= 0-12; score ≥ 4 indicates a severe sleep problem. Parents also answered questions regarding family employment and parental health and well-being. Descriptive statistics, independent t-tests, and Pearson chi-square (χ^2) tests were performed.

Results:

610 parent/child dyads were analyzed. Responding parents were the primary caregiver, primarily women (94%), white (89%), and non-Hispanic

(92%); mean age of 43.3 (SD 7.2; range 25-65) years. Children were primarily male (81%), white (84%), and non-Hispanic (88%); mean age of 12.1 (SD 3.6; range 3-17) years. On the CSDI, 377 (62%) subjects were classified as severe and 233 (38%) as not severe. Parental age, race (white/non-white), and ethnicity (Hispanic/Non-Hispanic) did not differ between those with severe and not severe sleep problems. For parents who are employed outside the home, there was no difference in percentage who work full-time vs. part-time. However, there was a significant difference in employment status associated with sleep problems, with fewer parents of children with severe sleep problems being able to work outside the home compared to those with non-severe sleep concerns. Parents of children with severe sleep problems reported needing to stay home to care for their child with ASD much more frequently than those without severe sleep problems (43% vs 26%, χ^2 (1) = 10.80, p = 0.001). The proportion of working parents missing 5 or more days of work annually due to their child's ASD was higher for those with severe compared to non-severe sleep problems (37% vs. 16%; χ^2 (2) = 19.64, p = 0.000).

Conclusions:

We found a strong association between the presence of severe sleep problems in the child with ASD and parental employment as well as work attendance. Parents of children with ASD and severe sleep problems tend to stay at home more frequently than parents of children with ASD without severe sleep problems, and miss more days of work. Co-occurring sleep problems may affect employment status in parents of children with ASD. Since identification and treatment of sleep problems in children with ASD may have benefits not only for the child, but also for family economic status and overall quality of life, children with ASD should be regularly screened for sleep problems.

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237 **242.237** Social Networks and Autism Spectrum Disorder: A Review of Findings for People with Autism, Their Families, and Communities

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Background: While decades of sociological research confirms that social networks provide critical social capital, including information, knowledge, advice and social-emotional support that create better life-course outcomes (Burt, 1992; Coleman, 1988, 1990; Granovetter, 1973; Lin, Ensel, & Vaughn, 1981), there is little research in the field of autism investigating the social capital ecosystem of people with ASD. (Hassrick, Shattuck, & Carley, 2018) We know almost nothing about what these networks look like and how to make them better. Social capital is defined as the resources embedded in and accessible through one's social connections. Social capital deficits can be framed as a life course health development challenge, where weak social capital during childhood and young adulthood shape later adult outcomes, such as job attainment.
Objectives: To describe the social networks of individuals with autism, and to identify current challenges and strategies relating to social capital attainment and maintenance for individuals with ASD for the purpose of improving adult outcomes for individuals with ASD.

Methods: The review included 15 studies. Ten studies included children age 7-17; one study included young adults age 19-37; and three studies focused on parents of children with ASD ranging in age from 2-50. Authors assessed eligibility for inclusion based on inclusion of social network protocols and analysis. Each article was double-coded and then consensus coded in pairs. The 15 articles incorporated data from 515 students with ASD and 623 parents across 2 continents (North America and Europe). The articles differed by methods: 8 quantitative and 7 mixed-method. Coding of data was conducted in two stages: 1) findings were extracted and pasted exactly as written into an SPSS data file. A codebook was developed, based on themes and subthemes of social capital findings and strategies, constructed through consensus. All data was then doubled coded and inter-rater reliability between coders was > .80.

Results: Findings suggested that individuals with autism face challenges building and maintaining relationships in part due to social difficulties typically associated with autism. Overall, individuals with ASD had smaller social networks. Children and youth age 11-16 had smaller peer, acquaintance, and same-gender acquaintance networks. Young adults age 19-37 had smaller informal, professional, and family networks. Adults had particularly small social networks when staff members from residences were excluded. People with ASD also experienced challenges maintaining personal networks due to lack of reciprocity in relationships and difficulty with maintaining friendships. Strategies for building networks include creating contexts that facilitate interactions, such as providing access, direct teaching and modeling, and the utilization of self-management. Overall, very few types of social capital were measured, with most studies focused on friendship and social and emotional supports.

Conclusions: Few studies have been conducted about social capital for people with ASD. There is a pressing need for more knowledge about how people with ASD acquire social capital, what kinds of social capital they need and how they can build networks that are embedded with the social capital they require to be successful.

238 **242.238** Stakeholder Engagement and Participant Satisfaction in SPARK Research Match Studies

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Background: Online surveys are a fast-growing method for conducting research as digital technologies improve and access to such platforms expand. However, little is known about participants' experience with and attitudes towards online research. To capture this information, it is important to acquire participant feedback after completing an online research study. Such information will lay the groundwork for successful recruitment and retention in online research studies now and in the future. The Simons Foundation Powering Autism Research for Knowledge (SPARK) provides an ideal platform to examine factors related to participant engagement and experience. SPARK is a collaborative, online study that enrolls individuals with a professional diagnosis of autism and their family members into an autism research cohort. With over 50,000 participants with ASD, SPARK offers the opportunity to facilitate autism research broadly by assisting researchers with study recruitment, called "research match."
Objectives: Utilize data from participant feedback surveys to identify common themes across family experiences and evaluate satisfaction participating in online research.

Methods: SPARK facilitates recruitment via research match by building online studies to which eligible participants are invited. After participants complete an online study, the following screen provides a feedback survey consisting of three questions. The first two questions ask for a

quantitative rating 1 to 5 (5 being the highest) on how important the study's research topic is to them and their experience participating in the study. The third question is an open-ended text box for comments. For each research match study, ratings for the first two questions were averaged to yield a final rating. The open-ended comments were qualitatively analyzed to capture common themes within and across studies.

Results: All online studies were rated highly for importance of the research topic and participation experience (see table 1).

In the open text comments, four common themes were found across the online studies (see table 2). The first theme was an expression of gratitude for the research SPARK does and a sense of pride in participating in autism research.

The second theme includes suggestions to modify and improve the study. Participant suggestions include changing or adding questions, shortening the length of a survey, and adding "don't know/not sure" or "not applicable" as an answer option. Participants also suggested adding more open text fields so they could provide richer, more meaningful answers.

A third common theme is the desire for families to obtain survey results from their participation in a study. Lastly, families used the feedback survey to share additional information with researchers to further clarify their survey responses.

Conclusions: Participant feedback allows researchers to understand the perspectives and concerns of parents, children, and young adults with autism when completing an online survey, which is critical to improving user experience as well as overall data quality. By addressing participant comments and suggestions, the research match team can improve future surveys and facilitate participant engagement and retention in SPARK. With research focusing on more patient-centered approaches, stakeholders and researchers can work together to improve autism research and the participant experience.

239 **242.239** Stakeholder Insights on Supporting Neurodiversity at Work and School

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Background:

The number of individuals diagnosed with Autism Spectrum Disorders has increased (CDC, 2013) with worldwide prevalence estimated from 1% (Elsabbagh, Divan & Koh, 2012) to 2.6% (Kim, Leventhal & Koh, 2011). Research tends to focus on children, and while there remains much to be done for autistic children, one certain outcome is that autistic children become autistic adults. Limited research exists on educational and employment activities of autistic adults (Taylor & Seltzer, 2012). Research suggests autistic adults can and want to work or continue education (Hendricks, 2009), but in the UK, 16% of autistic adults are employed full-time (National Autistic Society, 2016). Rates are likely similar in the US where 16.8% of disabled persons work full-time (Autism Society, 2015). Many factors contribute, however research in Germany found 94% of autistic adults had worked and 53% had pursued higher education (Frank et al., 2018). Thus, understanding the challenges faced by autistic adults at school and work may be crucial to improved outcomes.

Objectives:

To gather stakeholder insights about the best supports for autistic workers and students.

To create an instrument assessing importance and feasibility of implementation of stakeholder-authored approaches to supporting neurodiversity.

Methods:

An open-ended prompt presented via social media platforms and tagged to reach autistic populations asked, *"what are some of the best tools, supports and strategies you have used or been provided in work or at school?"* Twenty-seven people responded to this prompt generating 48 ideas. These 48 items were analyzed for themes and used to create a survey tool asking autistic workers and students to rate the importance of each item from and how feasible they perceived implementation to be. The survey also asks about educational/employment statuses, qualitative experiences in work and school, and basic demographics (e.g., country, gender, age).

Results:

In line with Autism Spectrum Conditions, most of the 48 ideas generated by stakeholders were aimed towards social communication (31.25%) and sensory processing (25%) differences However, many items spoke to independence (20.83%), respect and understanding of autism (10.42%), and ability to be open about being autistic (6.25%). Two respondents detailed how hiring practices often require face-to-face interactions that can be exclusive for autistics. Table 1 provides example ideas by topic.

All 48 ideas were included in the survey which has been shared with stakeholders, organizations, and prominent researchers for further dissemination. The survey has been shared widely across six countries.

Conclusions:

Results suggest that autistic adults have important insights into their own communication, sensory and needs and routines that work for them at work and school. These results are also promising in that most of the ideas generated appear to be feasible for many employers and educators (e.g., walking breaks, direct feedback). The next stages of this study include collecting survey responses, surveying employers and educational institutions about their current practices to support neurodiversity and comparing the fit between these two stakeholder groups. It is well documented that diversity can be a positive force if and when institutions provide an environment where diversity can thrive (Dos Reis et al., 2007).

240 **242.240** Student Voices: The Perspectives of Autistic Youth on High School Experiences

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Background: Students in US schools are increasingly identified with autism as a primary disability category. Autistic high school students have reported dissatisfaction with their school experiences, and often feel inadequately supported by school professionals (Bottema-Beutel, Mullins, Harvey, Gustafson, & Carter, 2016). Currently, there is little research that solicits the perspectives of autistic individuals that could be used to improve provision of school-based supports. Gathering and understanding the perspectives of these students on school-based services is critical

to ensuring their usability and effectiveness.

Objectives: The purpose of this project is to examine perspectives of US autistic high school students and recent graduates on their experiences in high schools, gathered via an online survey.

Methods: Participants were recruited via email solicitations to groups serving autistic populations (e.g. Federation for Children with Special Needs, Special Needs Advocacy Network), a Facebook advertisement, recruitment flyers posted on several Boston/Cambridge area campuses, and word of mouth. Two-hundred and thirty-six participants that reported receiving special education services in high school under the autism category completed an online survey. The survey included demographic questions, and questions pertaining to school experiences in four domains: (a) teachers and other service providers, (b) friends and peers, (c) family, and (d) factors that made high school positive and negative. Responses were coded using content analysis (Neuendorf, 2016). After developing a code book inductively from the data, three graduate students coded all survey responses, and overlapped on 20% of the data. All categories were coded to kappa levels > .60, indicating sufficient inter-coder agreement. Frequencies were derived for each category; we report the five most prevalent categories within each open-ended question, as well as statistics indicating the valence (i.e., whether positive or negative) of several questions.

Results: Respondents were 50% female, 18% LGBTQ, and 31% non-white. Ages ranged from 16- 24. Sixty-six percent of respondents indicated that their disability (ASD) negatively impacted their time in high school, while only 3.7% of respondents indicated positive impacts. Thirty percent provided responses that were neutral, ambiguous, or un-codable as negative or positive. Ninety-one percent of respondents were able to identify at least one positive aspect of their experience in high school, and 85% were able to identify at least one negative aspect (another 10% indicated that they preferred not to think about/report negative aspects). Specific contributions of teachers, family, and peers to school experiences are reported in Table 2.

Conclusions: Our results have several implications for school professionals who support autistic students. First, school professionals should take proactive steps to encourage autistic students to consider the positive aspects of their diagnosis. Second, autistic students should be supported in developing peer friendships that are emotionally supportive, and relationships with teachers or caregivers that provide help, attention, and care. Finally, as nearly a third of respondents reported having been bullied in high school, school professionals should work with the general population of students to prevent bullying and other forms of peer aggression toward autistic students.

241 **242.241** Taking Care of Their Child or Themselves? Adujsting Parent-Mediated Interventions to Answer the Various Needs of Parents Having a Toddler Suspected of ASD

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Background: Parent-mediated interventions may be an interesting alternative to increase timely access to interventions, especially during the period surrounding the diagnosis assessment for ASD. Although parents are the main actors in parent-mediated interventions, few studies have examined the impact of parent-mediated interventions on parental well-being.

Objectives: This sequential explanatory mixed methods study aimed to: 1) describe the impact of a 12-week parent-mediated intervention on parental outcomes (satisfaction, sense of competence, stress), and 2) identify potential factors associated with these outcomes based on parents' experience with the program.

Methods: Thirteen families with a toddler (12-30 month old) suspected of ASD were randomized either in the Intervention group (n=7) or the Waitlist group (n=6). Quantitative analyses of the direct impact of the intervention were conducted using the change in parental outcomes between assessment times T1 (baseline) and T2 (post-intervention for the Intervention group; second baseline for the Waitlist group) separately for the two groups. Then, a combined analysis looked at the effect of time comparing scores at baseline, post-intervention and follow-up for the combined group (Intervention and Waitlist groups merged). Qualitative interviews were conducted with a subsample of 6 families after receiving the intervention and analyzed independently by two evaluators. Finally, quantitative and qualitative data were compared for convergence and divergence, and then integrated, resulting in a more in-depth understanding of the impact of the parent-mediated intervention based on parental perspectives.

Results: Parents reported a high level of satisfaction with the intervention. Quantitative data revealed a stabilizing effect on parenting sense of competence compared to a decrease in the control group (PSOC Efficacy scale; p=.048; ES=.46). There was a trend toward reduced parental distress (PSI-SF; p=.141; ES=.48) during the intervention. Qualitative data pointed up the importance of providing: 1) early parental training about ways to stimulate their child, and 2) social support for parents in the stressful period surrounding the diagnosis. More precisely, parents were positive about being involved in stimulating their child and liked being able to take action, which gave them a sense of competence. However, they also highlighted their need for social support, especially during the stressful period surrounding the diagnosis assessment of their child. Parents felt torn between improving their skills and confidence in stimulating their child and reaching out for social support.

Conclusions: This study highlights the importance of considering the delicate balance between providing educational support to enhance parents' sense of competence and offering targeted social support for parents of children suspected of ASD.

242 **242.242** The 2016-2017 Iacc Strategic Plan's New Objectives and Trends in ASD Research Funding

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Background: The Interagency Autism Coordinating Committee (IACC) is a federal advisory committee composed of federal officials and public stakeholders; it was established by Congress to coordinate activities concerning autism spectrum disorder (ASD) within the U.S. Department of Health and Human Services (HHS) and among member federal agencies. The IACC produces an annual *Strategic Plan*, providing a framework to guide the efforts of federal and private funders of autism research. For the *2016-2017 IACC Strategic Plan*, the Committee formulated new objectives for each of the seven research question areas. The 23 new objectives address critical gaps and opportunities they perceived in the current research landscape.

Objectives: The Office of Autism Research Coordination (OARC), which coordinates and manages the Interagency Autism Coordinating Committee (IACC), will present the new *2016-2017 IACC Strategic Plan for Autism Spectrum Disorder* objectives along with analysis on funding trends towards

these objectives and the new recommended budget for U.S. investment in ASD research.

Methods: Each question in the *Strategic Plan* includes an Aspirational Goal, or long-term vision for the question, as well as a description of the state of the field; the needs and opportunities in research, services, and policy; and three to four broad objectives for each question topic. There is also one cross-cutting objective on the topic of ASD in females. Data on individual research-related projects is aligned with objectives in the *IACC Strategic Plan*, providing an accounting of how much funding has supported projects related to *Strategic Plan* objectives and highlighting trends.

Results: OARC has collected U.S. ASD research funding data for 2016 and 2017 and aligned research projects with the 23 objectives in the *2016-2017 Strategic Plan*. The overall ASD funding amounts for 2016 and 2017 are compared to the Committee's recommended annual budget (2015-2020). Funding data will provide information on if the Committee's objectives are being met as well as the Committee's budget recommendations.

Conclusions: The *2016-2017 IACC Strategic Plan* for ASD along with the recent analysis on ASD research funding will provide an insightful overview of the state of autism research.

243 **242.243** The 2016-2017 Iacc Strategic Plan's New Objectives and Trends in ASD Research Funding

*J. Rava[1] and **O. Celestin**[2], (1)National Institute of Mental Health, Office of Autism Research Coordination (OARC), Rockville, MD, (2)OARC, NIH/NIMH, Bethesda, MD*

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244 **242.244** Family Capacity Building through Parent-Mediated Intervention for Children with Autism

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Background: Research and current policy has highlighted the importance of supporting families and building family capacity to support the learning of children with autism spectrum disorder (ASD; Carter et al., 2009; IDEA, 2004). Parents who deliver intervention reported reduced stress and increased confidence in parenting a child with ASD (Woods and Brown, 2011). However, few studies have assessed parent learning and these effects on child outcomes. The aim of this study was to examine parent outcomes from the Joint Attention Mediated Learning (JAML) intervention. JAML was designed to improve preverbal social communication for toddlers with ASD through parent-mediated play-based interaction (Schertz, Odom, Baggett, & Sideris, 2018).

Objectives: To determine differences between intervention and control groups in parents' use of mediated learning principles and in parent-child social engagement

Methods: Intervention Coordinators (ICs) conducted weekly 1-hour home-based sessions with parents for 32 weeks. The ICs facilitated parents' learning of five mediated learning principles: focusing on social interaction (FO), organizing/planning for engagement (OP), encouraging self-reliance (EN), giving meaning and promoting motivation for engagement (GM), and expanding engagement across environments. Each week parents received conceptual guidance on the use of principles to promote child learning based on the child's current targeted outcome. This guidance included "Ideas Other Parents Have Used" in verbal and written forms and with video examples of other parents applying the principles. Further, ICs guided parent reflection on their use of the principles by reviewing videos of parent-child interaction. Control group participants were not exposed to the intervention until after post-intervention data were collected.

A total of 58 parent-child dyads from the larger three-site JAML study (the first 20 participants from each site minus two with missing data) were included in this study. Toddlers aged 30 months or younger who met ASD criteria were randomly assigned in pairs within sites to experimental or control groups. The Mediation of Social and Transactional Engagement Measure (MOSTE; Schertz & Horn, 2018, unpublished) was used to assess FO, OP, GM, and EN, parent and child demeanor/affect (PD & CD), and transactional social orienting (SO). Using 10-minute parent-child interaction videos that had been recorded pre- and post-intervention for intervention and control group participants, three independent observers coded 40 15-second intervals for occurrences of targeted outcomes. Inter-rater reliability was established and maintained between coders (kappa=.85). A one-way MANOVA was used to examine the group differences.

Results: No pre-intervention differences were found between groups in FO, OP, EN, GM(d=.11, p=.29). Significant advantages were found for the experimental group in FO, OP, EN, GM and PD (d=.24, p=.01) at post intervention assessments, indicating that parents in the experimental group increased their learning of mediated learning principles. Significant differences also favored the experimental group for SO (d=.14, p=.02) at post

intervention assessment.

Conclusions: The results support the usefulness of targeted professional guidance in parent-mediated intervention to help parents build their capacity to mediate child learning. Replication is needed to further validate the effects of JAML or other interventions on parent mediation of child learning and its relation to child outcomes.

245 **242.245** The Comparative Effectiveness of Study Recruitment and Task Completion between Social Media and Clinical Sites in SPARK, an Online Research Initiative

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Background:

Research has shown that social media is an effective tool for recruiting individuals for health research. One systematic review found benefits such as reduced costs, shorter recruitment periods, and better representation including improved participant selection in young and hard to reach populations. While social media may be effective at recruiting individuals to participate in research, less is understood about whether individuals recruited via social media are more engaged or if completion rates of study tasks are higher compared to research participants recruited through traditional approaches (e.g. direct contact from a clinical site).

Objectives:

The aim of this study was to compare recruitment and task completion between individuals and families who joined SPARK from January 31 to November 15, 2018 via social media outreach and those who joined through contact with a clinical site.

Methods:

Data from all individuals who enrolled in the SPARK study from January 31 to November 15, 2018 were included in this study. The referral source was defined by the web URL from which an individual joined, specifically a social media platform URL (e.g., Facebook) or through a clinical site-specific URL (e.g., https://sparkforautism.org/UNC). For both individuals and families (biological mother, father and proband), enrollment was defined as consent to the genetic component of the SPARK study (Y/N), and tasks were defined as completion of initial surveys (Y/N) and saliva kit return (Y/N).

Results:

During the study period, a total of 20,312 individuals and 2,243 families initiated the enrollment process in SPARK via social media, compared to 8,772 individuals and 1,815 families from clinical sites. However, for both individuals and families, those recruited through a clinical site were significantly more likely to complete online enrollment in SPARK as compared to those recruited through social media (p<.05 for both individuals and families). Forty nine percent (n=9,957) of individuals and 42% (n=947) of families recruited via social media completed their first round of online surveys compared to 51% (n=4,501) of individuals and 34% (n=611) of families recruited via clinical sites (p<.05 for both individuals and families). Among those recruited via social media, 31% (n=6,352) of individuals and 43% (n=975) of families returned their saliva kit(s), compared to 60% (n=5,260) of individuals and 70% (n=1,275) of families recruited via clinical sites (p<.05 for both individuals and families).

Conclusions:

This study suggests that social media advertising may lead to enhanced study recruitment compared to traditional methods such clinical site recruitment. However, individuals and families that were recruited through a clinical site were more likely to complete online enrollment and return their saliva kits. We also found that families recruited via social media are more likely to complete online surveys. A multi-modal recruitment approach that combines social media advertising with clinical site staff to assist with task completion may improve recruitment and study participation.

246 **242.246** The Cost of Caring: The Impact of Autism on Parental/Caregiver Workforce Participation

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Background:

Previous research has indicated that parents (or other caregivers) often reduce their workforce participation in order to care for their child on the spectrum. Limited information is available, however, on the characteristics of children that are associated with reduced parental employment, or parents' reasons for reducing their employment. Additionally, previous studies have focused on children, with little attention given to the workforce-participation restrictions of parents of adults on the spectrum.

Objectives:

This study explored (a) the percentage of parents who reduced their workforce participation in order to care for their son or daughter on the spectrum, (b) characteristics of the child or adult on the spectrum that can impact their parents' workforce participation, and (c) parents' reasons for reducing their employment.

Methods:

In response to an online survey, responses were received from 732 parents including parents of 85 children yet to start school, 403 primary school-aged children, 175 secondary school-aged children, and 69 young people who had left school. Descriptive and inferential statistics were used to analyse data on parental workforce participation rates and the characteristics of young people that impact their parents' workforce participation. Content analysis was used to analyse the open-ended responses on the parents' reasons for their need to reduce their workforce participation.

Results:

Sixty-eight per cent of parents of children yet to start school, 67% of parents of primary school-aged children and 60% of parents of secondary school-aged children said that they work less hours or did not work, because of the need to care for their child on the spectrum. A significant minority (47%) of parents of adolescents and adults on the spectrum who had left school, had reduced their workforce participation to care for their son or daughter. Co-occurring anxiety disorders in the primary and secondary school-aged children and the young adults were significantly

associated with the parents' reduced workforce participation. Specific learning disorders in the primary school-aged children and attention deficit disorders in the young adults were also significantly associated with their parents' reduced workforce participation. The reasons that parents gave for reducing their employment included (a) frequently reduced school attendance due to school refusal and/or parents being asked to collect the child early, (b) a lack of autism-friendly after-school and vacation care, (c) the need to take the child to appointments, (d) the need to home-school the child, and (e) the child's mental health issues. Parents of adults who had left school also described the need to provide support for mental health issues, the need to transport the young person to work or tertiary education, as well as the need to support the young person in basic activities of daily living. The financial impact of reduced parental employment was highly concerning for many families.

Conclusions:

These parental perspectives are enlightening in terms of the support needs of families. Additional supports such as autism-friendly schools, after-school and vacation care services, mental health services, and a range of programs for young adults would reduce the burden on families and enhance their workforce participation.

247 **242.247** The Decision to Participate in EHR Research: Factors Important to Adults with ASD

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Background: Electronic health records (EHR) can potentially provide large amounts of clinical data to researchers investigating autism spectrum disorders (ASD). Inclusive research design can lead to increased participant engagement and better outcomes. However, little research has investigated the perspectives of adults with ASD on sharing their EHR for research. These individuals may have much to gain from research participation, but they have many legitimate concerns. Understanding their preferences may help researchers enact more effective informed consent procedures, effect higher levels of participant engagement and ultimately, produce greater benefits.
Objectives:

- To investigate the preferences of young adults with an autism spectrum disorder (ASD) regarding research use of EHR data.
- To compare the preferences of adults with ASD with the preferences of young adults who are neurotypical (NT)

Methods: Adults with ASD and NT adults, aged 18-40, were invited to participate in an online survey about preferences for research using EHR. 207 NT adults completed the survey. As of submission, 129 adults with ASD have completed the ongoing survey with a recruitment goal of 200.

The survey uses a discrete choice experiment (DCE) to assess preferences for studies using EHR. A DCE uses random utility theory to explain choices individuals make. The DCE presents a series of questions asking participants to compare research studies and choose the one they prefer. Each study is depicted with different combinations of attributes that may influence the decision to share EHR. Combinations are generated using an experimental design algorithm that statistically varies combinations to estimate the probability that an individual will choose a specific option. Analyses reveal which attributes are most and least important to participants. Additional survey questions ask about demographics, adaptive skills, and healthcare experiences.

Results: DCE analysis results will be presented by plotting average preference weights by attribute and study population. Preferences of the two groups will be compared. Associations between preferences and demographic factors or health and behavioral variables will be explored.

Results for the NT group show significant preferences for research that uses deidentified data, is conducted by university researchers, investigates topics important to the individual, and returns study results. Preliminary data for the ASD group is inconclusive, possibly due to insufficient power. Current data shows less pronounced preferences which trend similarly to those of the NT group except for a preference for research using identifiable data.

Conclusions: Preliminary results indicate that individuals with ASD may be more likely to participate in research using identifiable data which is conducted by university researchers. Study topics important to participants and the return of study results may also influence their decision to participate in a study. Understanding the preferences of potential study participants with ASD may inform research design leading to increased participation rates and more impactful outcomes.

248 **242.248** The Impact of Social Stories on Neuroscience Research in ASD: A Qualitative Study of Parents' Perspectives

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Background: Neuroscience research has provided helpful information about mechanisms underlying the development of ASD. Although neuroscience research provides pivotal findings, recruiting ethnically diverse participants presents a challenge. Research on participant perspectives suggests that minority individuals report high levels of distrust and limited knowledge about the risks and benefits of research[3]. Studies have shown that using social stories that describe steps about new situations may decrease stress in children with ASD[1,2]. However, the impact of social stories in parents of children with ASD is unknown. This study explored the effect of a social story on parents' willingness to bring their child with ASD to participate in neuroscience research.
Objectives:

1. What were the reasons parents reported for being willing/unwilling to bring their child to participate in neuroscience research?
    - Did these reasons, given at pre-test, differ between English and Spanish-speaking parents?
2. What were the reasons that parents reported for change from pre to post-test?
    - Did reasons given differ based on condition (presentation of the information)?
    - Did participation willingness at post-test differ between English and Spanish-speaking parents?

Methods: Eighty parents (43 Spanish-speaking, 37 English-speaking) of children with ASD participated in an online survey. Parents were randomly assigned to one of two conditions: the social story condition (N=39), illustrating a child participating in an EEG study, or the read condition (N=41), where they read a description of the EEG process. Before presenting conditions, parents provided reasons for willingness/unwillingness to

participate. After seeing the social story or reading the description (post-test), parents reported whether their willingness/unwillingness had changed and if so, were asked to elaborate on the reasons.

Results: At pre-test, a one-way ANOVA on willingness was conducted between Spanish and English-speaking parents. No significant differences were observed (p=.66). At post-test, the same ANOVA was run. No significant differences were observed (p = .18). Qualitative themes of willingness/unwillingness were analyzed at pre-test (Table 1). Of the 80 participants, 13 parents reported reasons for change (Table 2). Fifty-seven participants reported no change. Thirty-five parents remained willing to participate at post-test (social story N=20, read N=15), while 22 remained unwilling (social story N=11, read N=11).

Major themes differed across conditions. In the social story condition, change in willingness was in response to the type of study, whereas unwillingness was in response to child's behaviors and child previously completing an EEG. In the read condition, change in willingness was in response to the procedure being noninvasive and for advancing ASD research, whereas unwillingness was in response to: child's behaviors, needing more information, safety concerns, child's willingness, time commitment, or other.

Conclusions: Social stories may be a useful recruitment strategy to help parents better understand procedures associated with neuroscience research. In the social story condition, parents did not report needing more information or safety concerns about participating when compared to the read condition. Moreover, no differences in willingness to participate were found between English and Spanish-speaking families for pre or post-test. Thus, social stories may be an effective way to provide more information about neuroscience research to ethnically diverse populations.

249 **242.249** The Journey through Healthcare and Educational Services: Perspectives of Parents of Teens on the Autism Spectrum

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Background:

In summer 2018, a community-university partnership between MacART, the McMaster Autism Research Team, and McMaster University developed the Job-Train Program (JTP), a 13 week program providing vocational skills training and a job placement at McMaster with job coaches for 12 autistic students in Hamilton, Ontario, Canada. From varying socioeconomic backgrounds, all participants were credit bearing students in secondary school. To provide background information for the JTP about prevocational training and other supports students had accessed in their communities, interviews were conducted with their parents to document their experiences seeking and using services in the healthcare and educational systems.

Objectives:

To ascertain the extent to which existing publicly-funded healthcare and educational services had met the needs of this group of autistic adolescents.

Methods:

Interviews were based on open-ended questions from an interview guide generated by the research team. Interviews were conducted in family homes or public places that parents selected. Responses were recorded through note-taking during the interviews. Reports were prepared on each family's experience, using a phenomenological perspective, and common themes were identified among families.

Results:

Ten parents were interviewed. Nine themes emerged from the interviews.

Useful Services Available. Most parents reported having received some helpful services from local healthcare and educational systems.

Difficult Elementary School Years. Most parents reported that their child's situation had been precarious in elementary school. Difficulties with school services involved accessing educational assistants and assistive technology, communication problems with school personnel, and bullying.

Importance of Confirmed Diagnosis. Parents reported that their child's situation improved once a diagnosis of autism had been confirmed, facilitating access to services.

Specialized Highschool Classes. At the highschool level, Social Communication Classes offered by the public school board were perceived by parents as highly effective in meeting student needs, although there were a limited number of places available.

Reliance on Private Health Insurance. Many parents, especially those with private health insurance coverage through their employers, reported paying privately for psychoeducational and/or psychological assessments which facilitated their child's diagnosis and access to services.

Importance of Parent Advocacy and Knowledge. Effective parent advocacy and a high degree of parent knowledge about available resources is crucial to obtaining good outcomes for autistic children and adolescents.

Socioeconomic Status. Higher socio-economic status appears to influence outcomes, since families can afford to pay privately for some services.

Invisible Disability. There is a perception among parents that services are particularly difficult to obtain for "high-functioning" autistic individuals because they have an "invisible disability."

Importance of Interpersonal Relationships. The quality of inter-personal relationships among parents, teachers and/or healthcare professionals, and the children and adolescents receiving services is also an important factor contributing to the success of these services.

Conclusions:

Preliminary conclusions suggest that programs like the JTP are a positive addition to existing services for adolescents on the autism spectrum. By preparing participants for the transition from highschool to the workplace, the JTP provided a unique form of support for students that would otherwise have not been available through the local healthcare and educational systems.

250 **242.250** The Leisure Participation Profiles of Australian Adolescents with ASD: The Interest-Participation Gap

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Background: Adolescence is characterized as a time of social development during which peers become increasingly important. Adolescents typically spend a large proportion of their time engaging in various leisure pursuits important to their development, health and well-being. While previous research has examined differences in the participation of adolescents with Autism spectrum disorder (ASD) and their peers in leisure activities, little in known in regard their levels of interest in various leisure pursuits, nor if there is an interest participation 'gap'.
Objectives: To describe the interest and participation profiles of Australian adolescents with ASD in leisure activities and compare these profiles with those of their neurotypical peers.

Methods: A modified version of the Pediatric Interest Profiles (PIP) (Henry, 2000) captured the interest and participation profiles of adolescents with and without ASD, in the leisure domain including areas of clubs/community, socializing, creative, intellectual, relaxation, outdoor, exercise and sporting activities. PIP provides a measure of interest, level of engagement, and with whom activities are undertaken across 85 activities. A total of 143 Australian adolescents (118 with ASD, 25 typically developing (TD)) between the ages of 12-17 years (62% male) participated. For ASD participants diagnosis was confirmed via the ADOS with the PIP completed during a face-to-face interview. TD adolescents completed the PIP online. Activity participation rates between groups were compared using Chi-square test for independence.

Results: Both Adolescents with ASD and their neurotypical peers reported high levels of interest in the activity areas of socializing and relaxation activities, with listening to music and taking vacations of most interest across both groups. While adolescents with ASD had high levels of interest in various activities there emerged a significant interest/participation gap. TD adolescents participated in all activities ($p<0.05$) more than adolescents with ASD, with the exception of sporting activities ($p>0.05$). In relation to 'who they do the activities with', adolescents with ASD more frequently participated on 'their own' or with 'their families' than 'with friends' compared to their TD counterparts in intellectual activities (playing with computer ($\rho=0.005$); math ($\rho=0.009$); politics ($\rho=0.006$); History ($\rho=0.005$); debates ($\rho=0.028$); literature ($\rho=0.034$); reading ($\rho=0.009$)). This pattern was repeated in socializing activities where TD peers participating more frequently with friends (going to: arcades ($\rho=0.003$); cinema ($\rho<0.001$); parties ($\rho=0.035$); shopping mall ($\rho=0.002$) and sporting events ($\rho<0.001$)).

Conclusions:

While adolescents with ASD show high levels of interest in a range of activities, particularly those social in nature, their participation rate falls significantly below that of their TD peers, with the exception of sporting activities which were most frequently engaged in at school. Clearly, despite high levels of interest in leisure activities adolescents with ASD experience significant participation restrictions. It is likely that challenges in social communication and interaction experienced by adolescents with ASD act as barriers to participation, particularly with friends. These findings highlight the importance of developing interventions which bridge the interest participation gap for adolescents with ASD.

251 **242.251** The Process of Autism Diagnosis and Access to Services: Zeibabwean and Ethiopian Parents 'view

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Background: The number of children diagnosed with autism around the world is increasing. Unlike a few years ago, more about the disorder is known today, which facilitate the improvement of outcomes of the many children diagnosed with the disorder. However most of what is documented about autism today is based on researcher from the Western world. Limited research has been conducted about children with autism and their families in other part of the world, particularly Africa
Objectives: This presentation aims to address parents view and experience on their journey in getting diagnosis and accessing service for their children with autism in Ethiopia and Zimbabwe , the two African countries.

Methods: Using purposive sampling ,10 parents (five from each country) of children with autism were interviewed. A semi-structured in-depth interview is used to collect data. Data were analyzed using systematic content analysis.

Results: The result indicated that parents viewed the process of diagnosis as difficult and at times in accurate. They also identified several challenges including social stigma, strained family relationship, and lac of access to appropriate services.

Conclusions: Based on the results of this study it is recommended that parents and service provider of children with autism should be educated about child development and autism promote efficient diagnosis. It is also recommended that service provider working with children with autism should collaborate with the parents in order to improve the treatment outcomes of children.

252 **242.252** The Types and Rates of Stigma Experienced By Parents and Carers of Children with Autism Spectrum Disorder (ASD) or 22q11.2 Deletion Syndrome (22q11DS) and Aggression: A Systematic Review.

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Background: Young people with a neurodevelopmental disorder are three to four times more likely to experience psychological disorders (particularly anxiety and mood disorders) than those in the general population. Challenging behaviours often co-occur in children with neurodevelopmental disorders. The most common behavioural challenge for young people with neurodevelopmental disorders, their families and their service providers, is aggression. Research has shown that up to 68% of young people with a neurodevelopmental disorder display aggressive behaviours. Aggression can cause social isolation and low quality of life for the individual and can have significant ramifications for family members and carers.
Objectives: This systematic review was interested in gaining an insight into how much is currently understood about the impact a child with a neurodevelopmental disorder, who behaves aggressively, has on parents and carers. In particular, the purpose was to identify what the available literature shows about the types and rates of stigma experienced by parents and carers of children with autism spectrum disorder (ASD) or 22q11 Deletion Syndrome (22q11DS), with aggression.

Methods: In accordance with the PRISMA guidelines, six databases were searched and studies were systematically screened against scheduled inclusion criteria. 23 articles met the inclusion criteria. Of these, 15 were included in an analysis of the rates and types of stigma experienced by parents and carers of children with ASD or 22q11DS, with aggression. A grey literature search was also conducted resulting in two additional articles.

Results: The analysis showed that stigma was identified within the ASD cohort; however, it was rarely specified in the title or abstract. Further scrutiny of the results and conclusion sections in the full texts was required to identify stigma. We found that stigma was often discussed in terms of judgement or isolation. Most commonly, public stigma and self-stigma were experienced. There were no results for the 22q11DS cohort.

Conclusions: Findings demonstrate that parents and carers raising a child with ASD, who is aggressive, experience stigma on a regular basis and would benefit from more understanding from professionals such as teachers, clinicians, medical staff, politicians and policy makers, as well as from the public. The structure of the options currently offered by the education system also presented significant challenges for these families. Further research is needed to gain a greater understanding of the experience of stigma within ASD cohorts as well as the unexplored phenomenon of stigma associated with 22q11DS and aggression. A theoretical framework has been developed to assist in the underpinning of future research.

253 **242.253** Titre : An Analysis of the Support Needs of Fathers Living with a Child with Autism Spectrum Disorder

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Background: The support needs of fathers living with a child with autism spectrum disorder (ASD) are rarely documented in the scientific literature. In fact, most research present mothers perception. That explain why support services offered to families seem to be more adapt to women, without integrating the needs of both parents. This findings supports the relevance of documenting father's experience and needs. It is also important to note that a high number of families living with a child with ASD experience a separation or a family restructuring. Step-parents are called on more and more to play a significant role in the life of the child and very little research has been done on their experience.
Objectives: The goal of this presentation is to present a portion of the results collected as part of a master's level research project in social work. This research project focussed on the comparisons between the needs of parental figures of children with ASD between 5-12 years of age. The participants were encouraged to express their needs for support as a parent and as a partner in a couple. This presentation will focus mainly on the support needs of fathers and stepfathers.

Methods: A review of the publications on the parental need for support allowed for particularities related to the father's experience to come out. Next, four fathers and one step father were invited to share their perspectives during focus group (n=3) or individual interview (n=2). Qualitative data were treated following Paillé et Mucchielli (2016) directives for thematic content analysis.

Results: All fathers indicate their limited knowledge about services offered to families. They claimed that it was the spouse who usually sought the services available. Fathers tend to be very preoccupied about schooling and socialisation of the child. They would like to have more strategies to support the development of the autonomy of their child. They wish to participate in more social activities and hobbies as well as to rest. Finally, the fathers mentioned a desire to attend practical training sessions on ASD. They prefer training that is more practical than theoretical.

Conclusions: A better understanding of the needs of fathers and stepfathers involved in families of a child with ASD is essential for optimising the practices of professionals who are also involved in daily life. Future research should look to developing how services can be adapted to support the reality of fathers and stepfathers.

254 **242.254** Toward Increased Self-Determination of Autistic Individuals: Perspectives of Autistic Adults

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Note about language: Consistent with the preference of autistic individuals, this abstract is written with identity-first language.
Background: Self-determination enhances quality of life. It is a fundamental human right, regardless of disability, as confirmed in the 2006 United Nations' *Convention on the Rights of Persons with Disabilities,* ratified by Canada in 2011. However, autistic individuals have lower levels of self-determination than their non-autistic peers, including peers with other developmental disabilities.

Objectives: What can be learned from independent autistic adults that would enhance autism service provider practices to support self-determination of autistic individuals?

Methods: A research advisory team was formed that included the Executive Team of a large community autism service provider and an autistic individual. Six interviews with independent autistic adults were conducted using an interview guide co-created by the autistic member of the advisory team and the researcher. Interviews took place in person (n=5) or over Skype (n=1). Interview questions addressed participants' interpretations of and experiences with self-determination, as well as potential strategies to improve self-determination. Interviews were audio-recorded and transcribed verbatim. The researcher generated initial codes and potential themes, guided by Braun and Clarke's six stage approach to thematic analysis. These themes were then reviewed and refined with the assistance of the Executive Team members of the research advisory team. A neurodiversity lens was employed throughout the process. This lens positions autistic individuals as equal citizens while recognizing that some individuals will require supports to enact their citizenship. As such, all data was considered equally valid and important, even if it did not align with the researcher's interpretation of self-determination.

Results: Participants included four men and two women. One participant lived on her own, one participant lived with his mother, three participants lived with their spouses and/or children, and one, a university student, lived with roommates. All participants used verbal language to communicate. Two overarching themes emerged: (1) individual factors related to self-determination, and (2) systemic factors related to self-determination. Within each theme, data were organized related to enablers of, barriers to, and strategies to improve self-determination. Strategies to support individuals primarily related to teaching skills (e.g., communication, stress management, social skills) and working from an individual's interests and strengths. Strategies to support systemic change primarily focused on self-advocacy and broad autism education.

Conclusions: Self-determination is complex and achieved via multiple means and strategies. Independent autistic adults all reinforced the

importance of including autistic voices in all that affects them. Strategies to directly engage autistic individuals in service decisions and planning at autism service providers could enhance their self-determination and ensure targeted outcomes are relevant. The creation of Advisory Committees of Self-Advocates within autism service providers could help ensure their programs and services support self-determination.

255 **242.255** Traits, Traumas and Treatments: The Many Associations between ACEs and Autism

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Background: In recent years, trauma and adverse childhood experiences (ACEs) have been discovered to be elevated in children with ASD, but little is known about how ACEs and ASD are associated, and the magnitude of the impact of trauma on children with ASD.
Objectives: The purpose of the current scoping review is to (a) summarize the current understanding of the relationships between adverse childhood experiences and Autism Spectrum Disorder, (b) synthesize key findings, and (c) make therapy recommendations based on the identified literature.

Methods: To meet the purposes proposed in the previous section, the first author performed a scoping review of the literature. The search for studies included two reference databases; *PsycINFO* and *PubMed* and limited search results to peer-reviewed English-language articles published between January 1st, 2008 and May 31st, 2018. Search terms included; ACEs, adversity, trauma, social determinants, and filtered the results for "autism". A pool of 214 articles met all search criteria. The author then read the titles and abstracts of those articles meeting the search criteria and excluded those that were not within the scope of the research questions stated above, reducing the number of articles included to 53. The articles were then read and summarized in a table and subsequently grouped by thematic category. 12 articles were determined to be thematically unrelated and were removed from the review, leaving 41 articles in the final analysis.

Results: 41 articles were included in the final analysis and grouped under six thematic categories; *ACES and ASD*, *Trauma and ASD*, *Trauma and ASD-like traits*, *Pre and Post-Natal Risk*, *Caretaker Burden and Resilience*, and *Therapy Recommendations.* These subjects are discussed at multiple ecological levels with a primary focus on the impact on the individual with ASD.

Conclusions: This scoping review explored the literature of the past decade to illuminate multidirectional, multigenerational relationships amongst adversity and ASD traits. These findings highlight the need for pediatric screening for ACEs and therapeutic accommodations for children with ASD who have experienced complex trauma.

256 **242.256** Using Parent-Identified Strengths of Adolescents with Autism to Inform Transition Interventions

N. Warren[1], *B. Eatchel*[1], *A. V. Kirby*[2], *C. Wright*[3], *V. D'Astous*[4] *and M. Diener*[3], *(1)FCS, University of Utah, SLC, UT, (2)University of Utah College of Health, Salt Lake City, UT, (3)University of Utah, Salt Lake City, UT, (4)King's College London, London, UNITED KINGDOM*

Background: Adolescence is a critical time in which families of adolescents with autism spectrum disorder (ASD) plan and prepare for the future. Recent evidence suggests that parents' expectations during adolescence act as significant mediators of outcomes in adulthood (Kirby, 2016). However, few research studies use parents identified strengths to inform transition interventions. Our research uses a qualitative approach that allowed for in-depth exploration of parent visions of the future, which also revealed their perceptions of the strengths of their adolescents. Research in this area is needed to provide professionals with information to better meet youth's transition needs and inform strength-based transition interventions.
Objectives: To examine parental perceptions of the strengths of their adolescents with ASD.

Methods: We analyzed qualitative interviews from parents of youth with ASD. Using similar interviews conducted as part of three related research studies, we collected qualitative interviews with 41 parents of youth with ASD (4 females, 37 males). All the youth were verbally-competent and most had average or above-average IQ scores. In the interviews, parents were asked about their visions for the future related to their adolescent with ASD transitioning to adulthood. Interviews were semi-structured in nature, audio-recorded, transcribed verbatim, and were analyzed using multiple coders. Although questions did not specifically address strengths, all participants discussed the strengths of their children. Interviews were thematically coded and categorized to identify parent perceptions of youth strengths.

Results: The qualitative analysis suggests a wide variety of strengths among adolescents with ASD. These strengths grouped into 5 key domains: Creative Thinking (creative, innovative thinking), Cognitive Strengths, (science, math, language arts), Strength in Structure (routines, following rules), Hands-on Learning Style and Technology. The large majority of the parents identified their children as smart, with reported strengths in a range of areas. Additionally, parents viewed youth preferences for structure and consistency as a strength.

Conclusions: The results of this qualitative analysis suggest that parents are important informants of the strengths of youth with ASD. Related to the transition to adulthood, we encourage parents and professionals to consider these strengths when planning for adulthood. Many transition plans focus on social-communication challenges that might overshadow strengths. The most commonly recognized skill domains were Creative Thinking, Cognitive Strengths, and Structure, suggesting that a focus on these strengths may be particularly important when discussing future outcomes for youth with ASD. For example, priority areas of career exploration could include those fields that might target the youth's strengths. Although individual youth present with unique strengths and challenges, this study suggests that parents can play an important role during transition to harness strengths for more successful transition plans. Future research should focus on the incorporation of strengths that are balanced with an awareness of challenges when supporting the transition process for youth with ASD in adulthood.

257 **242.257** Vaccine Hesitancy and Attributions for Autism in the SPARK Cohort

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Background: Although some data indicate that children diagnosed with autism spectrum disorder (ASD) are well-vaccinated until 2 years of age, new evidence suggests that vaccine receipt may decline later in childhood. Moreover, younger siblings of children with ASD often have lower rates

of vaccine receipt compared to both their older siblings and younger siblings of children without ASD. This suggests that parents of children with ASD may be at risk for becoming vaccine hesitant, resulting in concerns about vaccine safety and possible vaccine delay and/or refusal.
Objectives: To (a) estimate the prevalence of vaccine-hesitant parents (VHP) within the SPARK (Simons Foundation Powering Autism Research for Knowledge) cohort—a national sample of families with at least one member experiencing ASD—using the *Parent Attitudes About Childhood Vaccines* questionnaire (PACV; scores ≥ 50 indicate vaccine hesitancy); (b) describe attributions for ASD in this sample using the *Revised Illness Perception Questionnaire* for parents of children with ASD (IPQ-R-ASD); and (c) identify factors associated with vaccine hesitancy.

Methods: Invitations to participate in an online survey were emailed to 1,000 SPARK parents of minor children with simplex ASD; 225 parents (23%) responded. The majority were white (75%, *n*=168) and mothers (92%, *n*=207). Descriptive statistics were used to determine the prevalence of VHP, distribution of PACV scores, and average scores for IPQ-R-ASD subscales (Timeline-Acute/Chronic, Timeline-Cyclical, Consequences, Personal Control, Treatment Control, Illness Coherence, Emotional Representations). Multivariable logistic regression was used to estimate the odds ratio for vaccine hesitancy.

Results: Overall, 29% (65/225; 95% CI: 23%, 35%) of parents were vaccine hesitant. VHP had lower incomes (p=0.007), were less likely to be white (p=0.002), and were more likely to endorse accident/injury (13% vs. 4%; p=0.027), deterioration of the child's immunity (29% vs. 4.5%; p<0.001), diet (40% vs. 16%; p<0.001), environmental pollution (50% vs. 30%; p=0.007), general stress (47% vs. 26%; p=0.006), negative views (13% vs. 5%; p=0.038), own decisions (21% vs. 6%; p=0.002), own emotional state (27% vs. 13%; p=0.016), and toxins in vaccines (65% vs. 3%; p<0.001) as causes for their child's ASD. Compared to non-hesitant parents, VHP scored higher on the Personal Control (M=18.9 vs. 18.0, p=.011), Treatment Control (M=13.5 vs. 12.3, p<.003), Illness Coherence (M=15.5 vs. 14.3, p=.019), and Emotional Representations (M=18.2 vs. 16.0, p<.002) subscales of the IPQ-R. The final multiple logistic regression included two causes for ASD: general stress and vaccines. The odds of being vaccine hesitant were 3.3 (95%CI: 1.4, 7.6) times higher among parents endorsing general stress as a cause for their child's ASD and 61.5 (95%CI: 21, 180) times higher among parents endorsing toxins in vaccines as a cause.

Conclusions: Endorsement of general stress and vaccines as causes of ASD were associated with current vaccine hesitancy among SPARK parents. Based on IPQ-R subscales, VHP felt they had more control over their child's ASD, a clearer understanding of ASD, yet reported more negative feelings about their child's ASD compared to non-hesitant parents. This information could inform the development of preemptive vaccine-safety information targeted to parents of children with ASD.

258 **242.258** What's Next?!: Engaging Patients, Caregivers, and Stakeholders to Address Transitioning to Adulthood

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Background: Recent estimates indicate 1 in 59 children are diagnosed with autism spectrum disorder (ASD). Each year in the United States, approximately 50,000 of these youth transition to adulthood.Given that ASD emerges in early childhood, research and interventions have largely focused on children with ASD and not older youth. Another concern is that youth with ASD often have complex medical and psychiatric comorbidities (e.g., seizures, anxiety, depression, sleep disturbances, gastrointestinal disorders) in addition to the core symptoms of ASD (e.g., impairments in social interaction, communication deficits, repetitive behaviors). Thus, it is not surprising to find that research suggests young adults with ASD have poorer transition outcomes compared to peers with other disabilities. Clearly, there is a knowledge gap regarding the complex transition needs of young adults with ASD.
Objectives: This study had two primary objectives. First, to form partnerships between patients, caregivers, and stakeholders to gain insight into the challenges encountered during the transition phase of ASD. Second, to develop comparative effectiveness research questions alongside patients, caregivers, and stakeholders to address these challenges.

Methods: A patient-centered outcomes research (PCOR) approach was used to form partnerships among adolescents and young adults with varying degrees of ASD severity ages 14-36, caregivers, clinicians, independent living facility directors, educators, directors of medical and adult ASD services, patient care coordinators, advocates, special needs lawyers, legislative experts, and researchers. Patients and stakeholders were divided into six groups and met within their respective communities over a 12-month timeframe. Groups were facilitated by patients, caregivers, and stakeholders. An Autism Advisory Board (AAB) consisting of patients, caregivers, and stakeholders met monthly to provide overarching guidance to the project. Field notes were collected from all meetings. Qualitative content analysis was used to evaluate recurrent themes.

Results: This study identified seven key areas of transition in ASD (e.g., healthcare, self-advocacy, independent living skills, safety, career/job, social/relationships, and education) that have not been adequately addressed in research from the patient and stakeholder viewpoint. Additionally, this study identified the presence of racial and gender differences in the transition phase that presented unique challenges and needs. Lastly, patients and stakeholders identified four comparative effectiveness research (CER) questions to address the seven key areas of transition. CER questions focused on delivery methods of interventions, mentor models, peer navigators, and transition readiness assessment tools.

Conclusions: The transition from childhood to adulthood represents a tumultuous time for most, but especially for young adults with ASD and their families. This project demonstrated that a PCOR approach provides a unique opportunity for patients and stakeholders to identify their needs and to shape future research that is responsive to their needs. The use of this approach was critical in creating a deeper understanding of the complex needs of transition-age young adults with ASD and informing meaningful ways to address these needs. Patients, caregivers, and stakeholders identified several gaps in research, care, and services for individuals with ASD transitioning to adulthood. New research is currently being conducted by the partnerships formed in this PCOR study to advance this critical foundation.

259 **242.259** "I Am Different Because I Have ASD Sibling": A Qualitative Study on Siblings of ASD Child in Lithuania

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Background:
The relationship among the siblings is the longest lasting relationship among humans (Beyer, 2009). Sibling studies are extensively researched area (Beyer, 2009). However, there is still less known about the relationship among siblings when one of them has ASD and the existing findings

are mixed (Benderix & Sivberg, 2007; Mascha & Boucher, 2006; Orsmond & Seltzer, 2007).

Objectives:

This was a novel study that aimed to look at the siblings' experiences in growing up with ASD sibling in Lithuania. Especially, to capture the different types of experiences: risk and prevention factors through the eyes to the sibling. We also considered age, gender and ASD severity which are usually not considered in previous studies.

Methods:

We have used qualitative methods to access more in-depth experiences of the participant's. We used semi-structured interviews. Total of 15 siblings agreed to participate, age range from 11-24 years, from 13 families. The data was than transcribed and analysed using NVIVO 12 software. We applied grounded theory analytic framework to understand the findings.

Results:

Lithuanian siblings reported stress due to responsibilities given to them. Participants were obliged to take care of their ASD sibling despite the birth order (being younger sibling) or age difference (being 10 years apart). They have shared about challenges of having ASD sibling such as behavioural problems of ASD, feeling "secondary child", experiences of stigma and embarrassment of their ASD sibling. This was reported by siblings who had brother/sister with severe symptoms of ASD. Despite of all the difficulties siblings reflected on positive aspects like being more understanding and able to cope better in challenging situations compared to their friends.

Conclusions:

The current study highlighted the impact of ASD on sibling's relationships. In addition, it informed about existing family dynamics from the sibling's point of view. While it is not possible to mediate sibling's age, gender or severity of ASD, there are strategies that can be employed to facilitate more positive relationships between sibling participants and ASD sibling and family as a whole.

260 **242.260** "It's Not a User-Friendly System": Mothers Realities of Raising Children with ASD

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Background: Mothers raising children with Autism Spectrum Disorder (ASD) experience vast challenges when navigating the diagnostic process, medical system, funding programs, all while managing their own self-care needs.
Objectives: Through the theoretical orientation of phenomenology, this study sought to understand the lived experiences of mothers raising children with ASD, including diagnosis, symptoms, struggles, lessons learned, and advice for others.

Methods: Eleven biological mothers from the Region of Waterloo were interviewed for this research and many themes emerged, ranging from the diagnostic process, school experiences, therapies, and coping mechanisms.

Results: For the purpose of this presentation, the theme called "We fall in a gap" will be discussed, which includes the following subthemes: funding, programming, and mental health. Mothers discussed the availability of resources for families raising children with ASD, but many were not suitable for their children due to the spectrum nature of the disorder. For instance, programs may be tailored for boys, so mothers of girls do not feel welcome; or funding is available for those who require assistive devices, but not for all forms of therapy. In this way, mothers felt their needs were not being met adequately within the Region of Waterloo.

Conclusions: Several suggestions will be discussed for parents, program coordinators, health professionals, and policy makers in order to better meet family's needs.

261 **242.261** "Lo Ví En Facebook [I Saw It on Facebook]": The Role of Social Media in Informing Underserved Latino Parents about Autism

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Background: Social media platforms, such as Facebook, have become popular reference sites for gathering health information, including information related to autism spectrum disorder (Saha and Agarwal, 2015). The utility of social media sites has been explored and are found to have some success in providing social support and as a means to disseminate health related information among Latinos (Anguiano, 2017). Low-income Latinos, in particular, use social media at higher rates compared to other race/ethnic groups including non-Latino Whites (NLW) (Lopez et al., 2013).
Objectives: This study aims to understand the role of social media platforms in providing emotional and informational support to underserved/low-income Latino parents after they receive an autism-diagnosis for their children.

Methods: As part of this study, 22 self-identified Latino parents of children with ASD and 4 key informants (community leaders) were interviewed. Participants were recruited using snowball sampling and targeted Facebook advertisements. Criteria for study participation included residence in Los Angeles County, being of Latin American descent, and a parent of a child between the ages of 2 and 10 years with a professional diagnosis of ASD. Enrollment was limited to participants with low socio-economic status (SES) as defined by the U.S. Federal Poverty Guidelines used to determine financial eligibility for federal programs. In addition, key informants were eligible if they worked with low-income, Latino parents of children with autism. Focus groups and interviews were audio-recorded, transcribed verbatim, and independently coded for major conceptual models. Exploratory, qualitative analyses was conducted using a modified grounded theory approach. Six raters coded each transcript to ensure reliability. Data triangulation and methodology triangulation were employed to ensure validity and reliability of data interpretation.

Results: Parents reported heavily relying on social media platforms, such as Facebook and YouTube, for autism-related information after receiving a diagnosis for their child. They also reported that Facebook was one of the best ways to connect with other parents because it eliminated barriers to traditional methods of engagement, such as attending support groups. Participants reported using Facebook as a means to gather information, but also as a source of emotional support, endorsing feeling a sense of community through their online interactions with other parents. However, parents also endorsed concerns about unreliable resources being distributed across social media platforms. Community

partners reported relying on Facebook as a means to keep parents engaged and informed, particularly when the parents are unable to attend in-person support groups or when bilingual professionals were limited.

Conclusions: These findings confirm that low-income Latino parents are using social media for emotional and informational support, especially when they first receive their child's diagnosis. Understanding how Latino parents navigate and reference social media may facilitate initiatives to ensure that reliable and dependable information is accessible across social media platforms.

262 **242.262** Decision Makers Perceptions on the Current State of the Family Navigator Project in Quebec

A. Ibrahim[1], *I. Winkelmann*[2], *K. Shikako-Thomas*[3] *and M. Elsabbagh*[4], *(1)McGill University, Montreal, QC, Canada, (2)Douglas Mental Health University Institute, Montreal, QC, Canada, (3)School of Physical and Occupational Therapy, McGill University, Montreal, QC, Canada, (4)McGill University, Montreal, PQ, Canada*

Background: Families with an autistic child often experience stress as a result of the prolonged waiting period in accessing services in many communities. Our previous research in the Canadian context has shown that families experience significant barriers to access and coordinate care for their child, which can increase the burden on caregivers and prevent the delivery of necessary intervention services for their child. Navigation is defined as a professional-led model aiming to facilitate continuity of care and promote patient empowerment. Access to a Family Navigator is one of the policy priorities articulated as a strategy to address challenges in care coordination. However, there are currently no validated models for autism nor information on the potential active ingredients for effective delivery.

Objectives: To describe the perceptions of decision-makers on the Family Navigator model and the current and potential role of the Family Navigator strategy within public sector services.

Methods: Key informant open-ended interviews with decision makers within a large health care network in the province of Quebec (serving 37,4400 people). Of 22 decision makers, 8 were identified from the organizational chart of the health and social services network. They were included because their areas of involvement covered physical, intellectual deficiency, autism, mental health or youth protection. Interviews were audio-recorded and transcribed verbatim. Thematic analysis of interview transcripts was conducted by two independent reviewers using NVivo11.

Results: Emerging themes suggest diverging perspectives and experiences of Family Navigator functions across different levels of services (primary vs secondary vs specialist).This includes (a) the professional background of a Navigator, e.g., social worker vs educator, (b) whether their involvement is episodic (i.e. during transition periods and crisis), or continuous (addressing the various needs as they emerge), and (c) their initial point of contact (i.e., around time of diagnosis vs. in primary care around the time of initial concerns). In terms of current implementation of navigation functions in health and social services, decision makers identified duplication in the functions in first and second line services which can be addressed by increasing communication and collaboration between care teams. Finally, beyond public sector health and social services, the role of the community organizations was highlighted as a potential facilitator of navigation functions.

Conclusions: Decision-makers need a more concrete definition of the role and functions of Family Navigators in health and social services. Navigation is perceived as an essential strategy in supporting families of autistic children however the importance of having a Navigator assigned to one person early on across different levels of services is crucial for its beneficial outcomes. Future directions may include adaptation of evidence-based models from other areas of research into the autism system of care.

263 **242.263** Is There a Relationship between Cyber-Dependent Crime, Autism and Autistic-like Traits?

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Background:

A significant proportion of cybercrimes are termed 'cyber-dependent', that is, crimes that require digital technology, such as hacking, phishing and Distributed Denial Of Service. Several high profile extradition cases for cyber-dependent crime, where the USA has attempted to extradite hackers from the UK, have involved autistic hackers. The number of such cases is very small and evidence for a link between autism and cyber-dependent crime has not been established. International law-enforcement agencies, however, report that autism appears to be more prevalent amongst cyber-dependent criminals than the general population - although no empirical evidence exists to confirm or refute this common perception.

Objectives:

To identify any potential relationships between cyber-dependent crime, autism and autistic-like traits.

Methods:

174 individuals aged 14 or older from the general population without a known record of offending anonymously completed an online questionnaire assessing demographic information, non-verbal IQ (Ravens Matrices-short), Autistic-like traits (AQ), explicit Theory of Mind (Social Know How), perceived support (ISEL), basic digital skills, advanced digital skills and number of illegal digital activities. 72 (41.3%) reported engaging in illegal cyber-dependent crime and 10 (5.7%) individuals reported a diagnosis of autism. The characteristics of the sample by the absence or presence of illegal digital activity are described in Table 1 below.

Results:

Those who had carried out one or more illegal digital activities were likely to be older, have a higher total AQ score, have greater advanced digital skills and were less likely to have had received a diagnosis of autism.

Table 1: Descriptive statistics of the sample by the absence or presence of any illegal digital activity (n=174)

	No Illegal Digital activity (n=102) Mean (SD)	One or more Illegal digital activity (n=72) Mean (SD)	p

Age mean	22.9 (11.1)	26.6 (8.5)	0.020
Male sex (n, %)	72 (70.6%)	42 (58.3%)	0.094
Total Ravens	9.9 (2.8)	10.4 (1.8)	0.168
Total AQ Score	20.6 (8.3)	24.4 (8.9)	0.004
Social Know How	8.4 (4.5)	9.4 (4.8)	0.140
ISEL 12	23.5 (7.1)	23.6 (8.3)	0.892
Basic Digital Skills	48.9 (2.7)	49.6 (2.2)	0.074
Advanced Digital Skills	29.4 (12.6)	43.8 (8.4)	0.000
Autism diagnosis (n, %)	9 (8.8%)	1 (1.4%)	0.038

Conclusions:

Cyber-dependent crime was significantly related to autism and autistic-like traits, in opposite directions. Higher autistic-like traits related to increased likelihood of computer-dependent crime, whereas a diagnosis of autism related to decreased likelihood of cyber-dependent crime. This is particularly interesting given that typically the autistic population has been found to be higher in autistic-like traits than the non-autistic population. Previous research has found that autism can also be associated with being honest and trustworthy, and cyber-dependent crime may be an area that distinguishes those with high autistic-like traits and those with a diagnosis of autism. Obviously, the numbers of autistic respondents in this initial study was small, limiting such potential implications. Age and experience were also important, whereas non-verbal IQ, theory of mind and perceived support were not.

264 **242.264** The Attractiveness, Trustworthiness and Desirability of Autistic Males' Online Dating Profiles

*J. Gavin[1] and **M. Brosnan**[2], (1)University of Bath, Bath, United Kingdom, (2)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland*

Background:

A lack of success through traditional, face-to-face dating has led some autistic adults to pursue relationships through online dating. Creating an online dating profile, however, is a process that requires a range of complex social skills, the ability to balance a number of social demands, and self- and other-awareness - all of which can be challenging for autistic people.

Objectives:

The study explored the relative desirability of online dating profiles that include autistic attributes and interests presented in a positive way compared to the same attributes and interests presented negatively. It also measured the relative desirability of online dating profiles with and without an explicit autism diagnosis being stated.

Methods:

Participants were 127 self-identified heterosexual females who were 'seeking a man' through online dating, with an average age of 20.4 years (range 18-25; sd=1.56). These respondents were recruited through an advertisement on social media.

Participants viewed one of six profiles, all of which featured the same profile photo and basic details, for instance height and ethnicity. However, the profiles differed in regards to what was written in the 'About Me' section. Two variables were manipulated, the first being whether a diagnosis of autism was explicitly stated ('I am autistic') or not, and the second being the wording used to describe the male's autistic-like attributes (positive, negative or neutral). The neutrally worded profile was taken from the world's most popular online dating site. The authors inserted five autism-relevant statements that were either negatively or positively worded (e.g. I do not find social situations easy vs I am happy in my own company) for autistic-like attributes.

The dependent variables were interpersonal attraction (physical, social and task attraction), trustworthiness, desire to date, and familiarity with autism was controlled for.

Results:

There was a significant main effect for autism label on physical attractiveness ($F(1,120)=6.87$, $p=.01$) and trustworthiness ($F(1,120)=5.00$, $p<.05$). Post-hoc independent t-tests identified that an explicit statement of a diagnosis of autism related to the image being perceived to be more physically attractive ($t(125)=2.44$, $p<.05$) and more trustworthy ($t(125)=2.33$, $p<.05$). There was a significant main effect of wording on social attractiveness ($F(2,120)=3.75$, $p<.05$) and task attractiveness ($F(2,120)=4.21$, $p<.05$). Post hoc independent t-tests identified that positive wording was associated with a significantly higher social attractiveness rating than negative wording ($t(81)=3.04$, $p<.01$) and approached significance for neutral wording ($t(81)=1.83$, $p=.07$). In addition, negative wording was associated with a significantly higher task attractiveness rating than positive and neutral wording ($t(81)=2.05$, $p<.05$; $t(81)=3.29$, $p<.001$; respectively). There were no significant two-way interactions between label and wording (all $p>.05$).

Conclusions:

Explicitly stating a diagnosis of autism and positively-worded attributes associated with autism related to enhanced perceived attractiveness in online dating profiles. It is interesting that an explicit statement of a diagnosis of autism related to enhanced perceived physical attractiveness (as the same photo was used in all conditions) and may be related to enhanced perceived trustworthiness. Positivity would seem to be related to enhanced perceived social attractiveness.

Poster Session
243 - Interventions - Non-pharmacologic - School-Age, Adolescent, Adult
11:30 AM - 1:30 PM - Room: 710

265 **243.265** Launch: Development and Implementation of a Transition Planning Program for Youth with Autism

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Background:
It is uncommon for youth with autism spectrum disorder (ASD) to receive services to help them transition ***from*** childhood health, education and social service support systems of childhood services ***to*** adult services, activities, and systems of support. In fact, according to a recent report, only one fifth of youth with ASD receive any transition planning services (Kulhthau, et al., 2015) and the majority of these services focus only on employment and education (Gorter et al., 2011), not the full complement of domains that contribute to adult well-being.

The *Launch Program* was developed in response to family and community needs to have transition support and planning for youth with ASD. Development of the program was guided from consultation with family and community stakeholders and aims to support families and youth with ASD to identify their unique transition priorities across five life domains (i.e., 1) health and well-being, 2) education and employment, 3) communication and social relationships, 4) independent living skills and self-advocacy, and 5) legal and financial issues), help them to develop an Individual Transition Plan (ITP), and source resources in the community to meet their transition goals.

Objectives:

- To evaluate the *Launch* program impact, and
- To provide recommendations as Launch prepares to move forward from Phase One (development and pilot) to Phase Two (refinement and export to other community settings)

Methods:

A mixed method sequential explanatory design was used to address the research objectives. Questionnaires were completed by youth and their parents to better understand the program impact and implementation model. Questions addressed readiness for change, aspects that influence engagement (i.e., trust, cooperation, and diligence), key benefits of the program including skills, knowledge, and resources obtained, and barriers to implementing transition plans. Interviews were conducted with youth and their parents to help enrich understanding of the questionnaire results.

Results:

Fifty-eight families participated in the study. Youth presented with priorities from each of the five life transition domains. Social skills, communication, and relationships with peers were the most prevalent presenting concerns, with employment and employment supports higher for the clients who were older. Both parents and clients reported that they began Launch with a readiness to change and were engaged in the program, indicating that they trusted the clinicians and co-operated with them. Survey respondents indicated that they obtained knowledge, skills, and resources by participating in the program and there was a strong sentiment that the program served a vital guidance to help negotiate transitions to adulthood. Barriers to implementing the transition plans included personal, logistic, and resources difficulties. In addition, while the overwhelming response to Launch was positive, some barriers included issues related to the program including follow-up, adequacy of resources, and documentation.

Conclusions:

The Launch program components, delivery, and outcomes have the potential to contribute to the paucity of effective transition programming for youth with ASD. Proposed next steps include a Canada-wide scale out of Launch through the development of province-specific versions of the program, and training of local community facilitators to deliver transition planning workshops.

266 **243.266** Learning without Teaching: Social Performance-Based Intervention Promotes Gains in Social Knowledge in the Absence of Explicit Training for Youth with Autism Spectrum Disorder

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Background:
Children with autism spectrum disorder (ASD) display deficits in social knowledge, including formal social knowledge, facial emotion recognition (FER) and theory of mind (ToM; Mendelson, Gates, & Lerner, 2016). Traditionally, it was presumed that individuals with ASD *could not* acquire such knowledge without explicit teaching. Subsequently, most social skills interventions (SSIs) have employed a didactic approach (White et al., 2007). Recent literature shows improvements in overall social functioning using so-called "performance-based SSIs" (e.g., Lerner & White, 2015), where skills are taught implicitly via activities designed to potentiate prosocial engagement. However, it is unknown whether youth with ASD learn explicit social knowledge through these non-didactic, performance-based approaches.

Objectives:

To determine if performance-based SSIs can impact social knowledge in youth with ASD without explicit instructions.

Methods:

Youth with ASD participated in a randomized controlled trial of two performance-based social skills interventions (see Table 1). Both interventions aimed to provide enriched environments for reinforcing peer interaction and targeted specific social skills goals with minimal didactic instruction or instrumental reinforcement of skills (Lerner & Levine, 2007). The modified Children's Assertiveness Behavior Scale (CABS; Michelson & Wood, 1982; Wojnilower & Gross, 1988), and Test of Adolescent Social Skills Knowledge (TASSK; Laugeson & Frankel, 2006) assessed formal social knowledge. The Theory of Mind Inventory (ToMI; Hutchins, Prelock, & Bonazinga, 2012) assessed ToM and the Diagnostic Analysis of Nonverbal Accuracy (DANVA-2; Nowicki, 2004) assessed FER. All areas were assessed at baseline, endpoint, and 10-week follow up.

Results:

Generalized estimating equations (GEE; Hanley et al., 2003) were used to estimate effects of timepoints on change in dependent variables while accounting for nesting within groups (Table 1). There was a significant main effect of timepoint in CABS scores (Wald's χ^2= 6.56,p =.038) indicating that at endpoint youth had lower CABS scores than at baseline (Figure 1). There was a significant main effect of timepoint on TASSK scores (Wald's χ^2=10.31, p =.006) from endpoint to follow up. There was a significant main effect of timepoint on ToMI scores (Wald's χ^2=12.15, p<.001), evincing a

linear increase over time. There was no effect of timepoint on DANVA-2 Faces (Wald's χ^2=1.69, p=.43).

Conclusions: This is the first study to examine the effects of performance-based SSIs on social knowledge in youth with ASD. Findings indicate that such SSIs may improve aspects of social knowledge (formal social knowledge and ToM) without explicit, didactic teaching of social knowledge content. This was seen in both conditions, despite the absence of explicit teaching, contrary to extant theory suggesting that this should not occur. In contrast to previous reports on intensive performance-based community-administered SSIs (Lerner et al., 2011), we did not see results for FER. Factors such as dosage or the specific approaches used may be essential for acquiring a less explicit, formal aspect of social knowledge such as FER. Overall, these findings support the principle that youth with ASD are able to acquire aspects of social knowledge *without* direct teaching, provided there is sufficient scaffolding of the social context and activities are properly matched to outcomes.

267 **243.267** Malleability of Comorbid Anxiety and ADHD Symptoms and Moderating Effects across the PEERS® Intervention for Autistic Adolescents

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Background: Comorbid anxiety and ADHD symptoms are common among autistic adolescents, with rates of roughly 40% (van Steensel, Bögels, & Perrin, 2011) and 30-80% (Mattila et al., 2010), respectively. Additionally, each of these comorbid symptoms have been found to exacerbate social difficulties (Ames & White, 2011; Bellini, 2004). Social skills interventions may have secondary effects on anxiety (Corbett, Blain, Ioannou, & Balser, 2017; Lei, Sukhodolsky, Abdullahi, Braconnier, & Ventola, 2017; McVey et al., 2016; Schohl et al., 2014); secondary effects on ADHD are unknown. In one study of moderating effects, anxiety did not influence intervention response, but ADHD was associated with nonresponse (Antshel, Polacek, Dygert, Miller, & Faisal, 2011). More work is needed to better understand secondary effects on anxiety and ADHD symptoms and the potential moderating role of anxiety and ADHD symptoms on improvements *via* social skills intervention.
Objectives: The present study examined the malleability and moderating effects of anxiety and ADHD across the Program for the Education and Enrichment of Relational Skills (PEERS®).

Methods: One-hundred and thirteen adolescents aged 11-16 with IQ ≥ 70 were included in this *post hoc* study. Autistic adolescents were randomly assigned to an experimental or a waitlist control group as part of a larger randomized controlled trial. Parents reported upon social behavior *via* the Social Responsiveness Scale (SRS; Constantino & Gruber, 2002). Anxiety and ADHD symptoms were measured *via* parent-report on the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001).

Results: Gender and IQ were included as covariates in the following analyses, given that groups differed on IQ (Table 1) and gender was related to the CBCL ADHD Problems subscale ($r(99)=0.20$, $p<.05$). Four mixed model MANCOVAs were conducted. Results indicated improvements in some SRS subscales for the experimental, but not the waitlist control group (Table 2). For anxiety, results revealed nonsignificant main and interaction effects of Group, Time, and Group*Time. Exploratory paired samples *t* tests revealed that both groups showed declines across time (EXP: $t(41)=1.96$, $p=.056$); WL: $t(48)=2.91$, $p=.005$; Table 2). Results of ADHD also revealed nonsignificant main and interaction effects of Group, Time, and Group*Time. Exploratory paired samples *t* tests similarly revealed that both groups declined across time (EXP: $t(41)=2.29$, $p=.027$); WL: $t(48)=4.97$, $p<.001$; Table 2). Results examining the possible moderating effects of anxiety, ADHD, both, or neither, revealed a nonsignificant Group*Comorbidity*Time interaction ($p>.05$).

Conclusions: Some changes in social behavior were evident for the experimental but not the waitlist control group, consistent with prior literature (Laugeson, Frankel, Gantman, Dillon, & Mogil, 2012; Schohl et al., 2014). Declines in anxiety and ADHD were seen across the intervention for the experimental group, yet this pattern was also observed in the waitlist control group. Contrary to expectations, the presence of clinically-significant anxiety and/or ADHD symptoms did not moderate improvements in social behavior. Importantly, this evidence may suggest that, while it is unclear if PEERS® affects anxiety and ADHD symptoms, the integrity of the intervention is upheld for autistic adolescents with clinical levels of anxiety, ADHD, or both.

268 **243.268** Management and Intervention of the Children with ASD at Home Environment in a Developing Country

ABSTRACT WITHDRAWN

Background:
After assessing the child with ASD (Autism Spectrum Disorder) parents try to intervene the behavioral issue but most of the time parents do not know the proper way of ASD management. The Institute of Paediatric Neurodisorder and Autism (IPNA) in Bangabandhu Sheikh Mujib Medical University (BSMMU), Bangladesh, initiated home visit program for 35 Children with ASD who were admitted at IPNA Autism School in 2016. Home visit conducted by a team (at least two members must visit the child's home). This team consisted by: Paediatric Neurologist, Educational Psychologist, Head Teacher, Autism Instructor/Teacher, Counselor, Autism Teacher, Assistant Autism Teacher

Objectives:

Short term :

For Parents: Observed how parents dealt with child's behavior, Which types of methods and materials were followed by parents at home.**For Children:** Child's relationship with their family members, How they expressed own need at home and which place or task child liked most.

Aims:

For Parents: How they constructed work environment for child, How they built up materials and manage the child in future.**For Children:** How the child improved own self skill (ADL-Activities of Daily Living), How they coped/ shared own experience of emotion with others.

Methods:

Using semi-structured demographic questionnaires for observation/systematic observation (coding system), observer can give some intervention to the parents so that they can improve their management skills or how to deal with their ASD child. Each member of the team fill up Questionnaire developed by specialist team of IPNA Autism School and must deliver an evaluation report with the consultation of the expert team. For this purposes the child's activities of daily living (ADL), play, sharing and intimacy others information were taken. **Duration:** 1st Home

Visit: June 2016, 1st Follow-up Home Visit: June 2017

Results:

Both home (1st and 2nd) visit showed a clear structured improvement and involvement of the parents. Though a few numbers of parents didn't start to use each material utterly but most of the parents commenced the few PECS (Picture Exchange Communication System) item for some task. Comparison between two years improvement graphical representation shows that parents give a lot of effort on outing and self help activities (toileting, eating, and dressing) but structure routine and materials are not used enough. Parents commented that they need more technical structured training on making material and PECS item. IPNA Autism School home visit team also showed some pictured routine which were used in classroom and conduct some 1:1 task in front of the parents. Home visit is one kind of intervention technique that parents and other caregivers can use to help their children when professional services and school are not available.

Conclusions:

The strategies by the home visit team gave parents skills that improved how they interacted with their children and dealt with challenging behaviors. The goal was for the parents to help foster their children's communication and, when possible, their language skills. The emphasis was on skills that the parents and their children could use daily as they participated in activities at home and play.

269 **243.269** Mental Health Benefits of a Robot-Mediated Emotional Ability Training for Children with Autism: An Exploratory Study

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Background: Children with Autism Spectrum Disorder (ASD) have a high prevalence of mental health problems that are linked to reduced emotional abilities. Therefore, interventions that teach emotional abilities are fundamental for their development. However, existing interventions are costly, of difficult access, or inefficient for children with ASD. Furthermore, children with ASD have a preference for sameness and routines that makes technology, and especially robots, an ideal medium to convey interventions that are suitable to their needs.
Objectives: The aim of the present exploratory study is to evaluate whether a robot-mediated emotional ability training is effective in enhancing the emotional ability and the mental health of children with ASD.

Methods: Using a pre-post training design, 12 children with ASD (all boys) aged between 8 and 14 years (M = 10.93; SD = 2.46) undertook a 7 week long emotional ability training mediated by a robot. Sessions took place weekly and lasted 1h each. Children were compared before (T1) and after (T2) the training on their emotional ability and their mental health. Emotional ability was measured through the parent-report measures Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997), Emotion Regulation Rating Scale (ERRS; Carlson & Wang, 2007), Self-Control Rating Scale (SCRS; Kendall & Wilcox, 1979), and the Alexithymia Questionnaire for Children (Rieffe et al., 2006); as well through a direct measure of children's use of emotion regulation strategies using the Reactive and Regulation Situation Tasks (Carthy et al., 2010). Mental health was measured through the parent-report measures Children Behavior Checklist (CBCL; Achenbach & Rescorla, 2001), Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), and the Social Responsiveness Scale-2 (SRS-2; Constantino, 2002).

Results: It was found that regarding emotional ability, children's use of emotion regulation strategies in the Reactive and Regulation Situation Task, improved significantly after the training ($t(10) = 2.81$, $p < .01$) but no significant improvements were found on the parent-reported measures (ERC: $t(10) = 0.43$, $p = .34$; SCRS: $t(10) = 1.26$, $p = .12$), except for a marginally significant effect on children's emotional control (ERRS: $t(10) = 1.79$, $p = .05$). Regarding mental health, the training significantly reduced internalizing problems (CBCL: $t(11) = 1.91$, $p < .05$; SDQ: $t(11) = 3.19$, $p < .01$) and autism-related symptomatology (SRS-2: $t(11) = 3.24$, $p < .01$), but did not have an effect on externalizing problems (CBCL: $t(11) = 0.41$, $p = 34$; SDQ: $t(11) = 3.13$, $p = 07$).

Conclusions: Overall, the results of the present study are to be interpreted cautiously, they provide restricted evidence of positive effects of the robot-mediated emotional ability training in children's use of adaptive emotional abilities and in mental health issues such as depressive symptomatology and anxiety as well as autism-related social communication difficulties. This exploratory study contributes to the research progress in the domain of robot-mediated interventions for children with ASD.

270 **243.270** Mindfulness-Based Stress Reduction for Adults with Autism Spectrum Disorder: Feasibility and Estimated Effects

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Background: Adults with autism spectrum disorder (ASD) consistently report lower quality of life (QOL) and functioning compared to neurotypical peers. Despite the growing population and needs of adults with ASD, many psychosocial interventions target children and adolescents while relying on high level cognitive strategies for symptom reduction. Mindfulness-Based Stress Reduction (MBSR), which cultivates regulation skills through experiential practice instead of cognitive strategies, has been modified for autistic samples across the lifespan. However, it has not been tested if the standard MBSR curriculum for heterogenous adults is appropriate for an autistic population to improve functioning and QOL.
Objectives: This pilot feasibility trial aimed to (1) Establish the feasibility and acceptability of a traditional MBSR group intervention with adults diagnosed with ASD; (2) Evaluate teacher fidelity and integrity to the MBSR curriculum; (3) Calculate effect size estimates of change in QOL, life satisfaction, and mindfulness.

Methods: Participants included twelve adults with ASD (IQ>70; age 22-63). MBSR consisted of a one-hour orientation, 8 weekly 2.5 hour group classes, a full day (7.5 hours) silent meditation retreat after week 6, and 45 minutes of assigned daily meditation homework. The instructor was a certified rehabilitation counselor and recognized as a qualified MBSR teacher through the University of Massachusetts Oasis Institute. Fidelity was evaluated with the Mindfulness-Based Intervention Teacher Assessment Criteria (MBI-TAC) by a senior MBSR teacher trainer. Participants completed a self-report assessment battery at three time points (pre-, mid-, and post-treatment), including: Satisfaction with Life Scale (SWLS), World Health Organization Quality of Life questionnaire (WHOQOL-BREF-ID), the Child and Adolescent Mindfulness Measure (CAMM), and the Positive Outlook scale from the Healing Encounters and Attitudes Lists (HEAL). Participants also completed the client satisfaction questionnaire (CSQ-8) and a qualitative exit interview post-treatment with a research assistant not involved in the intervention.

Results: All participants completed the MBSR intervention and post-assessments (100% retention). Participants reported high satisfaction with the intervention on the CSQ-8 (*M* = 27.92, *SD* = 3.5). Sessions 4 and 5 were randomly selected for fidelity review. Both session 4 (*M*=5.33; *SD*=.5) and 5 (*M*=4.67; *SD*=.5) met fidelity with an overall rating of "proficiency +" on the MBI-TAC. While fidelity to MBSR was met without modification, ASD specific supports within the flexibility of the curriculum were identified. Participants required concrete structuring for small-group discussions and additional consultation between sessions (*M*=28.75, *SD*=22.48 minutes). Effect size estimates suggested large improvements in positive outlook ($F(2,22) = 12.42$, $p<.001$, d=2.12), satisfaction with life ($F(2,22) = 3.22$, p=.059, d =1.08), mindfulness ($F(2,22) = 3.34$, p=.054, d =1.10), and quality of life ($F(2,22) = 3.09$, p=.066, d=1.059). Seven of twelve participants listed emotion regulation as the primary benefit during qualitative exit interviews.

Conclusions: This project established feasibility and acceptability of traditional MBSR for adults with ASD while estimating that MBSR could be a promising QOL intervention. Utilization of a traditional heterogenous MBSR program would expand effective, affordable, and inclusive treatment options for autistic adults. Exit interviews suggest that future research should consider measuring emotion regulation as a mechanism for improved functioning.

271 **243.271** Neuroplasticity-Based Cognitive Training for Adolescents with Autism Spectrum Disorder: Preliminary Findings from a Computerized Intervention Program

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Background: Autism Spectrum Disorder (ASD), a complex neurodevelopmental disorder, is characterized by persistent deficits in communication and interaction, and restrictive, repetitive patterns in behavior, interests, and activities. Many difficulties experienced by individuals with ASD have been attributed, in part, to deficits in cognitive functions necessary for goal directed behavior that is adaptive to the environment. Cognitive training methods in auditory and social/communication (SC) domains have emerged as a promising approach to improve functional impairments in multiple pathologies (e.g., Schizophrenia, Attention-Deficit/Hyperactivity Disorder; ADHD). In particular, computerized and adaptive brain-based programs have shown considerable potential as effective and accessible interventions. This approach has been applied effectively to address general cognitive deficits in chronic schizophrenia and in children and adolescents with ADHD. However, despite the likely utility of these methods for the treatment of cognitive deficits in autism, few trials have been implemented in the ASD population.

Objectives: Longitudinal studies of adults with ASD with and without intellectual disability have shown consistent and persistent deficits across cognitive, social, and vocational domains. Moreover, the cognitive and social skill deficits that are core features of ASD have been identified as major challenges to employment success for these adults, highlighting the critical need for evidence-based interventions as adolescents with ASD transition into adulthood. Thus, we aim to assess the efficacy of a novel, computerized, adaptive, brain-based targeted cognitive training (TCT) program designed to leverage neuroplasticity in a pilot sample of adolescents with ASD.

Methods: We enrolled 20 adolescents (6F; Age=14.9±1.4years) with a prior diagnosis of ASD and IQ ≥ 70 from local ASD clinics. We customized two web-based TCT modules (Auditory/SC) and participants were randomized to each group. Study procedures included: 1) Pre-Intervention Assessments; 2) 10-14 weeks of TCT including forty (25-45 minute) training sessions; and 3) Post-Intervention Assessments. The Auditory Module was designed to improve information processing speed and accuracy while engaging working memory and cognitive control under conditions of close attention and reward. The SC Module applied principles of implicit learning to improve processing and use of socially-relevant information. Exercises continuously adjusted difficulty level to user performance to maintain an approximately 80% correct performance rate. Correct trials were rewarded with points and animation.

Results: Data collection and recruitment is ongoing, but to date, five participants (1F; Age=14.6±0.5years) have completed the Auditory Module and four participants (2F; Age=15±1.4years) have completed the SC Module. We anticipate having a total of ten participants in each group by Spring 2019. Preliminary data show mean percentage improvement from baseline to best performance of 24% for the Auditory Group and 21% for the SC Group.

Conclusions: Preliminary results are promising and indicate overall improvement on training tasks across groups. Pre- and Post-Assessment sessions include functional neuroimaging and behavioral measures of social and cognitive functioning. We will compare neural, clinical, and cognitive changes between the baseline and outcome assessments to gauge the efficacy of the TCT programs as well as generalizability across training domains.

272 **243.272** Parent-Child Agreement on Internalizing Symptoms before and after a Cognitive Behavioural Intervention

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Background: Assessment and diagnosis of many mental health disorders relies on multiple informants, one of which is typically child or adolescent self-report (Silverman & Ollendick, 2005). However, many individuals with ASD have difficulties engaging in introspection and demonstrate a lack of awareness and/or difficulties identifying their emotions (Losh & Capps, 2006). Consequently, whether children and youth with ASD provide valid self-reports of their mental health symptoms has been questioned (Mazefsky et al., 2011). Previous research examining parent-child concordance on measures of internalizing symptoms has been mixed (Magiati et al., 2014; Russell & Sofronoff, 2004). Although limited, there is literature to suggest that, in children and adolescents with anxiety but not ASD, parent-child agreement increases following treatment (Los Reyes et al., 2010). In children and adolescents with ASD, despite suggestions that discrepant reporting might relate to a lack of insight into mental health symptoms, no research to date has examined if and how the concordance between parent and child reported internalizing symptoms may be impacted following involvement in an intervention.

Objectives: The present study examined agreement between parent- and child- reported internalizing mental health symptoms after participating in a cognitive-behavioural intervention for children and adolescents with ASD and anxiety.

Methods: Fifty-one children (age 8-13 years, FSIQ ≥ 70) and a parent or caregiver participated in Facing Your Fears (Reaven et al., 2011) – a 14-week cognitive-behavioural intervention to address anxiety in ASD. Before and after participation in the intervention, children and their caregivers independently completed comprehensive (i.e., multi-informant, multi-method) assessments of their child's internalizing mental health symptoms. Preliminary analyses examined parent-child agreement on the Spence Children's Anxiety Scale (Spence, 1998) pre- and post-intervention using

intraclass correlations (ICC).

Results: Parent-child agreement for total anxiety symptoms at pre-intervention was modest (ICC = .47) but decreased post-intervention (ICC = .36). At the subscale level, agreement for generalized anxiety symptoms was poor at pre-intervention (ICC = .29) and increased to modest at post-intervention (ICC = .48). Similarly, agreement on the separation anxiety subscale was modest at pre-intervention (ICC = .45) and increased slightly post-intervention (ICC = .56). This pattern of decreased overall anxiety symptom agreement despite increases on certain subtests may be related to the issues addressed in the intervention. Secondary analyses will compare agreement on anxiety symptoms with agreement on the Children's Depression Inventory (Kovacs, 1992) while controlling for ASD severity and cognitive abilities.

Conclusions: Agreement between parent and child reports of internalizing symptoms may differ following participation in a cognitive-behavioural intervention. The intervention may present an opportunity for children and parents to discuss anxiety symptoms which could result in higher levels of agreement between ratings. Conversely, if children better understand their symptoms, they may report higher levels of symptoms while their parents endorse lower levels following participation. Secondary analyses will explore the pattern of reporting before and after participation. Understanding how participation in an anxiety intervention impacts how children and adolescents with ASD self-report internalizing symptoms can help clinicians better conceptualize discrepant parent-child reports and inform the development of self-report measures for ASD.

273 **243.273** Peer-Reported Social Distance in Response to DSM-5 Symptomatology

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Background: In their Reciprocal Effects Peer Interaction Model, Humphrey and Symes (2011) suggest two causal pathways for poor relationships between individuals with Autism Spectrum Disorder (ASD) and their peers: (1) social communication difficulties in individuals with ASD and (2) a limited understanding and acceptance of those difficulties among peers. While clinical interventions have been designed to address both causal pathways (e.g., social skills interventions, peer knowledge interventions), such interventions may be more efficacious if they target those clinical symptoms most disruptive to peer relationships.

Objectives: The aim of this exploratory study was to examine peer reports of social distance in response to autistic symptomatology and symptomatology consistent with other clinical diagnoses in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013).

Methods: 226 undergraduate students completed a revised version of the Social Distance Scale (Gillespie-Lynch et al., 2015). Across 34 clinical symptoms, participants responded to five Likert-scale questions indicating their willingness to interact with (e.g., "move next door to", "date or marry") a person with that clinical symptom. Sixteen symptoms represented the DSM-5 diagnostic criteria for ASD, with 2-3 symptoms indexing each of the core diagnostic components (social-emotional reciprocity deficits, nonverbal communication deficits, relationship difficulties, stereotyped behaviors, insistence on sameness, restricted interests, sensory sensitivity; American Psychiatric Association, 2013). Eighteen symptoms represented the diagnostic criteria for other clinical diagnoses (oppositional defiant disorder, generalized anxiety disorder, major depressive disorder, attention deficit hyperactivity disorder, anorexia nervosa, specific learning disorder). Two repeated-measures ANOVAs were conducted to determine whether peer-reported social distance varied across (1) clinical diagnoses and (2) core diagnostic components of ASD. The Bonferroni correction was used for all post hoc pairwise comparisons.

Results: Peers significantly differed in their desire for social distance across the clinical diagnoses, $F(6, 1350) = 297.70$, $p < 0.01$, $\eta^2_p = 0.57$. Among the seven diagnoses, peers were most reluctant to interact with others who showed symptoms of oppositional defiant disorder and second most reluctant to interact with others showing symptoms of ASD or generalized anxiety disorder (Figure 1). Peers also significantly differed in their desire for social distance across the core diagnostic components of ASD, $F(6, 1350) = 28.30$, $p < 0.01$, $\eta^2_p = 0.11$. Peers were least willing to interact with others with deficits in social-emotional reciprocity or an insistence on sameness (Figure 2).

Conclusions: Peers modified their willingness to interact with others, depending on the specific autistic or clinical symptoms exhibited. ASD was among the top three clinical diagnoses that yielded the greatest social distance scores from peers. Across the autistic symptoms, peers responded most negatively to others with deficits in social-emotional reciprocity (e.g., initiating social interactions, sharing emotions) and insistence on sameness (e.g., difficulty adapting to change). As these autistic symptoms may be most disruptive to peer relationships, interventions that target these symptoms, both those that strengthen social-emotional reciprocity and cognitive flexibility in individuals with ASD and those that increase awareness and understanding of these symptoms in peers, may be most efficacious.

274 **243.274** Pilot Test of an Intervention for Parents of Youth with ASD Focused on Life Skills and Preparing for Adulthood

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Background: Adolescence is an important time for families of adolescents with autism spectrum disorder (ASD) planning and preparing for adulthood. Parents play an important role in the transition process, with evidence suggesting that parents' expectations during adolescence are significant mediators of key outcomes for adults with ASD and that higher parent expectations and self-efficacy are associated with more positive post-secondary preparation activities (e.g., social activities, volunteer work/employment, parent-youth discussions about the future, working toward goals). There is a need for effective interventions to support the transition to adulthood for parents and youth with ASD. Maximizing Adolescent Post-Secondary Success (MAPSS) is a six-week intervention program developed by our research team to support transition preparation for parents and youth.

Objectives: To pilot test an intervention to provide support for parents of youth with ASD, focused on increasing positive post-secondary preparation activities and life skills by addressing parents' expectations and self-efficacy related to preparing youth for adulthood.

Methods: Parent participants were required to be a caregiver of an adolescent (ages 14-18 years) with ASD in high school and anticipating receipt of a high school diploma. Some parents chose to attend with a spouse/co-parent. Upon completion, we collected participant feedback about the program. The primary outcome measure was the Transition Preparation Activities Measure (T-PAM; Kirby, n.d.), which includes ratings of preparedness for the transition to adulthood, worry about the future, and frequency of various transition preparation activities. Secondary measures included the Competency factor of the Family Empowerment Scale (Koren et al., 1992) and Adulthood Expectations Questionnaire (AEQ; Kirby, n.d.), all of which were administered at baseline and at program completion. Included measures have demonstrated acceptable internal

consistency with this population. We summarized participant feedback and conducted paired t-tests to compare pre- and post-intervention ratings.

Results: At the time of submission, 14 families participated in the pilot study of the MAPSS; two additional groups will be completed prior to May 2019. 100% of participants remained in the program, however, 1 family did not complete post-intervention questionnaires within the necessary time frame. Participant feedback was positive (see Table 1). From pre- to post-intervention, parents' reported levels of preparedness for their youth's transition was significantly greater (t=-5.262, p<0.001) and their levels of worry related to their youth's future was significantly lower (t=2.88, p<.05). Both parent and youth transition preparation activities significantly increased (t=-5.07, p<0.001 and t=-2.51, p<0.05, respectively). A slight, but not significant, increase was noted in parent self-efficacy (i.e., competency). We observed slight, but not significant, increases in parent expectations for adult outcomes; parent sense of control over those outcomes did significantly increase (t=-2.47, p<0.05).

Conclusions: Last year we presented proof-of-concept data on the MAPSS intervention and made improvements to the program based on participant feedback. To date, two new groups (14 families) have participated in the updated program, and we will run two additional groups prior to May 2019. Preliminary results suggest the MAPSS program is well-received by participants and is demonstrating statistically significant improvements on the primary outcome measure related to family transition preparation.

275 **243.275** Preliminary Outcomes of a New Executive Function Treatment for Transition-Age Youth with ASD

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Background: Individuals without intellectual disability make up the fastest-growing subgroup of ASD, but as few as 9% reach full functional independence as adults (Farley, McMahon, & Fombonne, 2009). Executive Function (EF) problems are pivotal targets for intervention (Hume, Loftin & Lantz, 2009) because they are common (Hill, 2004), linked to independence (Pugliese et al., 2015), and responsive to treatment (Kenworthy et al., 2015). Flexible Futures (FF) is a new 20 session CBT delivered by trained teachers in the school setting. FF targets self-advocacy, flexible problem solving, planning, time management, and independent goal-setting through scripts and routines that are to be applied to real-world situations. Generalization is maximized with school staff as interventionists, parent training, and home and classroom extension activities.
Objectives: This project tests the effectiveness of FF in improving EF skills, including flexibility and planning, in transition-age youth with ASD compared to students who received the usual care in their school environment.

Methods: The trial compared Flexible Futures (FF) to treatment as usual (TAU) in 8 high schools across the DC Metro Area using a randomized, clustered, parallel clinical trial design. All participants (n=43, 8 female) were aged 14-20 (M=16.4, SD=1.3) had an FSIQ ³80 (M=105.8, SD=14.7) on the WASI-2 and diagnoses were verified using parent report & school classification of ASD supported by the Social Communication Questionnaire (n=35) or ADOS (n=21). Independent samples t-tests and corresponding effect sizes were used to examine between group change on WASI Block Design (problem solving), Tower of London (ToL; planning), parent Behavior Rating Inventory of EF (BRIEF, Plan/Organization & Shift scales), and Adaptive Behavior Assessment System (ABAS; Global and Practical domains).Paired samples t-tests were used to measure change from baseline to endpoint within each group. There were no significant differences between intervention group in age, gender, full-scale IQ, ethnicity, or race (Table 1).

Results: When examining the effect size differences between the groups, students in the FF group improved more than the TAU with small to medium effect sizes on Block Design (d=.5), ToL Total Correct (d=.4)/Total Move (d=.3), ABAS Global (d=.4) and Practical (d=.6), and BRIEF Shift scales (d=.6). However, it is important to note that these differences did not reach statistical significance. Students within the FF group significantly improved from baseline to endpoint on all domains with medium to large effect sizes (.5-1.0), while students within the TAU significantly improved on BRIEF planning (d=.6; Table 1).

Conclusions: This pilot RCT provided evidence that FF implemented at school led to improvement in key EF outcomes. Although between group analyses were not significant, and likely affected by the small sample size, effect size calculations demonstrated that students receiving FF improved on several key outcomes above those receiving TAU, and the pattern of results within the FF group was also in the expected direction. Small to medium improvements in the TAU are not unexpected given that students at these schools also received autism specific supports at school. Next steps include refining the FF curriculum and testing in a larger RCT.

276 **243.276** Regulating Together: Emotion Regulation Treatment for Children and Teens with ASD in an Intensive, Group, Parent-Assisted Program Pilot Trial

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Background: Individuals with Autism Spectrum Disorder (ASD) consistently present to treatment with non-compliance, temper tantrums, and aggression. At age 8, >95% of youth with ASD demonstrate co-occurring behavioral and emotional symptoms that are related to negative outcomes throughout development. Across all cognitive functioning levels, these clinical issues are hypothesized to arise from difficulties in *emotion regulation* (ER). Inadequate ER skills in individuals with ASD have been linked to higher rates of hospitalizations, school disciplinary action, peer rejection, failed transitions to college and employment, and use of psychotropic medications. Unfortunately, there are no empirically-validated interventions to address this impactful issue in ASD. Due to the severity of concerns associated with weak ER skills in ASD, traditional school- and outpatient-based programs are not equipped to deal with this population, and thus children with ASD are often excluded from treatment. Moreover, traditional interventions are typically individual-based and do not actively include caregivers. Thus, a group-based, parent-assisted model may be an effective method of treating many individuals with ASD who have ER deficits. CBT-based approaches have been shown to be effective at improving select aspects of ER in ASD and general child psychology indicate mindfulness and acceptance are needed for long-term ER skills, but their usefulness is untested for individuals with ASD.
Objectives: *Our group developed Regulating Together (RT)*, a unique comprehensive program including both caregivers and children in a group format that uses elements of CBT, ABA, and Mindfulness approaches. Here, we aim to determine the feasibility and efficacy from a pilot study

containing child (8-12 years) and adolescent (13-18 years) groups that met twice weekly for 5 weeks.

Methods: We examined a multi-diagnostic clinical RT group via a chart review of 59 participants (40 8-12, 19 13-18), 31 with ASD (20 8-12, 11 13-18), comparing pre- and post-treatment scores on the Aberrant Behavior Checklist, Pediatric Quality of Life Family Impact Module (PedsQL), and clinician rated CGI-I[7]. Each age group was analyzed separately.

Results: The ASD child group had statistically significant changes on all subscales of the Aberrant Behavior Checklist and the ASD teen group had significant changes on the Irritability, Lethargy, and Stereotypy subscales. Regarding CGI-I, 53% of the children were rated as Much Improved, 24% minimally improved, 21% no change, and one participant minimally worse post-treatment and 28.6% of adolescents were rated as Much Improved and 71.4% minimally improved. Parents provided overwhelmingly positive feedback in regard to learning, enjoying the program, and increased confidence in behavior management. There was a 15% attrition and a 13% absence rate suggesting overall feasibility. No significant changes were found on the PedsQL for either group.

Conclusions: ER is a critically under-studied and under-treated issue in ASD and other developmental disorders leading to high rates of hospitalizations and social and academic difficulties. Thus, we developed a short-term parent-assisted group intervention approach aimed at increasing ER. Our novel Regulating Together treatment program shows promising short-term preliminary findings, and thus indicate further evaluation of efficacy, identification of treatment responder characteristics and active components, and long-term benefits is warranted.

277 **243.277** Stepping It up: Assessing Physical Activity of College Students with Autism Spectrum Disorder

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Background: College students with Autism Spectrum Disorder (ASD) often face unique challenges in the college environment (Van Hess et al., 2015), experience higher levels of loneliness, depression, and anxiety than peers (Scott et al., 2018), and are more likely to lead sedentary lifestyles (Stanish et al., 2017). Lack of physical activity may be problematic as active lifestyles can lead to physical and mental health benefits. It is critical to assess physical activity, especially among busy college students. Physical activity programs may be one method to increase PA levels, yet empirical evidence is needed to evaluate new programs.
Objectives: The purpose of this study was two-fold: 1) to describe 10 weeks of physical activity for college students with ASD using wearable step trackers, and 2) to compare their mean steps per day (SPD) across 10 weeks of a physical activity program.

Methods: Twenty-one college students with ASD (Male = 19, Female = 2) from a large urban university participated in a 10-week peer-mentored physical activity intervention. Participants and Kinesiology students (i.e., Peer Mentors) were paired and worked out together two hours each week for 10 weeks. Participants wore a Fitbit Charge HR 2© daily for 10 consecutive weeks and SPD data were collected. Data were synced twice a week to Fitabase—a proprietary online database used to track activity levels and SPD for each participant.

Results: Average SPD were divided into step defined activity levels using Tudor-Locke's classifications (Tudor-Locke et al., 2009). Two students (9.5%) were classified as "low active: 5,000-7,499 SPD", 10 students (47.5%) were classified as "somewhat active: 7,500-9,999 SPD", 5 students (24%) were classified as " active: 10,000-12,4999 SPD", and 4 students (19%) were classified as "highly active: ≥ 12,500 SPD". There was a slight increase of mean SPD across the 10 weeks, however the exercise intervention did not have a statistically significant effect on steps per day, $p > .05$.

Conclusions: Although previous researchers have reported sedentary lifestyles in adults with ASD, our data provide evidence to suggest that college students with autism on this large urban campus appeared to lead active lifestyles. The majority of our participants consistently walked more than 7,500 SPD, with 43% of them regularly walking more than 10,000 SPD. These results are striking when compared to the average US adult SPD of 5,100-6,500 (Basset et al., 2010; Tudor-Locke et al., 2009). Participation in a 10-week physical activity program did not significantly affect the number of SPD. This may in part, be due to the university environment, which already promotes walking as students change classes and access services such as cafeterias and libraries across the large campus. Further research exploring the effects of exercise interventions on other health outcomes are warranted. Still, our finding that college students with ASD on this campus are physically active is highly encouraging for both students and the institutions that support them.

278 **243.278** Social Validity of the Working Together Intervention for Young Adults Wtih ASD and Their Families

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Background: A growing population of adults with autism spectrum disorder (ASD) has spurred increased interest in developing interventions to support positive outcomes across the life course. We developed a multi-family psychoeducation model, *Working Together*, designed for young adults with ASD and their families. The *Working Together* model adapts an approach commonly used with individuals with varying mental health conditions (McFarlane, 2002) and applies it to families of individuals with ASD, resulting in improvements in behavior and employment.
Objectives: The present study examined the social validity of the *Working Together* program for adults with ASD and their families. Qualitative and quantitative data were collected from young adults with ASD and their parents to examine their satisfaction with and level of engagement throughout the program as well as knowledge gained and personal goals achieved.

Methods: Data were drawn from the *Working Together* study, a multi-site randomized waitlist control trial which tested the *Working Together* intervention. Families were eligible to participate if they had a young adult with a diagnosis of ASD without intellectual disability, who co-resided with their parents, and who was disengaged from educational/employment activities (<10 hours per week). Forty-nine families enrolled in the study. The intervention included 8 weekly group sessions, 2 individual family sessions, 3 monthly group booster sessions, and a method for providing ongoing resources and referrals. Session topics for young adults and parents included goal setting, problem-solving, coping strategies, planning for independence, employment, community/relationships, personal safety, and health and well-being. At each session, interventionists rated participant engagement and participants rated satisfaction. Participants also reported on what they learned from the program at the

completion of the intervention. Measures of goal attainment were assessed at baseline and post-intervention.

Results: Preliminary analysis of data from 36 families indicated that 100% of parents and adults with ASD were satisfied or very satisfied with the program. Observational weekly engagement ratings indicated that 82% of young adults and 93% of parents were mostly/clearly engaged, on average, across sessions (interrater agreement was 87%). Young adults demonstrated more variability in engagement ratings, showing the clearest engagement during sessions involving coping strategies and employment information; there was less engagement during community/relationships and personal safety sessions. Qualitative analysis of exit interview data from the young adults suggested common themes that promoted positive changes including learning how to solve problems and learning how to help themselves. Parent exit interview data revealed common themes around learning to better understand their young adult, gaining skills to help support their adult in their journey to independence, and appreciation for the information provided during the intervention. Almost 80% of adults with ASD achieved at least one of their goals. Analysis of results is ongoing.

Conclusions: Findings highlight the social validity of the intervention for the targeted end users of the program, young adults with ASD and their parents. These findings, in conjunction with achievement of program goals of reduced behavior problems and increased rates of employment, support the potential of this program to enhance functioning of adults with ASD.

279 **243.279** Socialization Education and Learning for the Internet (SELFI): A Pilot Intervention Program for Online Social Skills for Adults with ASD

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Background: Individuals with autism spectrum disorder (ASD) suffer from impairments in social communication skills that may severely limit their quality of life and key outcomes. Previous research has reported that those who are not socially confident, such as individuals with ASD, may feel more comfortable communicating online (Goby, 2006). Furthermore, online social media communication has been shown to increase quality of friendships, decrease loneliness, and benefit individuals with social anxiety (Mazurek, 2013). These data suggest that social media could be a relevant tool and a critical target for social skills intervention. Although in-person social interaction has been frequently studied in individuals with ASD, it is currently unknown how effectively they engage with their peers online. The Socialization and Education Learning For the Internet (SELFI) program was developed to evaluate and improve the online social skills and etiquette of adults with ASD in an increasingly digital world.
Objectives: The objective of this study was to test the feasibility and preliminary efficacy of an eight session intervention targeting online social skills, specifically for adults with ASD.

Methods: In this pilot study, twelve young adults with ASD and average cognitive ability are scheduled to participate. SELFI is an 8-week socialization intervention aimed at systematically improving individual's positive social impression by targeting their interactions, responses, and initiations online. Four participants have completed the program thus far. The package placed a specific focus on modeling, teaching, and reinforcing skill use, common strategies that are often employed in in-person autism social skill interventions. Clients completed a battery of psychosocial measures before and following intervention and at a 3 months follow-up. Screenshots and other data from participants' social media accounts were gathered and coded for quantitative and qualitative indicators of appropriateness.

Results: To assess for treatment feasibility, data regarding the study's recruitment, treatment fidelity, attrition, and participant attendance will be analyzed. Recruitment for the current study is feasible, with ample response to recruitment advertisements and adequate enrollment. A fidelity checklist was completed during each session to monitor adherence to the established intervention protocol, with treatment fidelity falling consistently above 95%. There has been no participant attrition from the study and participants attended 100% of scheduled sessions. Subjective ratings of screenshot and online activity data made by raters masked to study time point and hypotheses are indicative of improvements in both quality and quantity indicators after completion of the program.

Conclusions: Preliminary data analysis suggests that the online social skills treatment intervention is feasible and may lead to positive gains in effective use of online social strategies and guidelines. These results suggest that SELFI may be a feasible approach to teaching online social skills to cognitively able individuals with ASD. This innovative format has the potential to target an area of communication that has not been focused on with individuals with autism previously. Future directions include a randomized controlled trial to systematically test the intervention and its long-term impacts on online communication and friendships.

280 **243.280** Sportsmanship Interventions for Individuals with Autism Spectrum Disorders: A Systematic Review

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Background:
Children with autism often have impairments in social behaviors which can lead to difficulties in developing meaningful friendships with peers (Bauminger, Shulman, & Agam, 2003). Deficits in social interactions including appropriate commenting and turn taking in children with Autism Spectrum Disorder (ASD) can result in problems in understanding abstract games and displaying sportsmanship behaviors. Previously, good sportsmanship has been defined as guiding the behavior of peers in a constructive direction, working together and playing cooperatively, and independently solving peer conflict (Kohlberg, 1963). However, these higher order social-communication skills may be difficult for individuals with autism. Developing sportsmanship behaviors, such as turn-taking, positive comments, and treating other players with respect, are instrumental skills to successful inclusion and engagement in team sports and leisure games. Children with autism may need to be explicitly taught sportsmanship behaviors to promote appropriate and effective participation in team sports and board games. While many researchers have studied social skills interventions for individuals with ASD, fewer studies have examined specifically targeting sportsmanship skills for individuals with autism.

Objectives:

The purpose of current systematic literature review is to: (a)identify interventions used to teach sportsmanship skills , (b) identify the effectiveness of the interventions used, and (c) identify methodological limitations within this body of research.

Methods:

Electronic database searches were conducted using PsycINFO, ERIC, and Academic Premiere with the combined set of keyword search terms: (1) autis*, OR Asperger*; OR PDD-NOS, (3) sports* OR "board game*" OR "social skills" OR "play. Articles were coded for participant demographics, methodology, intervention type, target outcomes, and quality of empirical evidence (Reichow, et al., 2011).

Results:

There was a total of 41 children included in the review from the 12 studies. The researchers targeted multiple domains of social-communication behaviors during game play or during unstructured school recess periods. From the articles reviewed, intervention targets included social skills, play skills, and sportsmanship skills. Various types of interventions and strategies including 1:1 social skills intervention, social narratives, Power Card, and Cool versus Not Cool were implemented to improve sportsmanship behaviors for individuals with autism. Of the studies reviewed, all the researchers reported increases in the targeted behaviors. Using Reichow's method for evaluating empirical evidence, the studies included ranged from weak to strong rigor ratings.

Conclusions:

Overall, results revealed that sportsmanship interventions may be a promising strategy to increase appropriate game play with peers. The specific strategies used to broadly teach sportsmanship behavior were flexible and varied in intensity in the studies reviewed. For studies using 1:1 support, results indicated improvements in turn taking, eye contact, and social interactions with peers in a small group. Social narrative strategies, such as social stories and the Power Card, reported increases in losing graciously and treating players with respect, and decreases in whining after game loss. Although these positive results should be interpreted with caution because of the small number of studies and methodical issues, they suggest that interventions can teach behaviors with autism sportsmanship behaviors.

281 **243.281** Salivary Cortisol in Children with Autism Spectrum Disorder : Longitudinal Variations in the Context of a Service Dog's Presence in the Family.

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Background: The primary function of service dogs for children with autism spectrum disorders (ASD) is to ensure the safety of the child. Several parents report that the mere presence of the dog encourages the family to follow a lifestyle typical of an average family in addition to providing a source of support. A preceding study suggested that the presence of a service dog in the family induces a significant and continuous decline of cortisol secretion at awakening for children with ASD over a period of four weeks (Viau et al., 2010). This reduction of stress measured by salivary cortisol would confirm parents' perception that their child is calmer when the dog is present (Harwood, 2018). Following this first study, our research group has established a new research design involving a larger sample of families of children with ASD, including a control group, and repeated daily measurements.

Objectives: The aim of the present study seeks to evaluate services dog's impact on a group of children with ASD, based on their well-being measured by salivary cortisol. The study also estimated if age and the severity of symptoms related to autism affected variations in the children stress system.

Methods: The sample was composed of 95 families of children with ASD, aged between 5 and 11 years old (20.7% of girls). 48 of these families received a service dog (certified and trained by the Mira Foundation). The remaining 47 families were recruited from a waiting list and composed the control group (WLC). Autism severity was estimated by the Childhood Autism Rating Scale (Schopler et al., 1988) filled out by an evaluator during the first three weeks of the study after a home visit. Effects of the service dog were evaluated by repeated measures of children's salivary cortisol. These weekly home-based samples were collected twice daily by a parent (wakening and bedtime). The cortisol analyses were based on aggregation of samples over a period of 15 consecutive weeks, yielding five blocks of data each for wakening and bedtime samples; a first block composing the baseline (T0) and four once the family received the dog (T1, T2, T3, T4).

Results: No significant relationship between diurnal cortisol, autism severity and gender was detected. As expected, temporal stabilities in wakening and bedtime cortisol across the last 4 blocks were higher for the control group compared to children who received a dog. Overall, salivary cortisol across the different periods do not differentiate the two groups. However, with a median split based on age, significant differences between the two groups at T1 and T4 are present only among children aged 7 to 11 who received a service the dog ($t = 2.1$ and 2.3, $p < .05$).

Conclusions: Cortisol regulation showed no association to autism severity nor gender. Cortisol remained stable for children of the WLC. Effects of the service dog on children's stress were present for a subgroup of children, demonstrating long lasting effects of the service dog for older children.

282 **243.282** Supporting Youth with ASD to Better Cope with Stress through Destress for Success: An Exploratory Study

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Background: Adolescence is marked by the development of important skills and physiological changes, increasing vulnerability to stress and the onset of mental health disorders in some adolescents. Adolescents with ASD might experience more stress than those with a typical development during social interactions, as suggested by high cortisol activity during social interaction and in the evening which is illustrative of stressful experiences during the day. Chronic (i.e. repeated and prolonged) stress induces excessive wear of biological systems and increases the risk of physical and psychological pathologies such as depression and anxiety, co-occurring conditions that undermine quality of life in youths with ASD. It thus becomes relevant to support teens in the prevention of chronic stress. Destress for Success^{c} was developed by the Center for Studies on Human Stress (CSHS). Destress for success^{c} includes 5 workshops of 50 minutes, each addressing a theme: (a) universal components of stress; (b) cognitive assessment; (c) problem solving in a stressful setting; (d) emotional regulation strategies and (e) problem-centered strategies. This program has been validated with a sample of adolescents with typical development. We conducted a first study, in collaboration with the CSHS, with a group of seven male adolescents with ASD (age range 12.11. to 15.6, mean 14.04 y.o.). **Objectives:** The objectives were 1- to evaluate the

relevance and feasibility of the evaluation protocol, and 2- to estimate the potential adaptations to make the program relevant for adolescents with ASD. **Methods**: Estimation of the potential effects of the program are studied according to pre and post-tests study design, combining stress-related physiological measure (salivary cortisol taken at wakening, 30 minutes later, 4pm and bedtime) and psychological measures (adaptive behavior and emotion recognition). Qualitative analyses of satisfaction questionnaires completed individually by the participants and their parents, and a journal completed by the trained clinician added to the comprehension of the program's potential. **Results:** The results show an increase in the adolescents' sense of control ($F = 4.42$; $p<.05$), a decrease in depressive symptoms ($F= 4.51$; $p<.05$), as well as an improvement in the recognition of emotions of joy ($F = 9.75$, $p <.01$) and anger ($F = 4.6$, $p<.05$). The group daily cortisol pattern at pre-test revealed a reverse profile, were cortisol at wakening is higher than at bedtime. One week following completion of the 5 workshops, mean group cortisol pattern showed expected daily profile. However, the difference was not statistically significant. **Conclusions**: This exploratory study supports the relevance to pursue validation of the adapted program based on the potential effects detected. Adaptations were mainly made to the animation of the program to make it more meaningful for adolescents with ASD. For example, we added visual aids, examples taken from the youths' experience and there were fewer participants taking part in the group. Conclusions also emphasize the importance of parental involvement to promote generalization.

283 **243.283** Sustainable Social Gains after Completion of a Group Socialization Program for ASD: Confluence Among Parent Survey, Self-Report Survey, Peer Conversation, Social Impression Rating, and Real-World Social Metric Measures

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Background: Social competence is the ability to understand, navigate, and adapt to unfolding social interactions in order to estabilsh and maintain age appropriate relationships. It is a complex, multi-faceted construct that cannot be easily quantified using a single measurement strategy. Therefore, adequately capturing the sometimes nebulous construct of social competence is best accomplished through a combination of complementary evaluative tools, each providing a unique contribution to our understanding of an individual's interpersonal ability. Parent report measures provide endorsements based on repeated family interactions. Self-report tools offer valuable information about internal thought processes and social self-perceptual accuracy. Live conversations with peers provide data on effective skill use in an uncontrolled, dynamic exchange. Social impression ratings provide insight into peers' perception of one's social desirability. Finally, data on the real world social metrics (number of friendships and frequency of peer contact) provide information on the practical impact of learned competencies.

Objectives: The objective of the current investigation is to examine follow-up data collected 20 weeks after participants had completed the Social Tools And Rules for Teens (START) program for evidence of sustained social competence gains.

Methods: Participants consisted of 35 adolescents with ASD (ages 12-17) who enrolled in an RCT of the START program and were randomly assigned to treatment or waitlist groups. The START program is a 20-week experiential socialization intervention consisting of peer facilitators, free socialization periods, interactive topic discussions, structured social activities, and individual check-in and check-out sessions. At pre, post, and 20-week follow-up time points, participants and their parents completed a comprehensive set of social measures, including parent survey measures (Social Skills Improvement System, Social Responsiveness Scale-2, Social Motivation & Competency Scale), adolescent self-report measures (SSIS, SMCS), two video-recorded 5-minute conversations with untrained peers, and reports of real-world social metrics. Trained research assistants systematically coded all peer conversations for a variety of key social behaviors (i.e. questions asked, speaking/listening ratio, eye contact, facial expressions, engagement). Additionally, multiple peers provided a composite social impression rating after reviewing randomized participant videos.

Results: Repeated measure ANOVA procedures were used to compare pre, post, and follow-up data for all described measures. Participation in the START program was associated with significant increases across social competence measures from pre- to post-intervention time points (p-values < 0.01) with medium to large effect sizes. Across most measures, there were no significant differences between post- and follow-up data, which was reflective of sustainable social gains. Cases of significant post- to follow-up differences were actually due to continued improvements in social functioning even though START participation had ended.

Conclusions: In targeted efforts to improve the social competence of individuals with ASD, the sustainability and social validity of post-intervention gains are arguably the most important metrics of a program's efficacy. Significant gains in social competence are irrelevant if they do not generalize to everyday peer interactions or persist after a program has concluded. The results of this START efficacy trial are indicative of sustainable, comprehensive social improvements reflected in a confluence of parent, peer, self-report, and observational social gains.

284 **243.284** The Active Ingredients of Specialist Peer Mentoring for Autistic University Students.

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Background:

Despite wide recognition of the benefits of post-school education in improving life outcomes for autistic adults the university completion rate for autistic adults remains below that those with and without disabilities. University environments are inherently unpredictable, with high social demands, which may overwhelm autistic students. This unpredictability can exacerbate executive functioning difficulties in planning and prioritising tasks.

Objectives:

The aimed to identify the active ingredients of specialist peer mentoring (SPM) and examine its impact on autistic university students.

Methods:

A total of 30 (8 female and 22 male; mean age=22.3; SD=6.7) autistic university students engaged in the Curtin Specialist Mentoring Program and UWA Specialist Peer Mentor Program participated in this study; with 18 (5 female; mean age=22.5; SD=9.9) completing both aspects of the study. Seven (2 female; mean age=22.3; SD=3.5) only completed the quantitative aspect and 5 (1 female; mean age=21.0; SD=8.9) participated only in the interview.

A convergent mixed-methods approach was utilised, including a pre-test post-test design examined changes in symptomology experienced by autistic university students. In parallel, the experiences of participating in SPM was explored through semi-structured interviews.

Results:

Thematic analysis of the interviews revealed five themes of active ingredients: *Developing Partnership and Understanding*, *Engagement*, *Modelling and Practising Communication, Psychological Support* and *Grading and Planning Skills*.

Significant improvements were noted at post-test on the SRS-2 total score (M1=89.72, SD1=24.00; M2=79.66, SD2=26.66; t(17)=2.52, p=0.02), and the Social Communication (M1=29.94, SD1=7.89; M2=25.50, SD2=11.29; t(17)=2.24, p=0.03) and Social Motivation (M1=18.22, SD1=5.88; M2=16.00, SD2=5.91; t(17)=2.27, p=0.03) sub-scales.

Conclusions:

These results indicated that the active ingredients of SPM included the mentor-mentee partnership. Mentors utilisation of person-centred counselling skills promoted the development of a *partnership and understanding*. This partnership appeared to modify social cognition and motivation for autistic university students through the active ingredient of *modelling and practising communication*. *Psychological support* provided by mentors was a key active ingredient in developing autistic students' autonomy and self-efficacy. While the active ingredient of the mentors using *grading and planning* allowed autistic university students to develop strategies to manage their studies and social communication challenges, maximising their social competence.

285 **243.285** The Effect of Early Intervention on Long-Term Developmental Outcomes of Children with Autism Spectrum Disorders: A Systematic Review and Meta-Analysis

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Background: Early intervention has been shown to improve short-term developmental outcomes in children with autism spectrum disorders (ASD), but little is known about its effect on long-term outcomes.

Objectives: This meta-analysis aimed to evaluate the long-term effects of early intervention on multiple developmental outcomes of children with ASD.

Methods: We searched PubMed, EMBASE, PsycINFO, Scopus, the Cochrane Library, OVID, ERIC and Web of Science from inception through April 24, 2018 for relevant full-text articles in English. Studies were selected if they investigated the long-term developmental outcomes of early intervention in 6-to-18-year-old children with ASD; they were excluded if they targeted subjects with a medical complications or drug treatment. The quality of included studies was examined by the Cochrane risk of bias tool and the Risk Of Bias In Non-randomized Studies-of Interventions assessment tool. Meta-analyses were performed on studies judged sufficiently similar and appropriate to pool using fixed-effect or random-effect models. The standard mean difference (SMD) was used as the effect measure: up to 0.5=small effect, 0.51 to 0.79=moderate effect, and larger than 0.8= large effect. Additionally, we conducted stratified analysis to explore the potential differences in effects of the various intervention methods on children with ASD.

Results: A total of 8 pre-post studies and 9 between-group studies were selected, with aggregate data on 634 non-overlapping children with ASD. Among these studies, 11 conducted the Application of Behavioral Analysis therapy (ABA), 2 performed the Early Start Denver Model (ESDM), and the others used comprehensive interventions. The quality assessment showed that 6 of included studies were low risk of bias. Meta-analysis demonstrated that early intervention can prominently enhance the IQ level (SMD= 0.94, 95% CI: 0.57-1.32), expressive language (SMD= 1.12, 95% CI: 0.70-1.53), and receptive language (SMD= 1.07, 95% CI: 0.73-1.42) in children with ASD. In addition, early intervention can improve certain domains of adaptive behavior, including socialization (SMD= 0.59, 95% CI: 0.02-1.16), social (SMD= 0.75, 95% CI: 0.35-1.16) and communication (SMD= 0.85, 95% CI: 0.62-1.08). However, the results indicated that early intervention has no significant long-term effect on adaptive behavior composite (SMD= 0.19, 95% CI: -0.32-0.71), as well as on ASD symptoms (SMD= -0.61, 95% CI: -1.22-0.01). Moreover, the stratified analysis indicated that ABA was more effective than other methods in reducing symptoms (pooled SMD= -1.33, 95% CI: -2.28 to -0.39). In contrast, ESDM displayed the largest effects in improving the IQ level of affected children (pooled SMD= 1.37, 95% CI: 0.95-1.80).

Conclusions: Our study demonstrated that early intervention improves the long-term prognosis of children with ASD, especially for the cognitive function, language and communication. Furthermore, ABA and ESDM show different effects in improving certain long-term outcomes. These findings may have implications for developing customized interventions that are targeted at improving specific developmental outcomes in children with ASD.

286 **243.286** The Effectiveness of Pivotal Response Treatment (PRT) in School-Aged Children and Adolescents with Autism Spectrum Disorder: A Randomized Controlled Trial

M. W. P. De Korte[1], *I. Smeekens*[2], *J. K. Buitelaar*[1,2], *W. G. Staal*[1,2,3] *and M. Van Dongen - Boomsma*[1], *(1)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (2)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Department of Cognitive Neuroscience, Nijmegen, Netherlands, (3)Institute for Brain and Cognition, Leiden University, Leiden, Netherlands*

Background: Pivotal Response Treatment (PRT) is a naturalistic behavioral intervention targeting core deficits in social communication and motivation. The treatment has been shown to enhance social skills, language skills, and adaptive behavior (Koegel et al., 1999; Mohammadzaheri et al., 2015). The majority of studies on the effectiveness of PRT focus on preschool children (e.g., Koegel et al. 2003, 2014). Studies on the effectiveness of PRT for school-aged children and adolescents are lacking or have methodological limitations (i.e. lack of control group, no blinded measurements). Since children with ASD often face challenges in social communication when entering school, examination of PRT as a promising intervention is needed for this population.

Objectives: The current study aims to explore the effectiveness of PRT, compared to treatment-as-usual (TAU), on improving social communication skills and clinical functioning of school-aged children and adolescents with ASD.

Methods: A randomized controlled trial was conducted to evaluate the effectiveness of PRT for children aged 9-15 years with ASD and a

total/verbal IQ above 80. Participants (n=44) were randomly assigned to PRT or TAU (i.e. other treatment or waitlist control). In the PRT group, parents were trained to apply PRT techniques and the teacher of the child was also informed about how to incorporate PRT in the classroom. At baseline, week 12, 20 and 28 (follow-up), social communication skills of the child were assessed with the Social Responsiveness Scale (SRS, Roeyers et al., 2011) completed by parents and teachers. Clinically significant improvement was examined using the Clinical Global Impression-Improvement Scale (CGI-I, Guy, 1976) completed by a blinded child and adolescent psychiatrist. Clinical responders were defined as being much or very much improved on the CGI-I.

Results: There were no baseline differences of participant characteristics between groups (see table 1). Repeated measures analysis performed over the currently finished cases (n=27), indicated a significant main effect of time ($F(3,23) = 5.56$, $p = .005$) and a time x group interaction effect ($F(3,23) = 3.54$, $p = .03$) on the parent-rated SRS score, with a steeper improvement of social communication skills over time in the PRT group. For the teacher-rated SRS score a significant main effect of time was found ($F(3,21) = 4.53$, $p = .013$), but no significant time x group interaction effect ($F(3,21) = .90$, $p = .457$). There were no significant differences in percentage of clinical responders between groups at week 12 (PRT (45,0 %) vs. TAU (36,4%): χ^2 (1) = 0.32, $p = .75$) and week 20 (PRT (57,9 %) vs. TAU (47,6 %): χ^2 (1) = 0.42, $p = .51$). However, at follow-up results showed a significant higher percentage clinical responders in the PRT group compared to the TAU group (PRT (91,7 %) vs. TAU (47,6 %): χ^2 (1) = 6.4, $p = .011$).

Conclusions: The preliminary findings of this study suggest that PRT is effective in improving social communication skills and clinical functioning of school-aged children and adolescents with ASD. Results of the complete dataset (available May 2019), implications of findings, and future research will be discussed.

287 **243.287** The Effects of Dance on Social and Motor Performance of Children with Autism Spectrum Disorder.

I. Peace[1], *E. Manders*[2], *L. Levine*[1], *M. Tavino*[3], *A. Pope*[1], *S. Cipollini*[1], *W. C. Su*[3], *M. Culotta*[3], *L. Overby*[1] *and A. Bhat*[4], *(1)University of Delaware, Newark, DE, (2)Drexel University, Philadelphia, PA, (3)Physical Therapy, University of Delaware, Newark, DE, (4)Department of Physical Therapy, University of Delaware, Newark, DE*

Background:

Children with ASD display significant impairments in social communication as well as sensori-motor abilities. However, the majority of ASD interventions focus on improving social communication and behavioral skills and less focus is placed on sensori-motor impairments. We believe that a multisystem approach involving high engagement, social interactions (non-verbal and verbal), as well as sensori-motor experiences will address the needs of the whole child. In the present study, we used creative movement/dance to promote social communication and motor skills, such as imitation quality, whole body coordination, social attention, and emotional understanding.

Objectives:

We evaluated the effects of an 8-week dance intervention provided by dance experts on the social and motor skills of school-age children with ASD between 6 and 12 years of age.

Methods:

13 children with ASD between 6 and 12 years of age received 8 weeks of training (2-3 sessions per week) involving a variety of dance activities. Each 45-minute training session comprised of various training conditions: hello, warm up, idea dance, partner dance, creating, and chance dance/farewells. We examined the smile rates, percent duration of attention to social partners, as well as verbalization quantity/quality during the first, mid, and last training sessions. We also coded for social and motor improvements before and after training during a standardized praxis/motor assessment.

Results:

Our preliminary analysis of 2/3^{rds} of the sample suggests that children found the intervention to be enjoyable as seen by an increase in smile rates, words per minute, as well as more spontaneous and functional verbalization following training. During the creativity condition during training and generalized testing, children with ASD were more creative in generating new movements and required less prompting following training. Lastly, in terms of standardized testing before and after training children showed a reduction in spatial and temporal praxis errors when acquiring novel postures and while performing rhythmic actions.

Conclusions:

Children with ASD improved their social communication and imitation/praxis skills following dance training as seen by greater smiling, increased spontaneous verbalizations, increased creativity scores, and reduced need for prompting by the trainer. In a standardized testing context, they showed improvements in praxis as seen by fewer spatio-temporal errors in the posttest compared to the pretest. Future studies must extend this work to a randomized controlled trial in a larger sample and a more intense training protocol.

288 **243.288** The Effects of Hippotherapy on Repetitive Behaviors and Verbalization in Children with Autism Spectrum Disorder.

E. Knocke[1], *D. Longo*[2], *M. Tavino*[3], *B. Tripp*[2], *W. C. Su*[3], *B. Gillespie*[4], *L. Janusz*[2] *and A. Bhat*[1], *(1)Department of Physical Therapy, University of Delaware, Newark, DE, (2)University of Delaware, Newark, DE, (3)Physical Therapy, University of Delaware, Newark, DE, (4)Brandywine OT LLC, Wilmington, DE*

Background:

Communication impairments and repetitive/maladaptive behaviors (RMBs) are the hallmarks of Autism Spectrum Disorder (ASD) according to the DSM V (*American Psychiatric Association, 2013)*. However, children with ASD often present with significant sensory processing and motor impairments such as atypical sensory preferences and poor motor coordination and balance. These comorbidities are not addressed in standard ASD interventions that mainly focus on communication and behavior. Hippotherapy, a treatment tool used by trained Occupational Therapists, Physical Therapists, and Speech Language Pathologists, addresses the core impairments of ASD while integrating treatment for the sensory processing and motor impairments as well. There are limited studies on the effects of hippotherapy for children with ASD and the effects it has on communication impairments and repetitive/maladaptive behaviors are largely still unknown.

Objectives:

In the present study, we evaluated the effects of an 8-week hippotherapy intervention on the repetitive/maladaptive behaviors and

communication skills of school-age children with ASD.

Methods:

Nine children with ASDs between 3 and 8 years of age were observed for 8 weeks with pretest and the posttest visits conducted in the first and last weeks of the study respectively. ASD diagnosis was confirmed with medical and/or school records. While majority of the children were low verbal, two children were highly verbal. Treatment, including hippotherapy, was provided 1 time/week for 45 min to 1 hour for 8 weeks. Each therapy session was videotaped and included: a play activity; warm up; pace changes; school figures; transfers; forward, backward and sideways positioning on the horse; a client-centered coordination activity astride the horse; and preparation and feeding of the horse. We coded the videos for the frequency of repetitive/maladaptive behaviors per minute, words per minute, and verbalization quality during an early, mid, and late therapy session. Repetitive/maladaptive behaviors were categorized into arm/leg stereotypies, object-related stereotypes, and negative behaviors.

Results:

The average frequency and duration of RMBs decreased significantly from early to late sessions across all children. In the early sessions, negative and inappropriate behaviors made up approximately 55% of all coded behaviors, but at the late sessions, they only made up approximately 35% of all coded behaviors. In addition to the treatment variables, we also found some decrease in the frequency of RMBs from pre-test to post-test. Lastly, there were some improvements in spontaneous and responsive verbalizations following the 8-week intervention.

Conclusions:

We found a significant decrease in the frequency of RMBs from early to late treatment sessions and from pre-test to post-test. We also found that the percentage of negative and inappropriate behaviors decreased by about 20% from the early to late session and some improvement in verbalizations was also noted. Our findings support the growing body of literature that hippotherapy reduces repetitive/negative behaviors and may improve verbalization in children with ASD.

289 **243.289** The Moderating Effects of Implementation Factors on Improvement in Classroom Behaviors in Unstuck and on Target and Contingency Behavior Management

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Background: *Unstuck and On Target* (UOT; Cannon, Kenworthy, Alexander, Werner, & Anthony, 2018), a manualized executive function intervention for children with autism spectrum disorder (ASD) or attention deficit hyperactivity disorder (ADHD), has demonstrated effectiveness in increasing children's flexibility, organization, and planning skills. In a recent randomized effectiveness study comparing UOT to Parents and Teachers Supporting Students (PATSS), an enhanced contingency behavioral management intervention, neither interventionist profession (for the sample as a whole) nor average overall fidelity (for the sample as a whole and within each intervention group) was significantly related to improvements in students' classroom behaviors pre- to post-intervention.

Objectives: To examine the potential moderating effects of implementation factors (i.e., fidelity and interventionist profession) on improvements in classroom behavior.

Methods: The current study analyzed data from the randomized, comparative effectiveness study of UOT and PATSS in 21 Title 1 elementary schools. Participants included 136 3rd to 5th grade students with ASD (*n*=45) or ADHD (*n* =91). The outcome of interest was pre to post changes in masked observations of students' classroom behavior. The presence or absence of six behaviors were coded by observers and summed, yielding total scores ranging from 0 (i.e., the student exhibited every problem behavior during the observation) to 6 (i.e., the student exhibited no problem behaviors). Fidelity was measured through two observations of each interventionist, with observers rating ten items (e.g., content fidelity) on a 5-point scale (1 = strongly disagree, 5 = strongly agree) and an overall fidelity item on a 10-point scale. The potential moderating effects of the ten fidelity items rated at pre-intervention were explored within each intervention and diagnostic group as well as the sample as a whole, while the effect of interventionist position was explored within each intervention group and for the sample as a whole.

Results: For students in UOT (but not PATSS), interventionist profession had a significant effect on changes in classroom behavior, $F(4,63)=3.338$, $p=.015$. Specifically, the mean change in classroom behavior was significantly lower for students whose interventionist was a school social worker (M=.238) compared to students whose interventionist was a teacher. It did not matter whether the interventionist was a school psychologist, counselor, special education teacher, or school administrator. Significant intervention-specific relationships between fidelity and changes in classroom behavior were observed for students with ASD (but not for ADHD). For students with ASD who participated in UOT, greater use of visuals during sessions was associated with greater improvement in classroom behavior, $r(21)=.435$, $p=.049$. For students with ASD who participated in PATSS, greater adherence to content delivery was associated with greater improvement in classroom behavior, $r(15)=.582$, $p=.023$.

Conclusions: Interventionist profession was related to changes in classroom behavior for students in UOT but not PATSS; however, this finding should be interpreted with caution due to small numbers of certain interventionist positions in the analysis. Furthermore, although specific fidelity ratings were related to changes in classroom behavior for students with ASD, the aspects of fidelity that were related to improvements in behavior differed across treatment groups.

290 **243.290** Humanoid Robot Social Intervention Shows Promise

R. Landa[1], *E. Holliday*[2] *and K. J. Greenslade*[3], *(1)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (2)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltmore, MD, (3)Communication Sciences and Disorders, University of New Hampshire, Durham, NH*

Background: Affect recognition is a core deficit in autism spectrum disorder (ASD); this deficit compromises ability to interpret facial cues to interpreting others' communicative intent. Humanoid robots offer potentially useful supports for interventions targeting social skills of children with ASD.

Objectives: 1) To evaluate responsiveness of children with ASD to a robot-mediated affect recognition intervention (ARI); and 2) To gather preliminary evidence on effect of an ARI curriculum on distal measures of affect recognition.

Methods: An RCT was used to investigate the effects of a social skills ARI for children 4-8 years with ASD on distal affect recognition measures. Participants were randomized to the ARI (Milo) (n=20) or Treatment-As-Usual (TAU) group (n=20) utilizing a matched-pairs design. The Milo group participated in a maximum of 24 sessions with the Milo robot and an instructor. Three treatment subgroups were created based on participants' rate of skill acquisition in Milo's affect curriculum (Slower, Moderate, Average+Rapid Rate). Demographic and outcome variables were examined for each treatment subgroup.

Results: Milo participants advanced through the ARI curriculum with an average total accuracy rate of 84%. Families were highly engaged, reflected by low attrition (5%) during the treatment phase. All parents either agreed (16%) or strongly agreed (84%) on the importance of weekly Milo treatment sessions, and 79% of parents rated the treatment as "very" or "very much" worthwhile. In the Milo group, 70% of children reported enjoying learning about emotions, and 75% reported enjoying how the robot helped them learn emotions. Descriptive analyses of the Milo subgroups revealed that Slower Rate (M age=55.71 months, SD=5.85) and Moderate Rate (M=59.46 months, SD=18.70) groups were significantly younger than the Average+Rapid Rate (M=81.71 months, SD=9.35) group (p=.0004, p=.0065). The Slower Rate group had higher ADOS-2 Total scores (M_{Total}=19.33, SD=1.15) and calibrated severity scores (CSS) (M_{CSS}=9.00, SD=1.00) compared to the Moderate (M_{Total}=9.66, SD=3.05; M_{CSS}=5.00, SD=1.00; p=.0068, p=.0080, respectively) and Average+Rapid Rate groups (M_{Total}=12.92, SD=4.64; M_{CSS}=7.35, SD=1.69; p=.0351,p=.1310, respectively). Repeated measures ANOVAs revealed no significant differences between Milo and TAU groups on the NEPSY-II Affect Recognition subscale [F(1,37)=0.05, p=0.818] or on The Transporters computerized quiz (Autism Research Centre, 2009) (1) matching questions [F(1,37)=0.18, p=0.6749], (2) identification questions [F(1,37)=1.63,p=0.2097], and (3) scenario questions [F(1,37)=0.16,p=0.6928].

Conclusions: Results show promise for humanoid robot-mediated intervention in engaging children with ASD. Indicators of treatment acceptability were high among parents and children, suggesting social validity of the intervention. A comprehensive analysis of the three Milo subgroups revealed important and unique trends that may inform future research with children with ASD and ARI. Older children and those with lower levels of ASD symptoms tended to progress through the curriculum at a faster rate than younger children or those with more severe ASD symptoms. Exploratory findings suggest there may be specific variables that could predict children's responsiveness to social robotic interventions. Although group differences were minimal on distal measures of affect recognition, the Milo robot has several other social skills curricula which warrant evaluation of efficacy.

291 **243.291** Effectiveness of Noise-Attenuating Headphones in Children with Autism Spectrum Disorders

B. Pfeiffer[1] *and L. I. Duker (Stein)*[2]*, (1)Rehabilitation Sciences, Temple University, Philadelphia, PA, (2)Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA*

Background: Children with Autism Spectrum Disorders (ASD) often demonstrate atypical responses to auditory stimuli in the environment (Stiegler & Davis, 2010). This can increase stress and overall arousal levels impacting functional performance (Pfeiffer et al., 2017). There are a number of methods to create more optimal auditory environments including the use of noise-attenuating headphones (NAH). Although this is often a low-cost and easily implemented intervention, there is minimal research documenting its effectiveness.
Objectives: The objective of this study was to examine the effectiveness of two types of NAH in reducing stress in children with ASD while in natural environments.

Methods: Single-case study design with randomization to sequence of intervention (ABAC or ACAB) was used to test the effectiveness of two NAH. Six children between the ages of 8 and 16 diagnosed with ASD completed the study and were randomly assigned into two groups for different phase sequences. Five points of data were collected in the 4 phases of baseline, intervention 1, wash out, and intervention 2. Participants were provided with a set of Bose over-ear and in-ear NAH for the intervention phases. Physiological data of heart rate and electrodermal responses (EDR) were collected using an Empatica wireless wearable device to measure arousal state. Momentary assessment data was collected on type of daily activity and environmental stimuli. Smart phone technologies collected decibel readings two times in each session and a visual scan of the environment. Moeyaert's model parametrization, a multilevel hierarchical linear random effect model was used to evaluate treatment effects (Manolov & Moeyaert, 2017).

Results: Participants had significantly lower NS-SCR scores (G1: = 15.67, $p < .001$; G2: = 33.65, $p < .001$) during the intervention phases as compared with the baseline. The levels of NS-SCR scores did not differ (G1: = 0.35, $p = .557$; G2: = 2.07, $p = .151$) between over-ear and in-ear phases. SCL scores were also significantly lower (G2: = 238.04, $p < .001$) during the intervention phases compared with the baseline for a random subsample. SCL scores were similar (G1: = 0.00, $p = .979$; G2: = 0.04, $p = .845$) between different intervention phases. Participants also had lower heart rates (G1: = 23.87, $p < .001$; G2: =111.23, $p < .001$) during intervention phases as compared with the baseline, in particular during the in-ear intervention (G1: = 23.66, $p < .001$; G2: = 43.29, $p < .001$). Further analyses showed that the interventions may have moderating effects on the relationships between environmental noises and the physiological responses, in particular NS-SCR (= 3.34, $p = 0.067$) and SCL (= 2.83, $p = 0.092$) levels.

Conclusions: Results provide preliminary evidence for the use of NAH to reduce or maintain physiological arousal levels in stimulating environments for children with ASD. Generalization is limited due the single-case approach. Findings provide information to guide treatment planning when integrating environmental-based interventions in natural settings.

292 **243.292** A Systematic Review of the Role of Parent Characteristics in Parent-Mediated Interventions for Children with Autism Spectrum Disorder

R. Shalev[1]*, C. Lavine*[1] *and A. Di Martino*[2]*, (1)Child Study Center at NYU Langone Health, New York, NY, (2)The Child Mind Institute, New York, NY*

Background: Parent-mediated interventions (PMI) are increasingly being employed to improve outcomes for individuals with Autism Spectrum Disorder (ASD). Although the benefits of PMI are well documented (Oono et al., 2013), it is unclear whether parents' characteristics affect their children's outcomes. The lacuna is notable given long-standing literature suggesting that parents' characteristics – including stress, mental health concerns, education, demographics, and certain cognitive profiles – may affect parents' participation in treatment (Burrell & Borrego, 2012; de Veld et al., 2017; Karst & Van Hecke, 2012; Kazdin & Weisz, 2003). Better knowledge of how these characteristics, which are observed in parents of children with ASD, bear on PMI may enhance treatment procedures and outcomes.
Objectives: We reviewed the PMI literature and identified articles that explored the relationship between parent characteristics and children's treatment outcomes.

Methods: We conducted multiple searches across PubMed, PubMed Central, and Web of Science databases, and screened, selected, and included articles in accordance with PRISMA guidelines (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009). We included articles that (a) were published in a peer-reviewed journal from 1987 to September 2018; (b) were written in English; (c) included at least one participant with a diagnosis of a Pervasive Developmental Disorder based on the DSM-III-R (American Psychiatric Association, 1987) or ASD in later DSM versions or the ICD classification systems; (d) included an intervention that explicitly employed a parent-mediated approach; (e) reported outcomes that focused on children's behavior; (f) and employed an experimental design. Two authors then extracted and recoded key information about each study that met those criteria and was available in full text.

Results: We identified 511 unique articles that satisfied our selection criteria; of them, 115 met criteria for full-text review and 11 (~10%) examined the relationship between parent characteristics and children's treatment outcomes. Their results indicated that stress, socioeconomic status, and the broad autism phenotype may be related to children's outcomes in PMI, with the direction of the effects varying based on the specific treatment and outcome examined.

Conclusions: Existing literature suggests that treatment response may vary as a result of the individual characteristics of the child and/or parent in PMI. In recent years, researchers have strived to understand how the characteristics of the child affect treatment response. But, as shown by the limited number of studies available to date, we know far less about how the characteristics of the parent bear on children's outcomes. Further research on that front is essential to understanding which families are best suited for particular interventions and how treatment procedures can be modified to improve intervention efficacy.

Poster Session
244 - Neuroanatomy
11:30 AM - 1:30 PM - Room: 710

293 **244.293** Atypical Anatomy of Primary Visual Cortex and Links with Intelligence in Children with Autism Spectrum Disorders

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Background: Previous research has indicated that individuals with Autism Spectrum Disorders (ASDs) show widespread abnormalities in cytoarchitecture and MRI derived measures of neuroanatomy, including cortical thickness (CT) and surface area (SA). However, primary visual cortex (V1) has received relatively little attention. Functional MRI findings, on the other hand, have shown atypical recruitment of V1 during performance on language and cognitive tasks in ASDs. In a previous study on a smaller, partially overlapping sample, our group found differences in functional connectivity of V1 in comparisons of ASD subgroups with high (>115) vs. low (<85) IQ.
Objectives: To characterize CT and SA of V1, and relate these measures to intellectual functioning in children with and without ASDs.

Methods: High quality T1 MRI scans from 165 children [83 ASDs, 82 Typically Developing (TD)], ages 7-18 [mean age(standard deviation) =13(3), mean IQ = 108(13), range: 66-141)], from two ABIDE sites (San Diego State University and New York University), were included. Groups were matched on age, sex, handedness, and IQ. After standard preprocessing and rigorous quality control of images, CT and SA of left and right pericalcarine (V1) cortex, and left and right hemisphere were calculated using Freesurfer. Linear regression was used to test group differences in CT and SA, as well as group by IQ interactions; relationships between age and CT and SA, and group by age interactions were also examined. In all analyses, we controlled for scanning-site and average whole-hemisphere CT or total SA.

Results: The ASD group had significantly decreased left V1 SA compared to the TD group (p = .002). In contrast, V1 CT was significantly increased bilaterally (left: p = .03; right p =.02) in the ASD, compared to the TD group. Diagnosis significantly moderated the relationship between IQ and V1 SA, bilaterally (left: p = .01; right p =.02). There was no such moderating effect for CT. ASD symptom severity (ADOS scores) was not significantly related to V1 SA or CT. Finally, independent of diagnosis, age significantly predicted an increase in right V1 SA (p = .004), and decrease in right V1 CT (p < .001); however, after controlling for whole-hemisphere SA/CT these effects were not significant.

Conclusions: In congruence with the literature on atypical function of visual regions in ASD, we found abnormal anatomy of V1 (reduced SA, but increased CT). Our findings add an anatomical basis to the growing evidence of a 'special status' of visual functions in behavioral profiles of intelligence in ASDs. In ASDs, but not in matched TD controls, SA of V1 was positively associated with IQ. Notably, diagnosis did not moderate the relationship between IQ and whole hemisphere SA, indicating that this effect may have some specificity for visual cortex. In contrast, age-effects were not specific to visual cortex, and didn't differ by group. These results suggest that our previous findings, implicating atypical functional connectivity of the pericalcarine cortex in intellectual functioning in autism, extend to the underlying anatomical morphology, including CT and SA, and that these differences may emerge before mid-childhood/adolescence.

294 **244.294** Developmental Trajectory of Pathological Brain Growth in a Mouse Model of Pten Haploinsufficiency: An MRI Study

A. E. Clipperton-Allen[1], *O. S. Cohen*[1], *M. Aceti*[1,2], *J. Levy*[1], *A. Zucca*[1], *J. Ellegood*[3], *J. P. Lerch*[3] *and D. T. Page*[1], *(1)Neuroscience, The Scripps Research Institute, Jupiter, FL, (2)Drug Discovery, Moffitt Cancer Center, Tampa, FL, (3)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada*

Background: Macrocephaly/autism syndrome is caused by mutations in the gene *PTEN* (*Phosphatase and tensin homolog*), which encodes a negative regulator of the PI3K-Akt-mTOR pathway. Some individuals with autism spectrum disorder (ASD) and/or *PTEN* mutations show brain enlargement and white matter abnormalities. Mice haploinsufficient for *Pten* (*Pten*$^{+/-}$) display brain overgrowth and ASD-like behavioral phenotypes.
Objectives: While *Pten*$^{+/-}$ mice show macroscale brain overgrowth, it is unknown whether this is region-specific or consistent across the brain. We used magnetic resonance imaging (MRI) to analyze the volume of the brain and individual structures in *Pten*$^{+/-}$ and wild-type littermate control (WT) mice at postnatal day 7 (P7; equivalent to human birth) and in adulthood (P60).

Methods: MRI was performed on brains of male WT and *Pten*$^{+/-}$ mice collected at P7 (WT: n=10; *Pten*$^{+/-}$: n=10) and P60 (WT: n=10; *Pten*$^{+/-}$: n=9) to measure the volume of different structures. Immunohistochemistry, immunocytochemistry, isotropic fractionator, and flow cytometry were used

to confirm findings and to examine glial overgrowth in the *Pten*$^{+/-}$ mice. All experiments were performed blind to genotype.

Results: *Pten*$^{+/-}$ mice showed similar patterns of regional overgrowth to humans with *PTEN* mutations and ASD. At P7 and P60, virtually all individual regions, collapsed grey matter (GM), collapsed white matter (WM), and total brain volume were increased. Examining relative volume across brain areas, we found that WM was increased, and GM was decreased, in adulthood, similar to human patients. Juvenile *Pten*$^{+/-}$ mice showed no relative differences in WM or GM. This may be due to increased inter-subject variability at P7 relative to P60, which is more pronounced in *Pten*$^{+/-}$ mice. Previously, we found hyperplasia in neuronal but not glial populations at P0. At P7, however, we found increased glia, but not neurons, indicating that the adult pattern of hyperplasia was already established. This increased proliferation of glia likely contributes to increased WM volume.

Conclusions: *Pten*$^{+/-}$ mice recapitulate the increased brain volume, WM overgrowth, and regional relative volume increases found in individuals with macrocephaly/autism syndrome. Increased variability among P7 *Pten*$^{+/-}$ mice in comparison to age-matched controls and *Pten*$^{+/-}$ adults suggests that specific brain region growth may be desynchronized across animals and during early developmental stages before stabilizing by adulthood. These findings indicate that *Pten*$^{+/-}$ mice are a useful model for investigating the mechanistic basis of brain structure abnormalities found in humans with *PTEN* haploinsufficiency. Furthermore, this model may help illuminate the relationship between abnormal scaling across brain areas and the behavioral and cognitive symptoms of ASD and intellectual disability.

295 **244.295** Neuroanatomical Underpinnings of Autism Symptomatology in 22q11.2 Deletion Syndrome and Idiopathic Autism Spectrum Disorder

A. Bletsch[1], *M. Gudbrandsen*[2], *C. Mann*[1], *E. Daly*[2], *C. M. Murphy*[2], *R. H. Wichers*[2], *V. Stoencheva*[2], *E. Perry*[2], *D. S. Andrews*[3], *C. E. Blackmore*[2], *M. Rogdaki*[4], *L. Kushan*[5], *C. Bearden*[5], *D. G. Murphy*[2], *M. Craig*[2,6] *and C. Ecker*[1,2], *(1)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Goethe-University Frankfurt am Main, Frankfurt, Germany, (2)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (4)Psychiatric Imaging Group, MRC London Institute of Medical Sciences, Imperial College, London, United Kingdom, (5)University of California, Los Angeles, CA, (6)National Autism Unit, Bethlem Royal Hospital, London, United Kingdom*

Background:

22q11.2 Deletion Syndrome (22q11.2DS) is a genetic condition resulting from a microdeletion at the q11.2 band of chromosome 22 (Scambler et al., 1992). All individuals with 22q11.2DS display a deletion within the same locus of chromosome 22. However, the phenotypic consequences of the deletion are both complex and variable (McDonald-McGinn et al., 2015), making the neurobiology of 22q11.2DS inherently difficult to characterize. One of the neuropsychiatric phenotypes commonly present in 22q11.2DS is co-morbid autism spectrum disorder (ASD)-symptomatology. However, the neuroanatomical underpinnings of these symptoms remain poorly understood.

Objectives:

We aimed to establish (1) whether the neuroanatomical underpinnings of ASD-symptomatology in 22q11.2DS are shared with - or distinct from - the neural systems mediating autistic symptoms in idiopathic ASD, and (2) whether the neuroanatomy of ASD is significantly modulated by the 22q11.2 microdeletion.

Methods:

We examined neuroanatomical differences in 126 individuals (6-25 years; 66 males and 60 females; IQ ≥ 60) assessed at three sites: (1) the Child and Adolescent Psychiatry, Frankfurt, Germany; (2) the King's College London, UK; and (3) the University of California, Los Angeles, US. The total sample included (1) 25 individuals with 22q11.2DS who also met diagnostic criteria for ASD (22q11.ASD), (2) 25 individuals with 22q11.2DS without a diagnosis of ASD (22q11.nonASD), (3) 25 individuals with idiopathic ASD, and (4) 51 neurotypical controls. All groups were matched for age and gender. The 22q11.2 microdeletion was confirmed by *in-situ* hybridization (FISH) or microarray analysis test. ASD-symptomatology was assessed using the Autism Diagnostic Interview-Revised (ADI-R; Lord et al., 1994). We employed a 2-by-2 factorial design, controlling for age, gender, site, IQ, and total brain measures to identify neuroanatomical diversity associated with (1) the 22q11.2 microdeletion (i.e. main effect of 22q11.2DS), (2) ASD-symptomatology (i.e. main effect of ASD), and (3) a 22q11.2DS-by-ASD interaction term.

Results:

We observed a significant main effect of ASD for cortical volume (CV), cortical thickness (CT), and surface area (SA) in several regions across the cortex that have previously been linked to wider autistic symptoms and traits (e.g. superior temporal lobes, entorhinal cortices, and anterior cingulate cortex). Moreover, individuals with 22q11.2DS were neuroanatomically distinct from those without the microdeletion displaying (1) decreased CV, SA, and CT in occipito-temporal and cingulate regions, and (2) increased CV and SA in frontal regions (see **Fig.1**). Notably, we also identified brain regions (i.e. dorsolateral prefrontal cortex, precentral gyrus, and posterior cingulate cortex) where the 22q11.2 microdeletion significantly interacted with ASD-symptomatology to elicit neuroanatomical differences that could not be predicted by either main effect alone (see **Fig.1** and **Fig.2**). Thus, in these brain regions the neuroanatomy of ASD-symptomatology was modulated by individuals having the 22q11.2 microdeletion.

Conclusions:

Our findings indicate that even though behaviourally similar, the neuroanatomical underpinnings of ASD-symptomatology differ between individuals with the 22q11.2 microdeletion and those without. Thus, the co-existence of both conditions does not appear to represent a combination of the neuroanatomical diversity exhibited by each of the two conditions in isolation, but rather constitutes an independent subgroup with a unique neurophenotype.

Poster Session
245 - Neurochemistry
11:30 AM - 1:30 PM - Room: 710

296 **245.296** Cannabidiol Modulates Brain Excitation and Inhibition Systems in the Human Brain; But Differently in Adults with Autism Spectrum Disorder.

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Background: There is increasing interest in the use of cannabis and its major non-intoxicating component cannabidiol (CBD) as a treatment for mental health and neurodevelopmental disorders, e.g. autism spectrum disorder (ASD). ASD is a common but complex condition, which shortens life. Currently there are no effective pharmacological treatments for its core symptoms. Therefore alternative options, such as CBD, are beginning to be explored. However, before embarking on large-scale clinical trials, it is necessary to better understand how CBD acts on human brain, and in ASD specifically. Among CBD's multiple actions there is preclinical evidence that it may directly or indirectly modulate brain excitatory glutamate (E) and inhibitory γ-aminobutyric acid (GABA) (I) systems, including in brain regions linked to ASD, such as the basal ganglia (BG) and the dorsomedial prefrontal cortex (DMPFC). Also, abnormalities in glutamate and GABA pathways are consistently associated with ASD.
Objectives: Therefore, for the first time, we tested whether CBD 'shifts' glutamate and GABA in the BG and DMPFC in adults with and without ASD *in vivo*.

Methods: We used a placebo-controlled, cross-over, double-blind design and magnetic resonance spectroscopy (MRS) to investigate the impact of CBD on measures of glutamate (Glx = glutamate + glutamine) and GABA in 34 healthy men (neurotypicals n=17, ASD n=17). Data acquisition from the left BG (including the caudate and putamen) and bilateral DMPFC (including the anterior cingulate cortex) was timed to commence (at peak plasma levels) 2 hours after a single oral dose of 600 mg CBD or placebo.

Results: There were no baseline group differences in Glx or GABA concentration. Also, the response of Glx to CBD challenge was similar. In both groups CBD increased Glx in the BG but decreased it in the DMPFC ($F(1,21)=5.235$, $p=.033$). In contrast, there were significant group differences in GABA response. In both regions CBD increased GABA in the neurotypicals, but decreased it in ASD ($F(1,22)=13.506$, $p=.001$).

Conclusions: Our results provide the first direct evidence that CBD can modulate the glutamate and GABA system in neurotypicals and in ASD. However, prefrontal-subcortical GABA systems respond differently in ASD. Our results do not speak to the efficacy of CBD; therefore the next steps will be to examine the effects of more chronic administration on brain and behaviour; and to determine if acute brain changes predict longer-term response.

297 **245.297** Citalopram Modulates the Neural Systems Involved in Processing of Facial Emotion in ASC but NOT in Neurotypical Controls

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Background: The neurobiology underlying the processing of facial emotion is reported to be altered in autism spectrum conditions (ASC), but its neurochemical basis remains unclear[1]. Abnormalities in serotonin (5HT) systems have been linked to ASC and 5HT is also implicated in emotion control, but to our knowledge no one has examined whether serotonin reuptake inhibition modulates facial emotion processing regions in ASC.
Objectives: Therefore, we examined whether an acute dose of the selective serotonin reuptake inhibitor (SSRI) citalopram would alter the activity of the amygdala and fusiform regions (known to be involved in facial emotion processing) in adults with and without ASC in a task-based fMRI study.

Methods: A sample of 18 right-handed male adults with ASC (mean age=29.22 years, mean IQ=111.39) and 19 age and IQ matched neurotypical right-handed male adults (mean age=26.79 years, mean IQ=114.95) were included in the current randomised double-blind crossover study. Participants with ASC were diagnosed by consultant psychiatrists according to ICD-10 and all participants completed two MRI scanning sessions. They were given either 20 mg citalopram or placebo before scanning, during which an adapted version of an emotional face-matching task[2] was administered. The task consisted of eight experimental blocks and half of them were trials with angry/fearful faces and the other half were with geometric shapes (**Figure 1**). Participants were asked to match the images in each trial. The preprocessed task-based fMRI data were analysed with a general linear model approach and permutation testing using FSL.

Results: The amygdala was less activated in adults with ASC than controls in the *Faces>Shapes* contrast during placebo ($k=56$, $MNI_{xyz}=[27,-7,-25]$) and citalopram eliminated this difference (**Figure 2**). This was due to an increase in amygdala activation in adults with ASC but no change in controls post citalopram.

Conclusions: Serotonin reuptake inhibition 'restores' a typical pattern of amygdala activation during facial emotion processing in adults with ASC.

References

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298 **245.298** Event-Related Functional Spectroscopy Reveals Distinct Glutamate and GABA Abnormalities in ASD and High-Risk Children

O. J. Surgent[1,2], *B. G. Travers*[1,3] *and B. Nacewicz*[1,4], *(1)University of Wisconsin - Madison, Madison, WI, (2)Neuroscience Training Program, Univeristy of Wisconsin-Madison, Madison, WI, (3)Occupational Therapy Program in the Department of Kinesiology, University of Wisconsin - Madison, Madison, WI, (4)Department of Psychiatry, University of Wisconsin - Madison, Madison, WI*

Background: Individuals with Autism Spectrum Disorder (ASD) often have impairments in social domains, such as difficulty decoding facial expressions and motor domains, including weakened grip strength. It is possible that a global imbalance of neural excitation and inhibition drives both of these behavioral atypicalities. In order to explore this potential relationship, we assessed grip response to perception of facial expressions using a motor-specific, event related, high-temporal resolution functional Magnetic Resonance Spectroscopy (ht-fMRS), which has the capacity to quantify second-by-second accumulation of the major excitatory and inhibitory neurotransmitters (i.e. glutamate and GABA) in specific regions of interest. Our ht-fMRS focused on the median pontine nuclei due to its implication in our prior DTI studies of ASD and the importance of these nuclei in integrating top-down emotion modulated startle circuits.

Objectives: 1) To use novel motor-specific ht-fMRS to characterize the neurochemical signature of perception of facial expression and initiation of grip response in the pons, and 2) to examine the motor-specific neurochemical signatures within the pons of children with ASD, at a high risk for ASD (ASD-Related), and with typical development (TD).

Methods: Data pertaining neurochemical accumulation during the perception of neutral and emotional faces and the subsequent grip response to those faces were gathered from 18 children with ASD, 12 children at a genetically higher risk for ASD (ASD-Related), and 13 children with TD, ages 6 -10 years. The ASD-Related group included children who had a genetic risk factor for ASD (i.e., having an ADHD diagnosis or a first-degree relative with ASD, major depressive disorder, bipolar disorder, or schizophrenia). Participants used bilateral MRI-compatible grip strength responders to indicate grip response (hard or light) in response to faces (emotional or neutral). A general linear model was constructed using the raw spectroscopic data to deconvolve the neurochemical signatures unique to grip in response to presentation of emotional and neutral faces.

Results: Baseline grip was associated with diagnostic group (p = 0.02), and latency to grip was significantly correlated with autism symptom severity (p=0.04). Neurochemical signatures of emotion modulation (emotion-neutral) of trial-by-trial grip intensity showed a blunted glutamate response in ASD compared to ASD-R and TD, but absent GABA in both ASD and ASD-R compared to TD (p =0.03).

Conclusions: Using a grip-strength and emotion task in ASD, we show a clearly impaired neurotransmitter response in ASD. Interestingly, we also find an intermediate phenotype in ASD-R: ASD-like GABA blunting but high-normal glutamate during emotion-modulated grip. Taken together these results provide evidence for altered neurochemical responses to sensory stimuli during a motor task in children with ASD as well as those with higher genetic risk for ASD.

299 **245.299** Excitatory-Inhibitory Response to GABA-B Challenge Is Different in Adults with and without an Autism Spectrum Condition

A. C. Pereira[1,2], *H. Velthuis*[1], *N. Wong*[1], *L. Kowalewski*[1], *D. J. Lythgoe*[3], *D. Rotaru*[3], *R. A. Edden*[4,5], *E. Daly*[1,2], *D. G. Murphy*[1,6] *and G. M. McAlonan*[1,2,7], *(1)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Department of Neuroimaging, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (4)Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins University School of Medicine, Baltimore, MD, (5)5F. M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, (6)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (7)Behavioural Genetics Clinic, Adult Autism Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom*

Background: The underlying neurobiology of Autism Spectrum Conditions (ASC) is still poorly understood, but progress is being made. Multiple lines of research converge to suggest that there are alterations in glutamate (excitation, E) and gamma-aminobutyric acid (GABA) (inhibition, I) function, especially in the GABA system(Coghlan et al., 2012). For example, post-mortem abnormalities in $GABA_B$ receptor expression [which regulates the release of both glutamate and GABA(Padgett and Slesinger, 2010)] have been reported in ASC (Fatemi et al., 2009). Our recent studies suggest that brain E-I responsivity differences in ASC can be detected in-vivo using proton magnetic resonance spectroscopy (^{1}H-MRS) (Ajram et al., 2017), however, no one has directly tested whether $GABA_B$ receptors modulate E-I differently in autistic individuals compared to neurotypical individuals.

Objectives: In the current study we used ^{1}H-MRS HERMES (Saleh et al., 2016) to investigate the role of $GABA_B$ receptors in the modulation of E-I after a single high or low oral dose of Arbaclofen, a $GABA_B$ receptor agonist, compared to placebo in adult men with and without ASC.

Methods: Thirty-two adult men, half with ASC, were scanned on 3 different days at least 5 days apart to ensure complete drug washout. On each visit a single-dose of Arbaclofen (15mg or 30mg) or placebo was administered in a double-blinded, randomised order. ^{1}H-MRS data collection from the dorsomedial prefrontal cortex (DMPFC) and medial occipital cortex (mOCC) started 60 min after drug administration, corresponding to expected drug peak plasma levels. We computed the Glx/GABA+ (E-I) ratio (Glx = Glutamate + Glutamine; GABA+ = GABA + macromolecules) and used a repeated measures ANOVA to test group, drug, and group x drug interaction effects within each voxel.

Results: Group differences: There was no main effect of group in E-I measures in the DMPFC. There was a main effect of group (p=0.021) in the mOCC region; E-I was lower in the ASC group. Effect of drug: Arbaclofen shifted E-I in the DMPFC voxel in both groups (main effect of drug p=0.024). However, the direction of change was different in the two groups (interaction *p*=0.026). In controls, E-I was reduced by both the 15mg and 30mg doses compared to placebo; however, this E-I reduction only reached statistical significance at the higher dose (p=0.017). Conversely, in the ASD group, low dose Arbaclofen increased E-I above baseline; high dose Arbaclofen decreased E-I below baseline, thus E-I was significantly higher in

the 15mg Arbaclofen condition compared to the 30mg condition (p=0.026). There was no drug effect or drug x group interaction in the mOCC voxel.

Conclusions: The responsivity of $GABA_B$ receptor systems is atypical in ASC. Arbaclofen is currently being examined in Clinical Trials for ASC. Our finding that the effect of Arbaclofen in ASC is both dose and region dependent may have implications for dose selection and/or understanding how this target engagement relates to a longer-term treatment response.

300 **245.300** Imbalance Glutathione Biosynthesis in Cingulated Cortices: ASD Kinetic Patterns In Vivo.

C. D. Jimenez-Espinoza[1,2], *F. J. Marcano Serrano*[2] *and J. L. González-Mora*[1,2,3], *(1)Physiology, University of La Laguna, Santa Cruz de Tenerife, Spain, (2)Neurochemistry and Neuroimage Lab., University of La Laguna, Santa Cruz de Tenerife, Spain, (3)University Hospital of Canary Islands HUC, La Laguna, Spain*

Background: Toxic effects defenses of reactive oxygen species are an essential task within the brain during a long human life, which indicates the presence of an effective antioxidant system. Markers of oxidative stress are strongly associated with severe mitochondrial dysfunction in autism spectrum disorders (ASD) pathology associated with deficits in the antioxidant defense of glutathione in selective regions of the brain, although the molecular pathway continue being unclear. Glutathione (GSH; γ-L-glutamyl-L-cysteinyl-glycine) is the most abundant endogenous antioxidant present in mammalian cells (0.1 to 15 mM) and plays a protective role for exogenous toxins and endogenous in the central nervous system. It biosynthesis pathway, have two consecutive reactions that consume ATP, including two enzymes; glutamate cysteine ligase (GCL), and glutathione synthetase (GSS), to generate GSH. Previously, we described the kinetic imbalance in tri-cellular metabolism of N-acetyl-aspartyl glutamate (NAAG), in anterior (ACC) and posterior (PCC) cingulated cortices relate to the executive control networks and the attention alert functions linked to pathogenesis of ASD, which lead the next step in our investigation to elucidate the multiple causes of imbalance neurochemistry linked to cingulated cortices.

Objectives: To study Kinetic imbalance of glutathione biosynthesis in the cingulated cortices as target of oxidative stress in individuals with ASD using ^{1}H-MRS.

Methods: Single voxel (^{1}H-MRS) in ACC and PCC, in adults with a clinical diagnosis of ASD (n=21) and controls (TD) typically development (n=46), matched for age, gender and Autism quotients (AQ) score were assessed. The affinity between enzyme and substrate (ES) associated with GSH biosyntethis was measured as Michaelis Menten constant (Km). Statistic one-way ANOVA and Bonferroni correction were applied.

Results: Km for glutathione biosynthesis in ASD group is significantly lower [$1.1e^{-012}$ (mM)]; R^2 = 0.001 in ACC and the dissociation constant (ki) reduced 67.22% compared to the TD group. Conversely, Vmax of the appearance of the product that depends on the slowest process of the reaction is significantly decreased [15.12 µM / min]; R^2 = 0.51 in PCC.

Conclusions: Imbalance enzymatic kinetic in ASD does not mean that the enzyme is not present. Our findings indicate that, at a small amount of substrate, the rate increases rapidly and linearly in ACC, suggesting that the active sites of the enzyme are saturated with the substrate. The enzyme-substrate complex is very tight and rarely dissociates without the substrate reacting to give the product. Imbalance enzymatic kinetic in glutathione biosynthesis in the autism cingulated cortices is a novel finding indicative of a chronic neuroinflamatory state in these regions. We further conclude that a better understanding of the enzymatic activity in the synthesis of glutathione in the cingulated cortices can lead us to a new therapeutic pathway in the treatment of individuals with ASD.

Poster Session
246 - Neurophysiology/electrophysiology
11:30 AM - 1:30 PM - Room: 710

301 **246.301** Longitudinal EEG Markers of Language Development in Infants and Toddlers at Risk for Autism Spectrum Disorder

C. L. Wilkinson[1], *L. Gabard-Durnam*[2], *A. R. Levin*[3], *K. Kapur*[4], *H. Tager-Flusberg*[5] *and C. A. Nelson*[6], *(1)Developmental Medicine, Boston Children's Hospital, Boston, MA, (2)Pediatrics, Harvard Medical School, Boston, MA, (3)Neurology, Boston Children's Hospital, Boston, MA, (4)Department of Neurology, Boston Children's Hospital, Boston, MA, (5)Psychological and Brain Sciences, Boston University, Boston, MA, (6)Boston Children's Hospital, Boston, MA*

Background:
Language development in children with autism spectrum disorder (ASD) varies greatly. While many children first present with delayed language skills, roughly one quarter go on to have age-appropriate language skills by school age, and an estimated 30% will be minimal verbal. One of the best predictors of later achievement in children with ASD is language acquisition. Despite this, we know little about the neurobiological correlates of language development in infants at high risk for autism. Here we present the results from baseline EEG data longitudinally collected from infants, as part of the Infant Sibling Project, aimed at comparing infants with familial risk of developing ASD with low risk controls.

Objectives:

This study aims to characterize longitudinal EEG data collected over the first two years of life in children at low (LR) and high risk (HR) for autism, and specifically determine (1) which EEG measures correlate with later language development and (2) whether there are differences between LR and HR infants.

Methods:

Each infant was seen at multiple points between 3 and 36 months for EEG collection, developmental evaluation using the Mullen Scales of Early Learning (MSEL), and eventual ASD evaluation at 18, 24, or 36 months. Data used for this analysis was collected from 112 infants (54LR, 58HR). Ordinary least squares modeling of longitudinal baseline power from 3 to 24 or 3 to 12 months over several frequency bands was used to determine each infant's estimated 6-month intercept and slope. Multivariate linear regression was then used to characterize the relationship between EEG measures and the MSEL verbal quotient at 24 months.

Results:

Model estimated language scores significantly correlated with actual scores (Model Adjusted R^2 = 0.329; Pearson r = 0.70, 95% CI:

0.59-0.78,*P*=1x10^{-18}). Two-way interactions between risk and EEG measures were assessed to characterize differences in brain-language associations between LR and HR infants. Here we found that estimated 6-month intercept in low frequency bands delta and theta significantly contributed to estimated language scores *only*in the HR group, while estimated beta slope significantly contributed to estimated language only in the LR group. A second model, limited to EEG data collected between 3-12 months of age estimated language scores with similar accuracy (Pearson r = 0.66, 95% CI: 0.54-0.76,*P*=2.5x10).

Conclusions:

These data support the potential use of longitudinal EEG data in providing estimates of future language development in HR infants. Furthermore, these data support a growing body of research showing early brain differences between LR and HR infants regardless of ASD diagnosis, and emphasizes the need to characterize EEG biomarkers of language development in ASD within a high-risk population. Future work will further characterize these differences between risk groups, and determine the effect of ASD as a possible mediator of EEG predictors of language within the high-risk group.

302 **246.302** An EEG Biomarker of Delayed Sensitive Period Onset in Autism Spectrum Disorder

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Background:

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder thought to result from dysregulated sensitive periods in development. Sensitive periods are windows of increased neuroplasticity when experiences get embedded in brain function with lifelong effects on cognition and behavior. Neural measures of sensitive periods in animal models have shown that the timing of sensitive periods is regulated by maturing inhibition, which shifts the balance of spontaneous neural activity and experience-induced neural activity (the S/E ratio). Specifically, the S/E ratio decreases during sensitive period onset relative to pre-sensitive period levels.

Objectives:

The present study sought to translate the S/E ratio measure of sensitive period onset into human ASD neurodevelopment with longitudinal high-density electroencephalography (EEG) from 3 to 12 months of age. Specifically, this study tested how the language phoneme sensitive period manifests in ASD neurodevelopment, as language deficits are frequent ASD symptoms. We hypothesized that reduced neural inhibition in ASD may delay the developmental timing when inhibition is robust enough to reduce the S/E ratio (i.e. delayed sensitive period opening).

Methods:

Data were contributed by 79 typically developing infants (TD), 67 high-risk infants without ASD at 3 years (HR-), and 24 high-risk infants with ASD diagnoses at 3 years of age (ASD+). Spontaneous EEG power was collected with a silent baseline recording, while experience-induced EEG power was generated by a phoneme oddball paradigm. All EEG data were processed through HAPPE software, optimized for developmental EEG data. The ratio of spontaneous EEG power to phoneme induced EEG power was calculated over auditory cortex to generate the S/E ratio.

Results:

The S/E ratio in TD infants decreased between 3 and 6 months of age, consistent with the native phoneme sensitive period onset behaviorally ($p < 0.05$, n = 79). However, the S/E ratio in ASD+ infants remained elevated at 6 months of age, and was significantly higher than both HR- and TD infants ($p = 0.015$, n = 170), consistent with a delayed phoneme sensitive period. HR- infant S/E ratios did not differ from those of TD infants at any timepoint. Post-hoc analyses showed the elevated 6-month S/E ratio in the ASD+ infants was due to elevated spontaneous EEG power, consistent with the model of hyper-excitability in early ASD neurodevelopment. The S/E ratio in ASD+ infants was significantly negatively associated with later receptive language scores at 12 months ($p < 0.05$, n = 24).

Conclusions:

These findings suggest early auditory sensitive periods may be delayed in ASD with ramifications for later language development. This delay appears to be specific to infants who go on to ASD diagnoses, rather than reflecting high-risk for ASD. Moreover, the S/E ratio measure may serve as a translational sensitive period biomarker that can link ASD animal model insights to human brain and behavior development.

303 **246.303** Using the Mcgurk Effect to Investigate the Neural Indices of Audiovisual Speech Processing in Infants at Risk for ASD

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Background:

The McGurk effect is an audiovisual (AV) illusion such that when the listener hears one syllable, /ba/, while seeing a speaker articulate /ga/, people report hearing /da/ (McGurk & MacDonald, 1976). Individuals with ASD are thought to have impairments in AV integration since they have difficulty perceiving the McGurk effect (Irwin et al., 2011) and show atypical neural processing to AV speech as measured by event-related potentials (ERPs; Magnee et al., 2011). Little is known about how ERPs to AV speech differ earlier in development.

Objectives: Our current study investigated ERPs in response to AV speech in infants at risk for developing ASD. We included infants at familial risk, infants who fail a 12-month screener, and an age-matched group of low-risk infants.

Methods:

*Participants*Seventy 12- to 14-month-olds (M=13.47) were divided into two groups: 1)low-risk typically developing controls (LR; N=41) or 2)high-risk for ASD (HR; N=32) defined as having an older sibling with ASD (N=18) or failing the Communication and Symbolic Behavior Scales Checklist (Wetherby & Prizand, 2002; N=14).

*Procedure*ERPs were recorded while infants watched 4 video types up to 120 times: 1)AV-congruent-ba (Visual-ba, Audio-ba or VbaAba), 2)AV-congruent-ga (VgaAga), 3)AV-incongruent-impossible (VbaAga), and 4)AV-incongruent-McGurk (VgaAba).

*Analysis*Analyses focused on the mean amplitude of the AV mismatch response (AVMMR; 290-390ms post-audio-onset) as it is modulated by

incongruent AV speech in infants (Kushenerenko et al., 2013). We combined the AV-congruent conditions (conditions 1 and 2). Controlling for age, we analyzed AVMMR differences using an ANOVA across 3 conditions (AV-congruent, AV-impossible, AV-McGurk), two regions of interest (central, temporoparietal), and two hemispheres (left, right; see Figure1). Also, given that the AVMMR relates to age specifically in the AV-impossible condition, we conducted Pearson correlations between age and AVMMR.

Results:

We found no condition or group differences at central sites (all *p*'s>0.200). At temporoparietal sites, there was a significant condition by hemisphere response (F(2, 140)=4.36, *p*=.015; see Figure2). Follow-up analyses revealed that AV-impossible showed a more negative response in the left temporoparietal sites compared to AV-Congruent (*p*=.034) and AV-McGurk (*p*=.050). There were no other main or interaction effects, and no effects involving group. We found a significant association between age and the AVMMR response to AV-impossible in the left temporoparietal sites (*r*=0.288, *p*=.013) which was driven by the LR infants (*r*=0.377, *p*=.015). No association was found in the HR infants (*p*=0.355).

Conclusions:

The AVMMR was modulated by incongruent AV stimuli. Infants showed a more negative response to speech that could not be fused together into a single percept (VbaAga) compared to congruent (VbaAba, VgaAga) or fusible (VgaAba) speech percepts. There were no group differences as LR and HR groups showed the same pattern. However, older LR infants showed a more positive response to AV-impossible speech, similar to past findings (Kushnerenko et al., 2013), while HR infants did not show this age difference. Future work will follow these infants longitudinally to investigate potential maturational delays in the AVMMR for HR infants, including HR infants who are later diagnosed with ASD.

304 **246.304** Neural Processing of Observed Actions Is Related to Imitation and Language Abilities in Young Children with Autism Spectrum Disorder

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Background:

The mirror neuron system (MNS), which becomes active when carrying out actions and observing actions in others, is considered to serve as a foundation for children's social-cognitive learning, language and understanding intentionality in others' actions. Given the core deficits in social communication in ASD, it has been proposed that the MNS may be impaired in this population, but there is ongoing debate and controversy about the functioning of the MNS in ASD. However, no studies have explored the MNS in very young children with ASD or how it might be related to individual variability to both language and social cognitive functioning.

Objectives:

The goal of the present study was to explore activation in the MNS, which was approximated by recording the EEG mu rhythm (power in the alpha frequency band over the sensorimotor areas), in preschoolers with ASD and compared to activation in age matched typical children. MNS activity was recorded in communicative (i.e. pointing actions) and non-communicative contexts (i.e. grasping actions) and we examined the relationship between neural activity and the children's language and imitation skills.

Methods:

Participants were between the ages 21 and 59 months (M = 39.2, SD = 10.4). Good quality EEG data was obtained from 23 TD children and 19 children with an ASD diagnosis (confirmed by administering the ADOS). Using an EGI system, EEG recordings were obtained to measure power in the central alpha frequency band (7-12 Hz) during action execution and observation. A minimum of 15 toys were grasped and placed in a container and 30 video clips were presented in which an actor performed grasping and pointing actions (Figure 1). The receptive and expressive language scales of the Mullen Scales of Early Learning (MSEL; Mullen, 1995) were administered to measure language abilities and an elicited imitation battery (based on Rogers et al., 2003) was administered to assess motor imitation skills (with and without objects).

Results:

Lower levels of central alpha power during action observation were found in children with ASD (Figure 2). Specifically, there was a group difference in power recorded from the left hemisphere during the observation of grasping actions, $F(1, 40) = 4.68$, $p = .04$, $\eta_p^2 = .11$. In addition, positive correlations were found between power levels in this area and imitation abilities, $r(30) = .48$, $p = .007$, and receptive, $r(31) = .53$, $p = .002$, and expressive language, $r(31) = .57$, $p = .001$. There were no group differences in power recorded during execution of grasping actions, $F(1, 28) = 1.09$, $p = .31$, $\eta_p^2 = .04$, or the observation of pointing actions, $F(1, 40) = .001$, $p = .95$, $\eta_p^2 < .01$.

Conclusions:

The current findings suggest that the MNS plays a role in language and social development. These findings contribute to our understanding of the mechanisms that support language and social development in the first few years of life and how impairments in these mechanisms might underlie early symptom expression in ASD.

305 **246.305** Abnormal Auditory Mismatch Fields Arising from Superior Temporal Gyrus in Minimally Verbal / Non-Verbal Children

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Background: Approximately 30 % of the autism spectrum disorder (ASD) population can be categorized as minimally-verbal/non-verbal (MVNV). Previously, abnormal auditory/language discrimination processes, indexed by abnormal mismatch negativity (MMN) potentials or their magnetic counterparts (MMNm or MMF), have been reported in higher-functioning (verbal) children with ASD along with an association with degree of language impairment; however, little is known about neural correlates of language ability in lower-functioning MVNV children with ASD. Objectives: To understand the neurophysiological mechanisms underlying auditory language discrimination of vowel stimuli in MVNV children with ASD, magnetoencephalography (MEG) measured mismatch fields (MMFs) arising from left and right superior temporal gyrus during an auditory oddball paradigm in three cohorts: 1) MVNV children with ASD, 2) higher-functioning children with ASD (both with and without clinical language impairment) and 3) typically developing (TD) children.

Methods: Eighty-seven participants (aged 8-12yrs) were included in the final analysis (MVNV children with ASD; n=12, 10.13±1.49yrs, higher-

functioning children with ASD; n=48, 10.61±1.20yrs (without language impairment, operationally defined as Clinical Evaluation of Language Fundamentals - fifth edition (CELF 5) core language index > 85): n=27, with language impairment (CELF-5 CLI < 85): n=21), TD children, n=27, 10.14±1.38yrs). MEG data were obtained in a magnetically shielded room using a 275-channel whole-cortex CTF magnetometer (CTF MEG, Coquitlam, Canada). Vowel stimuli /a/ and /u/ of 300ms duration were presented binaurally at 45dB SL with each token as the standard (85%) or deviant (15%) stimulus, respectively; stimulus onset asynchrony was 700ms. MMF was defined from subtraction of the standard response from the corresponding deviant. To assess language ability, The Vineland Adaptive Behavior Scales, second edition communication scores were used. Linear mixed model were used for statistical analysis. The study was approved by the Children's Hospital of Philadelphia IRB and all participants' families gave written informed consent, in accordance with the principles of the Declaration of Helsinki. As indicated by institutional policy, where competent to do so, children over the age of seven additionally gave verbal assent.

Results: There were no group differences of age (p>.05).There were statistically significant main effects of group on MMF latency and MMF amplitude (p's<.01) with no effect of Hemisphere and no interactions. Significantly delayed MMF latencies were found in MVNV children with ASD (247.5 +/- 3.9 ms;p's<.01) compared to higher-functioning children with ASD (with (215.9+/-2.9ms) and without (210.1+/-2.6ms) language impairment) and TD children (189.2+/-2.6ms), and these delayed MMF responses were negatively associated with language ability (r=-.52;p<.01). Furthermore, while TD children showed a leftward lateralization of MMF amplitude (LI=0.14+/- .05;p's<.01), MVNV children showed the abnormal rightward lateralization (LI=-.19 +/- .07) as did higher functioning children with ASD both with (LI=-.14 +/- .05) and without (LI=-.10 +/- .05) language impairment.

Conclusions: Findings suggest that delayed auditory discrimination processes and abnormal rightward laterality could be effective and objective markers associated with language ability both in higher functioning and, importantly, in MVNV children with ASD.

306 **246.306** Abnormal Maturation of Alpha Peak Frequency in Children with Autism Spectrum Disorder May be Explained By Abnormal White Matter Maturation

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Background: Characterization of abnormal neural oscillatory processes in children with autism spectrum disorder (ASD) is considered a promising route to understanding brain dysfunction in ASD. Our laboratory reported abnormal maturation of resting-state alpha activity in children with ASD, with higher peak alpha frequency (PAF) in young children with ASD than age-matched typically-developing children (TDC). A study by Valdés-Hernández et al. established a relationship between PAF and diffusion magnetic resonance (DMR) fractional anisotropy (FA) in adults. The present study investigated relationships between PAF and DMR measures in TDC and ASD to better understand the structural features that contribute to normal/abnormal alpha rhythms in children

Objectives: To determine if PAF and diffusion associations are observed in TDC and children with ASD.

Methods: Eyes-closed resting-state MEG data were obtained from 73 male TDC (M=11.9±2.97years) and 107 male children with ASD (M=11.7±2.72 years). Groups did not differ on age(p>0.05). A 15 regional source model was used to project MEG surface data into source space. A Fast Fourier Transform was applied to 3.41 second epochs of continuous data at each regional source. PAF was identified (8-12 Hz) from regional sources' average power spectra, with the PAF value obtained from the source showing the largest amplitude alpha activity. DMR with b=1000s/mm2 and 30 gradient directions was collected. Artifacts in the data were corrected using FSL's eddy. FA and radial diffusivity (RD) were measured in white matter subserving PAF regional source (midline parietal regions) to characterize local white matter maturation.

Results: Given known associations between age and both PAF/white matter integrity, a regression model with age, diffusion, and group was used to predict PAF. For both FA and RD, significant group-x-age-x-diffusion interactions(ps<0.01) indicated a different pattern of association for TDC and ASD. Simple effect analyses showed that whereas TDC age and diffusion metrics explained unique variance in PAF, neither age nor diffusion metrics predicted variance in PAF in ASD. In the TDC group, regression analyses with age entered 1st and FA 2nd showed that age explained 24% of variance(p=0.001) and FA explained 4% of variance(p<0.05) in PAF. Reversing the order of entry, FA explained 14% of variance(p=0.001) and age explained 14% of variance(p=0.001) in PAF. In the ASD group, age and FA together explained a non-significant 2% of PAF variance(p>0.05). A similar pattern of findings was observed for PAF and RD.

Conclusions: This is the first study to show associations between white matter structure and PAF in children, indicating white-matter maturation determines, in part, the dynamics of resting-state alpha. DMR measures of white-matter fiber density and myelination were directly proportional to occipital-thalamo-cortical alpha frequency. Myelination and white matter maturation support the rapid conduction velocities necessary to drive faster alpha rhythms. This relationship was not observed in ASD, indicating disruption of a basic developmental mechanism underlying resting-state-processes in ASD. To the extent that resting-state alpha rhythms are supported by thalamo-cortical circuitry, present findings support the hypothesis of a thalamic contribution to abnormal cortical activity in ASD.

307 **246.307** An Event-Related Potentials Study of Response to Name in Preschool-Aged Children with and without Autism Spectrum Disorder

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Background: The ability to respond to one's own name is an important aspect of social and language development, and is disrupted in autism spectrum disorder (ASD). Event-related potentials (ERP) research has demonstrated that typical adult brain responses differentiate own name from other stimuli (e.g., Tateuchi et al., 2012). To date, however, no studies on the neural indices of response to name have been conducted with typically developing preschool children or children with ASD. In addition, it remains unclear whether these responses index familiarity processing or subject's own name (ON) specific processing.

Objectives: To examine the neural response to name in preschoolers with and without ASD using an ERP paradigm that delineates the effects of speaker familiarity (familiar vs. unfamiliar) and stimulus type (own name vs. nonsense name).

Methods: Participants were age-matched 3-5-year-old typically developing (TD) children (*n*=13) and children with ASD (*n*=13). Each ASD participant was matched individually to a TD participant closest in chronological age, yielding a chronological age matched sample. Stimuli consisted of the ON and a pseudoword "nonsense name" spoken by either the child's parent or a stranger. Speakers were instructed to call both names as though they were attempting to solicit the child's attention. Stimuli were presented in random order in a single block of trials. Analyses focused on the frontal ON negativity component, given the previous findings supporting this component as an index of response to name in adults. A 2x2 repeated measures ANOVA was conducted using mean amplitudes with name (ON vs. nonsense name) and voice (familiar vs. unfamiliar) as within-subjects factors, and diagnostic group as a between-subjects factor.

Results: Within the TD+ASD comparison, the ANOVA revealed a marginally significant main effect of name (p=.05), such that ON elicited a more negative mean amplitude than did the nonsense name across both groups ($F(1, 24)=4.10$, p=.05, η_p^2=.15). There was also a marginally significant interaction between voice and group ($F(1, 24)=4.22$, p=.05, η_p^2=.15), such that the TD group exhibited a marginally stronger response to parent's voice than to stranger's (Bonferroni corrected p=.06), while the ASD group demonstrated the opposite pattern (corrected p=.36) (Fig. 1).

Conclusions: The current findings address a gap in the current neural processing literature on auditory processing of self-relevant stimuli in preschool children with and without ASD. Both TD and ASD preschool children had a stronger response to their own name than to a nonsense name. Children with ASD exhibited marginally stronger responses to the stranger's voice than to their own parent's voice, suggesting that that the familiarity of the speaker plays a unique role in how children with and without ASD process their name.

308 **246.308** Assessing Lateral Interactions in Autism Spectrum Disorder Using Visual Evoked Potentials

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Background: Excitatory/inhibitory (E/I) imbalance is one hypothesis of autism spectrum disorder (ASD) which can be tested objectively using electrophysiological methods such as visual evoked potentials (VEPs). VEPs reflect the sum of excitatory and inhibitory postsynaptic potentials, and provide a rapid, noninvasive, and reliable technique to assess the functional integrity of visual pathways in the brain. Previously, our group identified weaker excitatory input and a consequential reduction in an inhibitory component of the transient VEP in children with ASD.
Objectives: The aim of the current study was to use steady-state VEPs (ssVEPs) with two radial stimulus conditions, partial-windmill (PW) and windmill-dartboard (WD), to assess short- and long-range lateral inhibitory interactions in children with ASD.

Methods: ssVEPs were obtained from 47 children with ASD and 33 typically developing (TD) controls between the ages of 2 and 12 years old. PW and WD patterns were contrast-reversed in time at 4.29 Hz (peak contrast = 32%). Fourier analysis extracted amplitude and phase measures of frequency components of the response, and a magnitude-squared coherence (MSC) statistic was used to quantify the relative response power at each frequency. Facilitation (short-range lateral interaction) and suppression (long-range lateral interaction) indices were computed based on 1st and 2nd harmonic amplitude measures.

Results: There were no significant differences between groups for measures of amplitude, MSC, facilitation or suppression indices. Significant differences in combined PW and WD amplitude and phase measures, equivalently expressed as sine and cosine coefficients, were observed for diagnostic group (p < .001), age (p = .034) and Diagnosis x Age (p = .001) interactions. Sine-cosine plots for 1st and 2nd harmonics for both conditions indicate that responses change with age for each diagnostic group.

Conclusions: There were no significant differences in short-range or long-range lateral inhibitory interactions between groups, which is consistent with previous findings from tVEP studies demonstrating intact inhibitory activity, on average, in ASD. However, results indicate that global measures of lateral inhibitory interactions significantly differ between groups when age is included as a developmental factor. Further research is needed with larger samples within specific age cohorts to explore these findings in greater detail.

309 **246.309** Delayed M50 / M100 Latency Arising from Superior Temporal Gyrus in Minimally Verbal / Nonverbal Children

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Background: Abnormal auditory M50 and M100 responses, which reflect early auditory processing, have been reported in children with autism spectrum disorder (ASD) along with an association with abnormal language comprehension; however, most prior research has focused on higher functioning individuals and so rather little is known about neural activity during auditory processing in lower-functioning (e.g. minimally verbal / non-verbal (MVNV)) children.
Objectives: To understand the neurophysiological mechanisms underlying early auditory processing in MVNV children, magnetoencephalography (MEG) measured M50 and M100 arising from left and right superior temporal gyri during tone stimuli in four cohorts: 1) MVNV children with ASD, 2) lower Intellegence Quotient (IQ) Intellectual Disability/ Developmental Disability (ID/DD, non-ASD) clinical controls (of mixed genetic etiology), 3) high functioning children with ASD and 4) typically developing (TD) children.

Methods: One hundred and sixteen participants (aged 8-12 yrs) were included in the final analysis (MVNV children with ASD; n=17, 9.83±1.27 yrs, lower IQ ID/DD (non-ASD) clinical controls; n=6, 10.54±0.62 yrs, higher functioning children with ASD; n=59, 10.67±1.30 yrs, TD children, n=34, 10.18±1.36 yrs). MEG data were obtained in a magnetically shielded room using a 275-channel whole-cortex CTF magnetometer (CTF MEG, Coquitlam, Canada). Sinusoidal tones (300 ms duration; 10 ms ramps) with a pseudo-randomized 600-2000ms inter-trial interval were presented binaurally at 45dB SL. Responses were averaged, filtered and source-modeled to allow identification of M50 and M100 components bilaterally. To assess language and cognitive abilities, The Vineland Adaptive Behavior Scale, second edition (VABS-2) communication scores, Differential Ability Scale - II and Leiter International Performance Scale, third Edition Nonverbal IQ were used. The study was approved by the Children's Hospital of Philadelphia IRB and all participants' families gave written informed consent, in accordance with the principles of the Declaration of Helsinki. As indicated by institutional policy, where competent to do so, children over the age of seven additionally gave verbal assent. Analyses used linear mixed models (LMM's) with subject as a random effect.

Results: There were no group differences of age (p> .05). There were statistically significant main effects of group on M50 latency and M100 latency (p's< .001) with no effect of Hemisphere and no interactions (p's> .05). Significantly delayed M100 latencies were found in MVNV children with ASD

(169.28+/-7.47ms) and in the low IQ ID/DD clinical control children (174.38+/-12.40ms) compared to TD (128.79+/-5.47ms; $p < .01$) as well as higher functioning children with ASD (150.50+/-4.06ms; $p < .05$). Delayed M50 latencies were also found in MVNV children with ASD (93.15+/-2.47ms) and the low IQ ID/DD children (93.75+/-4.09ms) compared to TD children (80.05+/-1.76ms;*p's*< .01). These delayed latencies were negatively correlated with language and communication ability (M50: $r = -.45$; M100: $r = -.27$;*p*'s < .01).

Conclusions: Findings suggest that the delays in early auditory cortex neural activity in minimally verbal/non-verbal children with ASD were exacerbated compared to higher functioning children with ASD and could thus be effective objective markers in MVNV children with ASD, associated with language impairment as well as general cognitive ability (as evidenced by the delayed latencies also in the non-ASD, low-IQ clinical control cohort).

310 **246.310** Diminished Gamma Oscillatory Response in Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder behaviorally defined by a core set of features, including social interaction deficits and restricted and repetitive behaviors. Sensory abnormalities are present in up to 90% of affected individuals, and impairment in cognitive processing is common. Neural oscillations are a key mechanism by which communication and synchronization occur within the brain, in turn driving coordinated cognition and behavior. Gamma band oscillations reflect GABAergic synaptic function, and alterations in the balance between inhibitory GABAergic and excitatory glutamatergic activity have been identified in ASD. Therefore, measurement of gamma oscillations may offer a valuable biological tool to reveal mechanisms underlying cognitive dysfunction and behavioral symptomatology. Auditory steady-state response (ASSR) is a neurological response that occurs when the brain entrains to rapid auditory stimuli presented at a given frequency. ASSR in the gamma frequency range (30-50 Hz) has been identified as a robust measure of abnormal neural oscillations in other disorders where excitatory/inhibitory balance is disrupted. This study used electroencephalography (EEG) to explore gamma oscillations with the ASSR paradigm in order to probe fundamental disruptions in ASD.
Objectives: Test for alterations in gamma band response during entrainment using an ASSR paradigm. Explore the relationship between gamma band response and sensory abnormalities as indexed by clinical self-report measures.

Methods: Seventeen individuals participated in the study, including 8 participants with ASD (63% male, mean age=20.6), and 9 typically-developing (TD) controls (67% male, mean age=22.6). EEGs were recorded at 128 electrode sites using Hydrocel Geodesic Sensor Net and Philips/EGI NetStation software. The auditory stimulus was a 500ms click train with a stimulation rate of 40Hz presented 150 times (inter-trial interval: 50ms). Data were filtered, re-referenced to the average, and segmented to the event onset. We completed artifact detection, bad channel replacement and baseline corrections before conducting time-frequency analyses and calculating absolute power at 40 Hz.

Results: Deficits in 40Hz gamma-band ASSR were found in the ASD group when compared to typically-developing controls ($t(15) = -3.99$, $p < .001$). Mean 40Hz power was $0.25 \pm 0.09 \mu V^2$ in ASD and $0.43 \pm 0.10 \mu V^2$ in TD. Though not significant, a trend was observed between 40Hz power and the Auditory Processing domain of the Adolescent/Adult Sensory Profile ($r = -.76$, $p = .079$).

Conclusions: These results reinforce prior findings of diminished ASSR response in ASD. Because it is collected through a passive, non-invasive task, ASSR may be a promising objective biomarker to be used as an ASD screening and stratification tool. For example, ASSR may be diminished in individuals with ASD where GABAergic functioning is disrupted, as in some syndromic forms of ASD caused by rare genetic variants affecting synaptic functioning. In addition, ASSR may be useful as a biomarker for assessing change in clinical trials, particularly for drugs targeting the GABAergic system. Further directions for this work include increasing sample size and diversity to include those that are minimally verbal and/or have cognitive impairments. We similarly seek to implement the paradigm in syndromic ASD populations to test its sensitivity to GABAergic dysfunction in populations with known alterations in this system.

311 **246.311** Discriminant Diagnostic Quality of Resting-State EEG for Fragile X Syndrome, Autism Spectrum Disorders, and Typical Development

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Background: Fragile X chromosome syndrome (FXS) is a neurodevelopmental condition, caused by a mutation of the FMR1 gene. It is the second most common single-gene cause of inherited intellectual disability and the most common genetic cause of autism. While similar in several behavioral manifestations and probably neurobiologically related, FXS is different from idiopathic autism spectrum disorders (ASD) in intervention strategies, prognosis, and relevance of genetic counselling. A reliable and accessible biomarker, such as EEG, could enable timely differential diagnosis. The findings of the resting-state EEG changes in FXS are relatively consistent: most authors report elevated theta power, reduced alpha power as well as increased epileptiform abnormalities. Some EEG changes in ASD follow the same pattern but in general they are more variable, probably reflecting the higher heterogeneity of autism. Most resting-state EEG studies have had limitations associated with the experimental sample size.
Objectives: The spectral resting-state EEG data were used to determine typical changes in FXS and ASD in larger samples and individual spectral features with good discriminant properties were chosen to predict assignment of subject to FXS or ASD groups based on EEG.

Methods: 47 children with FXS (age 4 to 18) and 51 children with ASD (age 3 to 18) participated in the study. All subjects with FXS had a full FMR1 mutation; the subjects with ASD had a clinical diagnosis within the autism spectrum (F84.0, F84.1 or F84.5) according to ICD-10, they also scored 15 or higher on Social Communication Questionnaire. The resting-state EEG (with closed eyes) was collected from 14 standard 10/20% electrode locations with A1+A2 reference and recorded with a Neuro-KM EEG system. Spectral power was calculated for standard and narrow – 1, 1.5 and 2 Hz – frequency bands. The values were compared to 70 EEG records of typically developing (TD) children from the normative database of 700 TD records organized in one-year age groups. Linear discriminators were chosen with forward stepwise analysis among normalized power, relative power, coherency, asymmetry, and power ratio predictors. Linear discriminant functions were identified with leave-one-out cross-validation method.

Results: The FXS showed a particular pattern of EEG changes with higher theta and beta-2 power and lower alpha power (p<0.01 FXS vs.TD). In ASD alpha power was lower and beta power was higher (p<0.01 ASD vs.TD). Models for optimal discrimination of groups were identified. They included four predictors for the FXS-TD comparison, three predictors for the FXS-ASD comparison, and four predictors for ASD-TD comparison. Sensitivity ranged from 90% for FXS vs.ASD to 100% for FXS vs.TD (93% for ASD vs. TD); sensitivity ranged from 90% for FXS vs.ASD and ASD vs.TD to 92% for FXS vs.TD.

Conclusions: We identified the distinct pattern of resting-state EEG changes in FXS, manifesting in higher theta and beta 2 power and lower alpha power, in a larger sample of children. Discriminant analysis assigns subjects to ASD, FXS, and TD groups with excellent specificity and sensitivity.

312 **246.312** Dysregulation of Temporal Dynamics of Neural Activity in Adolescents on Autism Spectrum

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Background: Autism spectrum disorder is increasingly understood to be based on atypical signal transfer among multiple interconnected networks in the brain (Sun et al., 2012). Relative temporal patterns of neural activity have been shown to underlie both the altered neurophysiology and the altered behaviors in a variety of neurogenic disorders (Ahn et al., 2018). The present study investigated the temporal aspect of brain network stability and variability in resting state EEG of ASD adolescents and neurotypical controls.
Objectives: The purpose of the study is to assess brain network flexibility in ASD using measures of synchronization (phase-locking) strength (γ), and timing of synchronization and desynchronization of neural activity (desynchronization ratio, DR) in theta (4-7 Hz), alpha (8-12 Hz), beta (15-30 Hz), and low gamma (30-60 Hz) bands of resting state EEG.

Methods: Resting state EEG data was recorded from 14 individuals with the diagnosis of ASD (2 F, age M = 13.7, SD = 2.2, range 10–16) and 15 TD participants (5F, age M = 13.4 years, SD = 1.8, range 10–17). Pairwise γ and pairwise DR were computed between anterior (F3, F4) and parietal (P3, P4) electrode sites.

Results: EEG data of ASD participants manifested altered temporal of coordination in anterior and parietal brain regions in multiple frequency bands on very short temporal scales. Pairwise synchronization strength in fronto-parietal sites was, in general, lower in ASD (alpha P3-P4, p<.001; beta F3-P3, p<.001, F4-P4, p<.001; gamma F3-P3, p<.001, P3-P4, p<.012). Short desynchronizations were also more numerous in EEG data of ASD participants (alpha band: F3-P3 p<0.001, P3-P4 p<0.002; low gamma, F4-F4 p<.001, F4-P4 p<.046, P3-P4 p<.026). Pairwise analysis of right hemisphere electrodes (F4-P4) indicated an contrasting effect: synchronization was significantly lower in TD, as opposed to ASD participants, in the alpha band (alpha F4-P4, p<.005), while desynchronization ratio was higher in EEG data of TD participants over in the theta band (theta F4-P4, p<.04).

Conclusions: In ASD adolescents, stable cross-frequency networks during resting state have been previously shown to endure for a longer period of time, in comparison with the same in neurotypical peers (Malaia et al., 2016). The present analysis extends the findings to the temporal aspect of synchronization: we demonstrate that fronto-parietal synchronization is lowered in ASD, with more short periods of desynchronization. Mathematical modeling (Ahn & Rubchinsky, 2017) suggests that neural networks with high desynchronization ratio have increased sensitivity to inputs; this sensitivity may disrupt production of an adequate neural and behavioral responses to external stimuli. Cognitive processes dependent on integration of activity from multiple networks may be, as a result, particularly vulnerable to disruption. Contrasting findings of increased synchronization and lowered DR in the lower frequency bands over the right hemisphere in ASD participants require further exploration with regard to their relationship to linguistics (left-lateralized) vs. numeric (bilateral) manipulation skills. The study advances the understanding of the biological mechanisms underlying cortical computations in the complex ASD phenotype.

313 **246.313** EEG Repetition Suppression in Children with Neurofibromatosis Type 1: Evidence from Time-Frequency Analysis

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Background: Neurofibromatosis type 1 (NF1) is a genetic disorder associated with neurodevelopmental disorders, including autism spectrum disorder (ASD), the prevalence of which in this population is approximately 25% (Garg et al., 2013). Studies on animal models of NF1 have identified deficits in habituation, a simple form of repetition learning that is conserved across species and crucial for the development of higher cognitive functions (Larkin et al., 2010; Wolman et al., 2014). Repetition suppression (RS), the reduction of brain activity in response to repeated presentations of a single stimulus, is considered the neurophysiological equivalent of habituation and can be measured using electroencephalography (EEG). However, RS has not yet been investigated in humans with NF1.
Objectives: The purpose of this study is to explore RS in children with NF1 ranging from 4 to 16 years of age. We investigate RS in the time-frequency domain through the variation of event-related spectral power, hypothesizing that the NF1 group would present habituation deficits reflected by lower RS compared to controls.

Methods: EEG was recorded in 13 participants with NF1 and 13 age-matched neurotypical controls using a 128-channel EEG system (Electrical Geodesics System Inc.) in a soundproof room at the CHU Sainte-Justine hospital. Participants were presented with recordings of thirty pseudowords read by a female native French speaker, which were repeated six times each and allowed us to observe auditory RS in a previous study using a similar design (Knoth et al., 2018). Timeframes of -400 ms (pre-stimulus) to 1400 ms were segmented for each presentation of a pseudoword. Artifact-free segments were averaged according to presentation order (first through sixth presentation of a pseudoword) and analysed in the time-frequency domain using the Morlet decomposition.

Results: A mixed-design ANOVA controlling for IQ revealed a significant interaction between repetition and group ($F(5,115) = 3.770$, $p = 0.03$) in the lower theta band (3-5 Hz), between 800 and 1400 ms. Post-hoc one-way ANOVAs controlling for IQ revealed a significant difference between the two groups at the third repetition of the pseudowords ($F(1,23) = 9.006$, $p = 0.006$), with higher suppression of theta power in the control group (Bonferroni-corrected, $p = 0.036$). A repeated measures ANOVA controlling for IQ revealed a significant RS effect in the control group ($F(5,55) =$

3.929, p = 0.004), but not in the NF1 group (F (5,55) = 0.310, p = 0.905).

Conclusions: Considering the role of theta activity in language processing and memory (Bastiaansen et Hagoort, 2003), the absence of repetition suppression for that frequency range in the NF1 group could reflect an altered habituation process in response to auditory presentations of language stimuli. Thus, RS alterations in NF1 may help us understand language, memory and learning deficits that are common in this population (Batista, Lemos, Rodrigues et de Rezende, 2014). Also, EEG markers of habituation promise to be highly relevant translational markers of basic learning mechanisms for clinical trials aimed at learning disabilities in NF1.

314 **246.314** EEG Time-Frequency and Phase-Locking Alterations during Auditory Processing in SYNGAP1 Mutation Individuals

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Background: Alterations in basic sensory processing have been reported in various genetic syndromes related to neurodevelopmental disorders. SYNGAP1 is a mutation thought to be a common cause of intellectual disability (ID), epilepsy and autism spectrum disorder (ASD). Excitation/ inhibition imbalance at the molecular level has been shown in several genetic neurodevelopmental disorders involving ID and ASD. Haploinsufficiency of the SYNGAP1 gene affects the GABAergic circuit function and oscillatory activity in mice (Berryer et al., 2016). In electroencephalography, these imbalances impair synchronisation in brain rhythms oscillations (Garrido et al., 2009; Larrain-Valenzuela et al., 2017; Lee et al., 2017; Rojas & Wilson, 2014).

Objectives: Here we assessed brain response oscillation and synchronisation in the time-frequency domain of individuals with SYNGAP1 mutation.

Methods: We recorded EEG in 61 participants ranging from 3 to 19 years of age (SYNGAP1 n = 8, neurotypical n = 37 and Down syndrome (DS) n=16) with an auditory stimulus (broadband white noise). We investigated auditory evoked potentials (AEP), time-frequency (TF) and inter-trial coherence (ITC) in SYNGAP1 mutation compared to DS and neurotypicals. Group comparisons were performed using ANOVA and Gabriel or Tamhane post hoc tests.

Results: ANOVA revealed a group effect on P2 latency and amplitude where DS shows a tendency of longer latency. TF analysis demonstrated delayed responses in SYNGAP1 mutation carriers compared to other groups. Specifically, they showed more power in late beta-low gamma band (18-35 Hz/ 150-300 ms) compared to neurotypicals (p=.046) and low gamma (30-40 Hz/ 250-380 ms) in comparison to neurotypicals (p=.004) and DS (p=.022). Importantly, SYNGAP1 mutation carriers showed less phase locking ITC compared to controls in early time windows and lower frequency bands. Specifically, they showed less ITC compared to neurotypicals and DS in theta-alpha (6-10Hz/ 300-450ms; vs. neurotypicals (p=.003); vs. DS (p=.012)) and less ITC compared to neurotypicals in early theta band (3-5 Hz/ 0-300ms; p=.014), (3-6Hz/ 100-350 ms; p=.035). Further, SYNGAP1 individuals expressed less ITC in low beta (16-19 Hz/ 0-100ms; p=.001) and early alpha (7-12Hz/ 50-300 ms; p<.001) compared to neurotypicals, and DS (p=.015). ITC in SYNGAP1 mutation carriers is also significantly reduced in later theta-alpha bands (6-10Hz/ 300-450ms) compared to neurotypicals (p=.003) and DS (p=.012).

Conclusions: SYNGAP1 mutation carriers showed delayed brain responses to auditory sensory stimulations that were also less synchronized in the theta, alpha and beta bands. Beta/low gamma oscillations also occur delayed compared to neurotypicals and DS. Lack of synchronisation in SYNGAP1 individuals could reflect the imbalance of excitation/ inhibition found at the molecular level in several animal models of ID/ASD. Further research is needed to investigate how these auditory processing characteristics in SYNGAP1 relate to cognition and behavior.

315 **246.315** EEG-Indexed Conditional Salience Processing Mediates the Relationship between ASD Symptom Severity and Theory of Mind

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Background: Theory of Mind (ToM) reasoning involves making attributions about others' mental states and is critical for competent social functioning. Although impairments in ToM are a common feature of autism spectrum disorder (ASD; Baron-Cohen, 2001), individual differences in ToM ability exist across ASD (White et al., 2014), and do not consistently vary by ASD symptom severity. Such heterogeneity suggests upstream individual differences in the recruitment of neural mechanisms necessary for ToM reasoning. However, no research has examined whether individual differences in the association between ASD symptom severity and behavioral performance on ToM tasks are attributable to specific neurocognitive components. Two distinct event-related potentials (ERPs) have been elicited during ToM tasks in typically developing (TD) youth (Meinhardt, et al. 2011); the Late Positive Complex (LPC), associated with automatic processing of conditional salience, and the Late Slow Wave (LSW), related to making mental state attributions. It is essential to examine these neurocognitive components in conjunction with ASD symptom severity to understand whether they may account for variability in ToM deficits in youth with ASD.

Objectives: Investigate whether LPC and LSW are elicited in youth with and without ASD during a ToM task. Explore whether magnitude of the difference between ERPs elicited to correct vs. incorrect conditions is associated with ToM accuracy and ASD symptom severity.

Methods: Participants were 76 adolescents (47 ASD, 54 male) ages 11-17 (M_{age}=13.0, SD_{age}=1.8) with IQ ≥ 70. ASD symptom severity was measured using the ADOS-2 Calibrated Severity Score (CSS) in all participants. During EEG acquisition, participants viewed illustrated, narrated ToM vignettes and were asked to make mental state inferences about characters' behavior (McKown et al., 2015). ERPs were time-locked to the presentation of correct and incorrect response options, measured at parietal electrode sites, and extracted as mean area amplitudes within post-stimulus time windows (LPC 300-600ms; LSW 600-1200ms). Residualized scores were calculated to index the difference between ERPs elicited to correct vs. incorrect conditions. Pearson correlations were used to assess the relationship between ERP residualized scores, ToM accuracy, and ADOS-2 CSS. Bootstrapped mediation analyses were performed to assess whether these components may explain the relationship between ToM accuracy and ADOS-2 CSS.

Results: LPC and LSW residualized scores correlated with ToM behavioral accuracy and ADOS-2 CSS (Table 1). Mediation analyses revealed LPC (but not LSW) partially mediates the relationship between ADOS CSS and ToM accuracy with a medium effect size (Figure 1).

Conclusions: Results show the LPC and LSW are elicited to a novel ToM EEG task in TD and ASD adolescents. ERPs were associated with ADOS-2 CSS

and ToM in opposite directions. This suggests the ASD group may rely on compensatory neurocognitive mechanisms to engage in ToM, resulting in attenuated discrimination between ToM conditions. Furthermore, although ToM performance is related to ASD symptom severity, mediation analysis revealed that this relationship disappears when LPC magnitude is taken into account. Therefore, automatic processing of conditional salience during active ToM reasoning partially explains the relationship between ASD severity and individual differences in ToM ability in adolescents with and without ASD.

316 **246.316** ERP Responses to Social Stimuli and ASD Symptoms in "Unaffected" Siblings of Children with Autism Spectrum Disorder

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Background: Siblings of children with autism spectrum disorder (ASD), even those who are not later diagnosed with ASD themselves (non-ASD ASIBs), often exhibit elevated ASD-related social-behavioral difficulties, known as the broad autism phenotype (BAP). Few studies have characterized the BAP in young children or investigated underlying neurophysiological mechanisms.
Objectives: The objectives of the present study were to a) characterize ERP responses to social and non-social stimuli and b) investigate the relationship between ERP responses and social-behavioral phenotypes in non-ASD ASIBs.

Methods: Twenty-six participants, ranging from 4 to 8 years old, were included in this study (non-ASD ASIBs: *n* = 11, 81.8% male, *M*age = 5.96 years; TD controls: *n* = 15, 100% male, *M*age = 5.60 years). Non-ASD ASIBs had an older sibling with a diagnosis of ASD but were not diagnosed with ASD themselves. TD controls had no family history of ASD. Participants completed an EEG experiment in which they passively viewed upright faces, inverted faces, upright houses, and inverted houses. The latency and amplitude of P1 was measured at the central occipital (OZ) electrodes. The latency and amplitude of N170 was measured at right posterior lateral electrodes (P8). Participants completed a battery of social-behavioral measures that included the Autism Diagnostic Observation Schedule – Second Edition (ADOS-2), the Childhood Autism Rating Scale (CARS), and the Social Responsiveness Scale (SRS). ERP component latencies and amplitudes were examined across conditions and groups in repeated measures ANOVAs. Correlations between ERP responses and social-behavioral variables were investigated using Pearson correlations.

Results: No main or interaction effects were observed for P1 latency or amplitude. For N170 latency, no main or interaction effects were observed. For N170 amplitude, the main effect of condition was significant, $F(3, 69) = 10.22$, $p < .001$, with faces eliciting larger amplitudes than houses, $ps < .037$, but no main effect of group or group by condition interaction was present. In TD controls, P1 and N170 latencies and amplitudes were not significantly correlated with any social-behavioral measures. In non-ASD ASIBs, several significant correlations emerged. Shorter N170 latency to upright faces was associated with higher ADOS-2 Social Affect severity score, $r = -.71$, $p = .021$ and marginally correlated with higher CARS total score, $r = -.620$, $p = .056$ and SRS total score, $r = -.63$, $p = .068$. Greater (i.e., more negative) N170 amplitude to inverted faces was correlated with higher ADOS-2 Social Affect severity score, $r = -.66$, $p = .050$ and higher SRS total score, $r = -.80$, $p = .009$, whereas greater N170 amplitude to upright faces was marginally correlated with higher ADOS-2 Social Affect severity score, $r = -.62$, $p = .057$, and higher SRS total score, $r = -.62$, $p = .076$.

Conclusions: These results indicate that ERP responses to social and non-social stimuli are similar in non-ASD ASIBs and TD controls. In contrast, correlations between ERP responses and BAP symptoms in non-ASD ASIBs suggest distinct relationships among neurophysiological functioning and behavior in ASD-related behavior in those at elevated genetic risk for ASD relative to TD controls.

317 **246.317** Early Visual Processing Indicates E/I Imbalance in Adults with Autism and Schizophrenia

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Background:
Visual Evoked Potentials (VEP) are robust and well characterized EEG responses that index the integrity of the visual system with amplitudes that reflect the ratio of excitation and inhibition (E/I) in the brain. Past research has shown attenuated P1-N1 amplitude in disorders with sensory features, including autism (ASD) and schizophrenia (SZ); these disorders share a neural phenotype of attenuated VEP P1-N1 amplitudes and overlapping behavioral phenotypes of social and communicative difficulties, termed *negative symptoms* in schizophrenia. The use of VEPs as a transdiagnostic measure of cortical function and a neural correlate of behavior may lead to a better understanding of the neurobiological underpinnings of these disorders with implications for prognostic evaluation and treatment selection.

Objectives:

Determine shared features of low-level visual processing as a metric of E/I imbalance in adults with autism and schizophrenia and explore the relationship of these neural markers with social and communicative severity.

Methods:

Participants were 18-40 year old adults with ASD (*n*=23; mean IQ=105), SZ (*n*=15; mean IQ=99), and typical development (TD; *n*=29; mean IQ=114), matched for age (mean age=24.6 years). All participants were extensively behaviorally characterized, including the Autism Diagnostic Observation Schedule (ADOS) and Positive and Negative Symptom Scale (PANSS). EEG was recorded with a 128 sensor Hydrocel Geodesic Sensor Net while participants viewed a black and white checkerboard reversing at a rate of 1 Hz. EEG was filtered from 0.1-30 Hz, re-referenced, segmented from -150 to 300 ms, artifact detected, and averaged. Peak amplitudes and latencies were extracted for the N1 (60-100 ms) and P1 (80-180 ms) components at electrode 75 (Oz). The difference in N1 and P1 amplitudes was calculated for all participants. One-way ANOVAs tested for differences in P1 and N1 latency and P1-N1 amplitude. Pearson correlations were used to assess relationships of ERP components with social abilities as measured by the ADOS and the negative symptom scale of the PANSS.

Results:

No main effects of diagnosis were seen for N1 [$F(2, 64)=2.57$, $p>.05$] or P1 [$F(2, 64)=.32$, $p>.05$] latency. There was a significant main effect of diagnosis on P1-N1 amplitude [$F(2, 64)=5.37$, $p=.007$]. Post hoc tests revealed the difference was driven by greater P1-N1 amplitude in the ASD group as compared to the TD group [$t(29)=2.9$, $p=.007$]; no differences were seen between the SZ group and either group ($ps>.1$). Collapsing across clinical

groups (ASD, SZ) revealed a significantly greater P1-N1 amplitude compared to the TD group [$t(57)=-2.9$, $p=.004$]. P1-N1 amplitude was positively correlated with ADOS calibrated severity scores ($r=.291$, $p=.017$) and PANSS negative symptom total score ($r=.31$, $p=.012$) across all participants.

Conclusions:

Differences in the P1-N1 amplitudes of the VEP in adults with ASD and SZ are consistent with intact visual processing circuitry but atypical E/I balance. P1-N1 amplitude is associated with clinician-reported social symptomatology in both ASD and SZ, demonstrating a link between objective neural responses and social function. These findings suggest a degree of shared pathophysiology between SZ and ASD and demonstrate the promise of transdiagnostic research for informing social-communicative biomarker development in neurodevelopmental disorders.

318 **246.318** Event-Related Brain Dynamics of Auditory Cognitive Control in Adults with Autism Spectrum Disorder

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Background:

Atypical sensory reactivity in autism spectrum disorder (ASD) is a core diagnostic feature. It is also one of the earliest and most persistent indicators to be behaviorally observed in this clinical population. Yet, a basic understanding of the neural mechanisms that mediate these behaviors remains unclear. Event-related neural oscillatory activity plays a key role in brain function and is easily evaluated by electroencephalography (EEG), which provides a high-temporal resolution of brain dynamics. Specifically, theta- (4-8 Hz), alpha- (8–12 Hz), and gamma-band (25-50 Hz) activity, are important for sensory processing, sensory integration, and working memory. Additionally, these bands have been observed as atypical in ASD and have been associated with deficits in cortical inhibition. In neurotypical controls, event-related spectral dynamics associated with target detection in the oddball paradigm have been used to examine the functional integrity of brain circuits. However, this relationship has not been well-characterized among adults with ASD.

Objectives:

In participants with ASD and age- and IQ-matched neurotypical controls, event-related spectral dynamics during attentional processing in an auditory oddball task will be evaluated. The relationship between sensory reactivity and average band power will also be examined.

Methods:

Adults with ASD (N=12) and age- and IQ-matched control controls (N=12) completed a modified 3-stimulus (target, non-target, and distractor) oddball task, as well as being assessed by the Adolescent/Adult Sensory Profile (AASP) and Kaufman Brief Intelligence Test (KBIT-2). During the oddball task, scalp-level EEG was recorded as the stimuli was binaurally presented, this included: randomly infrequent pure tone targets (1000 Hz, probability = .12) presented at 0° midline and frequent non-targets/distractors (probability = .88) with an inter-stimulus interval of 2000ms (~60dB, 200ms duration, 200 stimuli/block, 8 blocks total). EEG data was filtered, segmented into 2-s epochs, and edited for artifacts. Time/frequency analysis was performed using the standard frequency band ranges: Delta: 1- 4 Hz; Theta: 4 - 8 Hz, Alpha: 8 - 12 Hz; Beta: 12 - 25 Hz; Gamma: 25 - 50 Hz; and High Gamma: 50 - 80Hz. A 2x5 ANOVA (threshold $p<.05$) was used to compare power spectra across bands and between groups.

Results:

Average power at low perceptual loads were significantly different between groups ($p=0.015$). Adults with ASD demonstrated decreased theta and alpha-band power as well as increased gamma-band power ($p=0.0127$, $p=0.06$, $p=0.044$). Changes in spectral power in those with ASD were correlated with atypical reactivity ($r=0.851$).

Conclusions:

In adults with ASD increased sensory reactivity were related to changes in spectral power in low-and high-frequency bands compared to neurotypical controls. This atypical EEG pattern in auditory target detection is a potentially distinct profile of neural circuits functionality in sensory processing and top-down cognitive control between in adults with ASD.

319 **246.319** Externalizing Behaviors in Autism Spectrum Disorder Modulate Neural Responses during a Novel Interactive Social Paradigm

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Background:

Aberrant development of attention is indicated in both autism spectrum disorder (ASD) and disorders associated with externalizing behavior (e.g., conduct disorder). Attention modulates electrophysiological (EEG) neural responses elicited by visual social stimuli, and atypical patterns of these neural responses are seen in individuals with both ASD and maladaptive behavior. However, there have been few investigations into the potential influence of externalizing behaviors on neural responses to social information in ASD.

Objectives:

To examine whether externalizing behavior modulates event-related potentials (ERPs) to social information in individuals with ASD compared to typically developing (TD) controls.

Methods:

Preliminary EEG and eye tracking data were collected from children with ASD (n=49, mean age=14.17 years, mean IQ=107.41) and age/IQ matched TD controls (n=44, mean age=13.39 years, mean IQ=108.52); data collection is ongoing. Participants viewed an experimental paradigm in which onscreen faces responded contingently to participant gaze (monitored with eye tracking) with direct or averted gaze. The amplitudes and latencies of the N170, a face sensitive ERP, and the P100, an ERP associated with early sensory processing, were extracted from selected electrodes over the occipitotemporal scalp of the right and left hemispheres (RH; LH), segmented to the gaze shift. Externalizing symptomatology was measured using parent-report on the Child Behavior Checklist (CBCL). Group differences were examined using t-tests. Effects of diagnosis and gaze on ERPs were examined with two-way ANOVAs. Linear regression analyses were used to test whether externalizing behaviors significantly predicted neural responses.

Results:

Participants with ASD exhibited significantly greater parent-reported externalizing behavior than TD participants, as determined by the CBCL's Externalizing T-Scores [$t(88)=4.30$, $p<0.001$]. Analysis of N170 peak amplitude revealed that there was a significant main effect of gaze [LH, $F(1,158)=4.48$, $p=0.04$] such that the N170 was enhanced to direct gaze compared to averted gaze. There was no main effect of diagnosis and no interaction between diagnosis and gaze ($ps>0.05$). In ASD but not TD, externalizing behaviors predicted N170 latency to averted gaze [LH, ($b=1.36$, $p=0.04$), ($R^2=0.10$, $F(1,43)=4.53$, $p=0.04$)]. The analysis of P100 peak amplitude and latency indicated no main effects of diagnosis or gaze and no interaction between diagnosis and gaze ($ps>0.05$). Similar to the N170, externalizing behaviors predicted in ASD but not TD P100 latency to averted gaze [RH, ($b=0.81$, $p=0.02$), ($R^2=0.13$, $F(1,43)=6.22$, $p= 0.02$)], and P100 amplitude to direct gaze [RH, ($b=-0.07$, $p=0.01$), ($R^2=0.11$, $F(1,39)=4.96$, $p=0.03$)].

Conclusions:

Results of this novel interactive gaze paradigm indicate enhancement of the face-sensitive N170 to direct gaze across diagnostic groups, suggesting similar response to mutual gaze at initial stages of face perception. Externalizing behaviors were associated with gaze perception in children with ASD but not TD. In children with ASD, more severe externalizing behaviors were associated with slowed visual and facial processing in an avoidance-oriented social context and with more impaired visual processing in an approach-oriented one. These findings suggest that externalizing behavior may be useful in guiding strategies to stratify a heterogeneous ASD population to advance the objective of individualized, targeted therapies.

320 **246.320** Genetic Correlates of Electrophysiological Responses to Repeated Auditory Stimuli in Phelan-Mcdermid Syndrome

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Background:

Phelan-McDermid Syndrome (PMS) is a rare disorder caused by a loss-of-function point mutation in the *SHANK3* site or a deletion at site 22q13.3, which includes the *SHANK3* site, that alters synaptic and glutamatergic function. PMS is characterized by global developmental delay, hypotonia, and generalized sensory hyporesponsiveness. The presence of PMS confers approximately a 75% likelihood of a comorbid Autism Spectrum Disorder (ASD) diagnosis. Sensory differences including both hyporesponsiveness and hyperresponsiveness are a common feature of ASD.

Objectives:

We investigated whether the hyporesponsiveness observed behaviorally in individuals with PMS can be recorded in electrophysiological (EEG) responses to repeated auditory stimuli. Additionally, we examined whether deletion size at the 22q13.3 locus in individuals with PMS correlated with degree of neural hyporesponsiveness and habituation to repeated auditory stimuli, as compared to typically developing (TD) controls.

Methods: EEG was recorded from 19 participants with PMS and 21 with TD, all 9-30 years of age, while a series of four consecutive 1000Hz tones was repeatedly presented. Within trials, each 50ms tone was separated by 616ms; inter-trial interval was 4000ms. Amplitudes of N1, P2, and N2 event-related potentials (ERPs) were extracted and compared between groups. Genetic reports for all PMS participants were assessed for base pair deletion length at the 22q13 gene. Individuals with a loss of function mutation at *SHANK3* were assigned a deletion size of 58571 base pairs, the size of the entire *SHANK3* gene.

Results: The PMS group showed a significantly lower mean P2 amplitude to the first tone relative to controls (p=.045). Habituation of the mean P2 amplitude was significantly larger in the TD group than the PMS group between tones 1 and 2, tones 1 and 3, and tones 1 and 4 (p=.038, p=.003, p=.018, respectively). Larger deletion size was associated with smaller mean P2 amplitude (r=-.43, p=.06) to the initial tone. Increased deletion size also correlated significantly with lesser habituation of mean P2 amplitude between tone 1 and 2 (r=-.51, p=.023), and approached significance for habituation between tones 1 and 3 as well as tones 1 and 4 (r=-.36, p=.12; r=-.38, p=.10; respectively).

Conclusions:

Our results indicate relative electrophysiological hyporesponsiveness to auditory stimuli in the PMS group as compared to the TD group, consistent with global behavioral observations of under-reactivity in this group. Results also suggest lower levels of habituation of the P2 ERP component in the PMS group, with a robust negative relationship to base pair deletion size at the 22q13.3 locus. Results also demonstrate a strong relationship between degree of neural hyporesponsiveness and base pair deletion size; further investigation in necessary to parse the relationship between these variables.

321 **246.321** Increased Inter-Trial Variability in Sensory Processing of Social Stimuli in Children and Adolescents with ASD

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Background:

In Autism Spectrum Disorder (ASD) neural correlates of sensory processing differ from matched typically developed controls (TDC). Most studies have focused on differences in group means but have not compared intra-individual variability of neural processing. The model of reduced sensory precision posits that sensory processing abnormalities in ASD may be caused by increased variability in the neural response patterns to sensory information (see Baum et al., 2015 for an overview). First studies have already indicated increased variability in neural markers of sensory processing (Dinstein et al., 2012; Haigh et al., 2014; Milne, 2011).

Objectives:

The objective of the current study was to test the hypothesis of reduced sensory precision during the processing of social stimuli. For this purpose the variability of a neural marker of sensory processing, namely the P100, was compared between children and adolescents with ASD and TDC. Furthermore, the correlation of this variability with performance in social perception tasks was explored.

Methods:

In a sample of 21 children and adolescents with ASD and 15 age, IQ and gender matched TDC EEG was recorded during the viewing of emotional facial expressions. EEG data were analysed on the single trial level, identifying P100 amplitude and latency for 60 trials. The median absolute deviation (MAD), which reflects the degree of variability across trials (Milne, 2011), as well as mean amplitude were computed for each participant. Mean and MAD were compared across groups using univariate ANOVA.

Results:

No between-group difference for mean P100 amplitude was found ($F(1,34)=.450$ $p=.507$). In contrast, MAD of the P100 amplitude was increased in ASD compared to TDC ($F(1,34)=4.616$ $p=.039$). Higher variability in P100 amplitude correlated with poorer performance ($r(36)=-.387$ $p=.010$) as well as increased reaction times ($r(36)=.351$ $p=.018$) in an emotion discrimination task.

Conclusions:

Results confirm increased variability in sensory processing of emotional facial expressions in children and adolescents with ASD. Importantly, the analysis of inter-trial variability seems to provide information on neural processing differences between ASD and TDC which do not become evident by a comparison of mean amplitudes. Furthermore increased variability is linked to deficits in facial emotion processing. These findings indicate that reduced sensory precision indeed contributes to social perception deficits in ASD. Further replication is needed to confirm this hypothesis. Preliminary analyses of P100 variability during biological motion processing indicate similar patterns also apply to other areas of social perception.

322 **246.322** Machine Learning Methods Reveal Improved EEG Biomarkers in an Autism Clinical Trial

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Background:

Clinical trials for autism spectrum disorder (ASD) frequently utilize electroencephalography (EEG) measurements to track and evaluate neural dynamics. The utility of these measurements is determined by the efficacy of the biomarkers (or features) extracted from the EEG. Novel methods to *learn* improved biomarkers from clinical trial data can increase this efficacy and statistical power. A particular challenge for machine learning is the "little big data" structure, where there are many EEG samples but only a small number of participants. We introduce a new framework to address this challenging structure in conjunction with an interpretable deep network.

Objectives:

Our objective is to evaluate whether there are significant changes in neural activity in an open-label clinical trial designed to evaluate the efficacy of a single infusion of autologous cord blood for ASD. Specifically, the goal is to uncover improved EEG biomarkers using a machine learning algorithm to capture neural differences based on EEG recordings taken while watching social and non-social stimuli in longitudinal data.

Methods: The study involves secondary analysis on 22 children with ASD from ages 3 to 7 years who participated in this clinical trial and had available EEG recordings. High-density EEG recording (EGI, Inc) were collected at baseline (T1), 6 months post treatment (T2), and 12 months post treatment (T3). The EEG was recorded while watching a total of three one-minute long videos designed to measure responses to dynamic social and nonsocial stimuli. To learn EEG biomarkers, an interpretable convolutional network was applied to clean one-second data chunks to predict whether an EEG sample was from T1, T2, or T3. The "little big data" structure of the recordings was addressed with a novel multi-domain adaptation approach by explicitly learning and using similarities between patients. By examining the features, we can track how neural changes correlate to treatment stages. The learned features were evaluated with a leave-one-patient-out cross-validation scheme.

Results:

Our learned features distinguished between trial stages at a significantly higher rate than traditional approaches. Specifically, our features determined the correct stage 67.8% of the time. We compared this to a number of existing methods, with the next best performance giving 58.4% accuracy from a Multi-Channel Deep Convolutional Neural Network, suggesting that our novel methodology captures improved EEG information ($p<.001$, Wilcoxon signed-rank test). One confound on predictive ability was age, but age only captured a small amount of variability. The EEG was more predictive for trial stage compared to using age alone ($p<.001$, paired t-test). Visualization of learned features showed that particular frequency bands and sections of the brain were important to distinguish among trial stages. Neural similarities of participants can be revealed by using a graph visualization.

Conclusions:

Our machine learning methods empirically learned improved biomarkers related to clinical trial outcomes. By enhancing discrimination by a non-trivial margin, the statistical power of EEG biomarkers was significantly enhanced. The learned EEG biomarkers are a powerful tool to identify changed neural patterns in a longitudinal study, which we will soon be evaluating in a larger, placebo-controlled study.

323 **246.323** Maturation of Face-Sensitive MEG Responses in 6-24 Months Old Infants

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Background: Failure to detect or respond to faces is a predictor of autism spectrum disorder (ASD), with most research showing altered brain networks and abnormal fusiform gyrus (FFG) activity to face stimuli in adult or school-age children with ASD. Although orienting to face stimuli is an ability that emerges in the first year of life, little is known about how the brain processes social face stimuli in young populations.
Objectives: The present study employed magnetoencephalography (MEG) to study the development of face processing in infants and toddlers. The primary study goals were: (1) identify brain areas showing differences when processing Face versus Non-Face stimuli in typically-developing (TD) infants 6-12 months old (Time 1); (2) evaluate the developmental trajectory of face processing by obtaining MEG measures 12 months after the

participants' initial visit (Time 2; 18-24 months old). Associations between FFG peak latencies and age were also examined to evaluate whether the latency of the face FFG response decreases as a function of age.

Methods: MEG responses to Face and Non-Face stimuli were obtained from 35 infants aged 6-12 months. Follow-up MEG data (Time 2) were obtained from 12 TD infants 12 months after their initial visit. MEG data were obtained using an infant MEG system (Artemis 123™). MEG data were co-registered to a one-year-old MRI template. Artifact-free epochs 200 ms pre- to 500 ms post-stimulus were averaged according to stimulus type. Distributed source modeling via dSPM estimated activity throughout the brain at each digitized time point.

Results: A within-subject paired t-test showed stronger Face than Non-Face activity in multiple brain regions across time, with greater activity to Face than Non-Face stimuli most evident in right FFG at ~300 ms. Right FFG latencies in response to Face stimuli decreased as a function of age (R^2 = 0.43, p < 0.001). For the 12 infants with a follow-up MEG exam, the average right FFG latency difference between Time 1 and Time 2 was 110 ms (range 0 – 260 ms).

Conclusions: Face-sensitive brain activity was identified in TD infants in left and right FFG at ~300 ms post-stimulus, with right FFG activity occurring on average 110 ms earlier after a year interval. The above suggests that the face-sensitive FFG response (right hemisphere) evolves to an adult-like FFG face response (~170 ms post-stimulus) by 3 years of age. With a better understanding of face processing in infants, longitudinal studies are now needed to characterize neural responses to social stimuli during the first year of life in infants at-risk for ASD. It is expected that via such studies early brain markers that predict future (and possibly atypical) brain function will be identified, with these functional markers eventually used to identify children at risk for conversion to ASD.

324 **246.324** Modeling the Connections of BRAIN Regions in Children with Autism Using Evolutionary Algorithms and Electroencephalography Analysis.

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Background: Recent studies with neuroimaging methods like diffusion tensor imaging, functional connectivity, and graph theoretic methods have showed atypical development of neural connectivity in ASD, with excessive local connectivity within neural assemblies and deficits in long-range connectivity between functional brain regions. In this paper we present a new pre-processing approach of EEG data based on a novel algorithm applied to raw data and to quantitative EEG features able to pick-up abnormal connections.

Objectives: The aim of this study is to focus brain connections abnormalities in ASD using novel algorithms applied to EEG data.

Methods: Twenty children diagnosed with ASD (DSM-V criteria) and 20 children diagnosed with NPD (ADHD –N.16, mood disorders –N.2, anxiety disorders –N. 2) matched identically for age and male/female ratio, were entered into the study. A continuous segment of artifact-free EEG data lasting 10 minutes in ASCCI format were entered in Cin-Cin algorithm, a new pre-processing method to treat multichannel time series related to brain activity. The algorithm is based on an input vector characterized by a linear composition of city-block matrix distances between 19 electrodes. In this way, each EEG is transformed in a vector of 171 numbers expressing all the one by one distances among the 19 electrodes. Each distance value is assumed to express the connection among the two brain areas below corresponding electrodes. An evolutionary algorithm (a TWIST system based on KNN algorithm) was used to subdivide the dataset into training and testing set and select connections yielding the maximal amount of information. After this pre-processing different machine learning systems were used to develop a predictive model based on a training testing crossover procedure applied to selected connections distances.

Results: The connections subset involving 11 electrodes with nine connections (T4_F3, O2_F4, P3_T3, P3_C3, O1_C4, P3_T5, P4_T5, O1_T5, O1_P3) allowed the maximum degree of predictive performance by Machine Learning Systems used as classificators. Four of these connections are long range (three inter hemispherical and one intrahemispherical) and five short range. Long-range mean distances values resulted higher in ASD group while the opposite was true for short-range distances. The best machine learning system (three-layer feed- forward neural network with 8 hidden nodes) obtained a global accuracy of 96.2% (96.4 % sensitivity and 96.0 % specificity) in differentiating ASD subjects from NPD subjects.

Conclusions: The results of this study indicate the existence of brain connections abnormalities in ASD detected with evolutionary algorithms and Electroencephalography Analysis applied on a linear composition of city-block matrix distances between 19 electrodes. In addition, the model could distinguish the autistic children from the control children with an accuracy rate of 96.2%.

325 **246.325** Neural and Behavioral Predictors of Friendship in Children with Autism Spectrum Disorder

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Background: Peer friendships are fundamental for social and affective functioning throughout the lifespan. In a meta-analysis, Mendelson et al. (2016) proposed a model of friendship success in children with autism spectrum disorder (ASD): efficient social information processing speed (SIPS), social cognition, and social motivation may underlie increased friendship quality and quantity and improve psychosocial functioning in individuals ASD who are able to form and maintain successful friendships. The present study utilized N170 latency to dynamic mutual eye contact as an index of SIPS. We hypothesized SIPS, social cognition, social motivation, and psychosocial functioning would relate to friendship (interest, quantity, and quality) in children with ASD.

Objectives: To empirically investigate and extend a model of successful friendship in ASD by examining the behavioral and neural correlates of friendship.

Methods: Children with ASD and average intelligence participated in a gaze-contingent experiment with co-registered electroencephalography and eye-tracking (N=72, 17 females, mean age=14 years-old, mean IQ=105). Participants viewed faces that responded to their gaze in four conditions: fixate on eyes, eyes open (mutual eye contact); fixate on eyes, mouth opens; fixate on mouth, eyes open; fixate on mouth, mouth opens. The amplitude and latency of the N170 were extracted from selected electrodes over the right and left occipitotemporal scalp. Friendship, social motivation, social cognition, and psychosocial functioning were measured with standardized interviews and questionnaires (see Table 1). Two ordinal regressions were conducted to examine the predictors of friendship quantity and interest, respectively, with N170 latency, social cognition and social motivation entered into the model as independent variables. A third multiple regression was run to assess whether friendship quantity and interest predicted psychosocial functioning. Final analyses will assess friendship quality as measured by coding from the Autism Diagnostic Observation Schedule-2.

Results: The first model significantly predicted friendship quantity over and above the intercept-only model [$\chi^2(3)=16.91$, $p=.001$]. Shorter N170 to mutual eye contact [Wald $\chi^2(1)=12.34$, $p<.001$] and higher social motivation [Wald $\chi^2(1)=4.31$, $p=.04$] significantly predicted greater number of friends. The second model significantly predicted friendship interest over and above the intercept-only model [$\chi^2(3)=11.64$, $p=.009$]. In this model, only higher social motivation emerged as a significant predictor of greater friendship interest [Wald $\chi^2(1)=7.15$, $p=.04$]. A third regression model examined friendship quantity and interest as predictors of psychosocial functioning. The overall regression model was significant [$R^2=.24$, $p=.03$].

Conclusions: Associations between friendship and SIPS, social motivation, and psychosocial functioning in ASD are consistent with the model proposed by Mendelson et al. (2016). Results suggest neural differences in SIPS and social motivation in children with ASD are associated with enhanced ability to form and maintain friendships and thereby positively impact psychosocial functioning. Moreover, this study extends Mendelson et al. (2016)'s model, demonstrating that improved neural SIPS in response to mutual eye contact in ASD is associated with greater number of friendships and that social cognition is not associated with friendship. These clinically significant findings suggest that targeting SIPS and social motivation may lead to improved friendships in ASD and, eventually, improved psychosocial functioning.

326 **246.326** Predictive Processing in Changing Environments in Autism: Electrophysiological, Pupillometric and Behavioral Assays

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Background:

The brain continually produces predictions of upcoming sensory inputs rather than passively waiting for input to act upon. Impairments in the ability to flexibly generate and update predictions about upcoming events could be stressful, and it could lead to resistance to even trivial changes in life, which is a major feature in autism spectrum conditions (ASC). In a stable and predictable environment, the neurotypical brain generates expectations with a high level of confidence; while in a volatile and unstable environment where contingencies fluctuate wildly, the predictions earn lower levels of confidence. Thus, the brain not only makes predictions, but also assigns them an expected error rate.

Objectives:

Here we test the hypothesis that individuals with ASC are impaired in the ability to flexibly adjust the confidence level of their predictions according to changes in level of volatility in the environment. This is done by investigating whether & how quickly a new prediction model is adapted upon new experience in environments with different levels of volatility (high, medium, low).

Methods:

Data from 15 high functioning adults with ASC (18 to 25 years, three females) and 15 IQ- and sex- matched neurotypical controls were collected. We first remotely trained subjects to perform a sequence pattern learning task, where three consecutive shapes appearing in a particular order can create a pattern. The subjects were instructed to respond to a target, which is the final item the pattern. On the laboratory day, we then presented conditions with varying levels of pattern violation (environmental volatility), while high-density electroencephalography (EEG), behavioral responses and pupillometry were recorded. To examine how the level of surprise was modulated upon pattern violations in different volatility conditions, we measured changes in pupil dilation. Evoked response potentials (ERPs: CNV, P3, and error related responses) and reaction times were analyzed to infer predictive processing mechanisms.

Results:

In neurotypical subjects, as expected, P3 was present for the target, and increased in amplitude for low volatility through high volatility conditions. Further, there was a graded P3 function for the predictive items leading to the target in all volatility conditions. In the ASC group, a clear target P3 was only seen for the high volatility condition. In both groups, response times (RT) varied according to the level of volatility, showing an increase in RT when the condition switched to a higher volatility, and a decrease as it switched to a lower volatility. Additional analyses will focus on how fast this RT change occurred to determine learning rates of subjects, as well as how the CNV response and pupil dynamics modulate across volatility conditions and differ between groups.

Conclusions:

The P3 data reveal that the level of volatility and predictability had a lower influence on confidence of predictions in ASC, compared to neurotypical controls. This implies that people with ASC are less capable of processing the differences in volatility in the environment, which could make the changes in daily life unexpected and discomforting. Further analyses will show whether the data fully supports these conclusions.

327 **246.327** Psychophysiological Biomarkers of Stress As Predictors of Behavioral Disturbance in Autism Spectrum Disorder

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Background: Many individuals with autism spectrum disorder (ASD) who are non-verbal and intellectually impaired are unable to effectively communicate their internal stress state, which may manifest as problem behavior during times of high stress. This presents significant challenges for those providing care and services for this population. Psychophysiological measures of arousal, such as skin conductance level (SCL), may provide an early indication of proceeding problem behavior, which may eventually be used to intervene prior to the engagement of problem behavior.

Objectives: The present study examined the feasibility of collecting SCL data from severely affected individuals with ASD during lesson time in a school setting at a residential facility for severely affected individuals with developmental disabilities. SCL was examined prior to the occurrence of problem behaviors to determine if a period of time exists prior to when the problem behavior occurred that could be used to intervene. SCL was also examined after the problem behavior occurred to determine how long it takes on average for an individual in the classroom to return to median baseline levels of SCL after the occurrence of a problem behavior. We also explored whether subtypes of SCL responders within the sample differed regarding types of problem behaviors.

Methods: SCL data from 8 individuals with ASD who are non-verbal and have severe intellectual impairment were collected over a 1-year period. SCL data were analyzed once per month for a year prior to engagement of problem behavior as well as after the problem behavior ceased. Also, the SCL data prior to engagement in problem behavior were visually inspected for the presence of different SCL subtypes in an exploratory

manner.

Results: An anticipatory rise in SCL only occurred 60% of the time prior to the problem behavior, with an average rise time of 10 minutes between the initial rise in SCL and the engagement in problem behavior. Furthermore, SCL levels after a problem behavior returned to median baseline levels only 45% of the time. Additionally, three different subtypes of SCL response were found, suggesting that different treatment strategies may be effective for each SCL response pattern.

Conclusions: It is feasible to utilize SCL as an indicator of stress in severely affected individuals with ASD who are non-verbal and intellectually impaired. A significant window of opportunity for intervention (10 minutes on average) may exist between the initial rise in SCL and engagement in problem behavior in some people with ASD. Further, almost half of the participants did not return to baseline SCL levels after engaging in problem behavior, reinforcing the importance of prediction and intervention prior to the engagement of problem behavior. Finally, distinct SCL patterns were associated with different problem behaviors, which may have implications for treatment strategies (i.e. cognitive/behavioral vs. pharmacological). Taken together, these results may ultimately help caregivers and practitioners create better personalized, precise treatments that will be more efficient and help increase the quality of life for individuals with ASD.

328 **246.328** Reduced Beta and Gamma Band Activity to Auditory Stimuli in Children with Autism Spectrum Disorders.

ABSTRACT WITHDRAWN

Background: Abnormal sensory reactivity is a key feature in the DSM-5 and is related to the most functional impairment in individuals with autism spectrum disorders (ASD). Auditory processing is the most commonly affected sensory domain. Atypical auditory processing is hypothesized to play a role in social, communicative, and cognitive deficits in ASD. However, there is little research examining the basis of auditory processing dysfunction in ASD.

Objectives: To examine brain oscillations during a sensory gating paradigm in children with ASD using electroencephalography (EEG). Based on previous research, we hypothesized that children with ASD will have reduced beta and gamma band activity to the click sounds compared to typically-developing (TD) controls.

Methods: Participants included 21 children with ASD (*M*= 8.6 years, *SD*= 2.14), and 20 age-matched TD children. EEG data were collected during a modified sensory gating paradigm consisting of 100 paired-click stimuli while the participant watched a silent movie. The base-line corrected time-frequency characteristics measured included a) evoked power, representing signal intensity, and b) phase-locking factor, depicting synchronization of signals across trials. The following regions of interest (ROI) were identified 1) Beta: 13–18 Hz from 60-90 ms and 2) Early gamma: 30–50 Hz from 20–60 ms and 3) Late gamma: 30–50 Hz from 60–90 ms. Data from each ROI were analyzed using a 2 (Clicks) by 2 (Group) ANOVA procedure. Caregivers of all participants filled out the Sensory Profile questionnaire.

Results: Evoked power and phase synchronization plots show that children with ASD appear to have less evoked power and reduced synchronization than the TD group to the clicks. (Figures 1 and 2). The ANOVA evaluating evoked beta power indicated a significant group effect, $F_{(1,39)}$= 25.1, p < .0005, η^2_p = .39, with reduced beta evoked power in both clicks in the ASD group compared to controls. Similarly, the ANOVA examining beta phase synchronization indicated significantly reduced beta phase synchrony to both clicks in the ASD group compared to controls, $F_{(1,39)}$ = 27.3, p < .0005, η^2_p = .41. There were no group or interaction effects in *early* or *late* gamma-band evoked power. However, early gamma phase synchronization was significantly reduced in the ASD group compared to controls for both clicks, $F_{(1,39)}$ = 10.5, p = .002, η^2_p = .21. There were no significant group differences in late gamma synchrony. Across all participants, greater sensory processing issues as measured by the Sensory Profile total score was associated with lower click 1 evoked beta power (r=.44, p= .004), lower beta phase synchronization (r=.49, p= .001) and lower gamma synchrony (r=.45, p= .003).

Conclusions: Results shows that children with ASD have reduced evoked power and phase synchronization of beta activity and reduced early gamma phase synchrony during auditory processing compared to controls, specifically in orienting and filtering auditory stimuli. Moreover, neural oscillations of click 1 strongly correlate with sensory processing in everyday activities suggesting that the sensory processing deficits observed in children with ASD may arise from atypical neurophysiological functioning specifically when orienting to an auditory stimulus.

329 **246.329** Respiratory Sinus Arrhythmia, Parenting, and Externalizing Behavior Problems in Children with Autism Spectrum Disorder

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Background: Children with autism spectrum disorder (ASD) exhibit significant difficulties with emotion regulation. Respiratory sinus arrhythmia (RSA) is a biomarker for processes related to emotion regulation, with higher baseline levels generally linked to beneficial outcomes. Although reduction in RSA in response to challenge (RSA reactivity) can index adaptive engagement in community samples, excessive reactivity may suggest loss of regulatory control among children with clinical concerns. Psychophysiological risk for dysregulation may be protected against or exacerbated by parenting environments more or less supportive of the development of children's regulatory competence.

Objectives: The current study examined RSA in relation to externalizing problems in children with ASD, and considered positive and negative parenting as moderators.

Methods: From an original sample of 77 children, usable RSA data were obtained from an ethnically- and developmentally-diverse subgroup of 61 children with ASD (74% male; 47% Hispanic, IQ range = 47-121) aged 6 to 10 years (*M* = 7.95, *SD* = 1.48). RSA was measured with MindWare acquisition equipment and analysis software during a laboratory baseline and challenge task. Positive parenting included warmth as coded from a recorded speech sample, and observers' ratings of parental scaffolding. Negative parenting was comprised of critical comments from the speech sample and parent report on a measure of harsh discipline. Children's externalizing scores were indexed by parent report on the Child Behavior Checklist, and symptom ratings of oppositional defiant disorder (ODD) on a structured diagnostic interview.

Results: Parents were generally rated moderate (63%) or high (30%) on warmth and average scaffolding was in the moderately-high range. Critical comments and harsh discipline were relatively low. The positive and negative parenting composites were uncorrelated, r = -.05, *ns*. Almost one-

third of the children (30%) fell within the clinical range on externalizing problems and 34% met criteria for ODD. No main effects for RSA baseline or reactivity were observed after controlling for child age, IQ, and ASD symptom level; however, RSA reactivity interacted with both positive, *B* = -.26, *t* = -2.07, *p* = .044, and negative parenting, *B* = .30, *t* = 2.18, *p* = .034. Simple-slope analyses revealed that moderate-to-high levels of positive parenting buffered the association between higher RSA reactivity and children's externalizing problems (low positive parenting, *t* = 2.34, *p* = .022, others were non-significant), while high negative parenting appeared to strengthen this risk, *t* = 2.35, *p* = .022. Alternative follow-up analyses with RSA reactivity as the moderator suggested a dual-risk model wherein less optimal parenting was particularly problematic for children with high RSA reactivity (low positive parenting, *t* = -2.32, *p* =.025; high negative parenting, *t* = 2.26, *p* =.028).

Conclusions: Findings suggested a dual-risk model wherein children with both high RSA reactivity in response to challenge *and* less-optimal parent support (low positive or high negative parenting) were uniquely at risk for higher externalizing problems. Differential susceptibility was not supported in that high reactivity did not similarly sensitize the children to more positive environments. Implications for tailoring parenting interventions for different children with ASD will be discussed.

330 **246.330** Sex Differences in Neural Response to Emotional Faces in Children with ASD

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Background:

Previous studies indicate that males and females with autism spectrum disorder (ASD) exhibit different social behaviors. School-aged girls with ASD tend to be more socially motivated and mimic peers in social interactions more frequently than boys with ASD (Sedgewick et al., 2016; Dean et al, 2016). Event related potential (ERP) recordings show promise in clarifying the neural basis of sex differences in ASD. One study found that in response to static, neutral faces, girls with ASD showed weaker neural activity than boys at the N170, an ERP marker of face perception (Coffman et al., 2015). However, a general population study indicates that autism-like traits are associated with poorer performance on emotion recognition tests in boys, but not girls (Kothari, 2013). While the body of ERP research focuses on response to static faces, the current study is unique both in that it utilizes dynamic faces and that the faces exhibit emotional expressions.

Objectives:

The study aims to assess potential sex differences in N170 and P100 amplitudes in response to dynamic, emotional faces in typically developing (TD) children and children with ASD.

Methods:

The current study included 30 children with ASD (24 male, 6 female) and 24 TD children (14 male, 10 female) matched on age (ASD: *M* = 13.78 , *SD* = 2.83; TD: *M* = 12.83, *SD* = 2.94) and IQ (ASD: *M* = 107.38, *SD* = 28.56; TD: *M* = 109.75, *SD* = 11.31). Participants were presented with photorealistic faces with neutral facial expressions. When a participant fixated directly on a face, as measured by eye-tracking, the facial expression changed to happy or fearful. Data were filtered, re-referenced, epoched from -100 to 500 ms, baseline corrected, artifact detected, and averaged for each stimulus (happy and fear). ERP latencies and amplitudes were extracted from left and right occipitotemporal electrodes. Amplitude difference scores were calculated as fear minus happy condition.

Results:

A two-way ANOVA indicated a significant interaction between diagnosis and sex, $F(1, 63) = 5.57$, $p = .022$, $\eta^2 = 0.10$, with a medium effect size, on amplitude difference. Post-hoc independent samples T-tests were performed with Bonferroni correction (.050/2: $p < .025$). Among the ASD group but not the TD group, males showed significantly attenuated N170 amplitudes in the left hemisphere in response to emotional faces (*M* = -.41, *SD* =1.91) relative to females (*M* = 2.37, *SD* = 3.58), $t(28) = -2.66$, $p = .013$.

Conclusions:

These findings highlight sex differences in neural activity when viewing emotionally salient stimuli that may underlie sex differences between social difficulties in children with ASD, which may help to identify new, specific therapeutic targets for individuals with autism of both sexes. Analyses in progress examine relationships among sex differences in neural response and clinical phenotype.

331 **246.331** Sex-Related Differences in Youth with ASD: Alpha EEG Power in Eyes-Open and Eyes-Closed Conditions from the ACE Gendaar Network

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Background:

The EEG alpha frequency band (8-12 Hz) is thought to reflect levels of cortical excitability, with greater alpha power indicating lower cortical activity. Prior studies have demonstrated that individuals with ASD have decreased alpha power at rest (with eyes open) compared to control but comparable alpha power in eyes-closed (for review: Wang et al., 2013). The disparity in eyes-open vs eyes-closed alpha power is attributed to failure of individuals with ASD to increase cortical activity in preparation for visual input (e.g., Mathewson et al., 2012). Additionally, sex differences in resting EEG have been demonstrated in neurotypical participants, with females spend demonstrating lower power (greater attentional processes) compared to males (Tomescu et al, 2018). Little is known about sex-based difference in brain functioning in individuals with ASD, as most studies enroll males with ASD.

Objectives:

This study will evaluate resting-state EEG alpha power in youth with ASD, comparing alpha power during eyes-open and eyes-closed resting conditions. Analyses will focus on exploring sex differences within youth with and without ASD.

Methods:

EEG was collected as part of the ACE GENDAAR network. EEG data were collected while the participants passively watched screen-saver-like videos (eyes-open) and while sitting with eyes closed (eyes-closed). To be included in the analysis, youth had to provide artifact free data in both

conditions. EEG data was available from 61 youth with ASD (males=35, females=26), 24 siblings of the youth with autism (males=12, females=12), and 94 neurotypical youth with no family history of autism (males=50, females=44). A fast fourier transformation (FFT) was performed on artifact-free EEG data to assess alpha power averaged across mid-posterior electrodes. Linear regressions were used to evaluate the effects of sex and diagnosis on alpha power.

Results:

Regression models with group, sex, and age as predictors of eyes-open frontal alpha power were significant for the eyes-open calm viewing alpha power at all regions (Fs>9.698, ps<.001, R2=.111-.137). Higher power (less activation) was found in the ASD group compared to NT (ps<.05) and for younger participants compared to the older (ps<.01). For eyes-closed frontal alpha power, the regression model was significant for eyes-closed at all regions (F≥2.62, ps≤.05, R2=.033-.39). Higher power was found in the ASD group compared to NT (ps<.05) and for the females compared to the males (ps<.05).

Conclusions:

EEG resting brain activity significantly differed between youth with ASD and youth with NT development. In the eyes-open condition, EEG power also differed for age; while for the eyes-closed condition, power differed by sex. These analyses extend previous findings to a sample of youth with ASD. Additional analyses will examine the relation between eyes-open and eyes-closed, include the interaction between these main effects, and the relation to phenotypic characteristics.

332 **246.332** Social Reward Circuit Dissection in the Rat Valproate Model of Autism

*G. D'Urso, P. Schoenenberger, R. Lütolf, J. Tampe, P. De Luna, S. V. Gornati, M. Schmitt, M. Bainier, M. Maco, L. Aubert, B. Biemans, R. L. Redondo and **C. Grundschober**, Neuroscience Discovery, Roche Pharma Research and Early Development, Roche Innovation Center Basel, F. Hoffmann-La Roche, Basel, Switzerland*

Background: The Ventral Tegmental Area (VTA) is a heterogeneous region that plays a key role in the control of rewarding activity, motivation and social behavior. It is mainly composed of dopaminergic neurons (> 60%), intermingled with GABAergic neurons (~30%) and glutamatergic neurons (2-3%). Activation of dopaminergic or GABAergic VTA neurons can induce reward or aversion. VTA prominently sends dopaminergic projections to the Ventral Striatum (VS), another region actively involved in processing motivation, decision making, and reward. It has been shown that VS activation following dopamine neurons stimulation in VTA has rewarding effects. Moreover, in humans, diminished fMRI BOLD striatal responses to social reward have been reported in autism spectrum disorder.
In humans, prenatal exposure to valproic acid (VPA) is known to increase the probability to develop autism in children up to ten-fold. Similarly, rats prenatally exposed to VPA display impairment in social behavior, increased anxiety and hyperactivity.

Objectives: In this study, we used the rat VPA model of autism to dissect the VTA-VS circuitry and its link to social behavior. We recorded local field potential and unit activity in freely behaving VPA-exposed and vehicle (VEH) control rats during social behavior. Our goal was to measure brain activity during social interaction to detect differences in social reward signaling between VPA and VEH control rats. In a second step, we wanted to test if treatment with a vasopressin V1a receptor antagonist was affecting this circuitry.

Methods: VPA-exposed (N=5) and VEH rats (N=5), implanted with single wires electrodes in both VTA and VS, were free to explore an open field arena with two Plexiglas boxes placed at opposite corners. The two insert boxes had three rows of holes to facilitate social interactions. The test was composed of three different time blocks for a total duration of 35 minutes. The first block consisted of 10 minutes of exploration with empty Plexiglas boxes. During the second time block, an unfamiliar conspecific was placed inside one of the two boxes and an object was inserted in the other for 15 minutes. In the third time block, the boxes were empty again for 10 minutes. Video tracking of the task allowed for segmentation of electrophysiological brain activity according to the position of the nose of the experimental animal in the different zones (object, animal and neutral zone).

Results: In VEH control rats, we found that the VS showed higher 80Hz Gamma Oscillation power in proximity to social cues compared to inanimate objects or empty environments. We are further characterizing differences in VPA rats and interactions with V1a antagonist treatment.

Conclusions: This work will add to our understanding of the brain circuits involved in social behavior in the rat VPA model of autism and how they may be affected by V1a antagonism, a mode of action which is currently being tested in Phase III studies in adults with autism.

333 **246.333** Spatiotemporal Electrophysiologic Responses to Linguistic Stimuli in Children with Low Language and Cognitive Ability

***L. Bloy**[1], T. P. Roberts[1], K. Shwayder[1], H. L. Green[1], L. Blaskey[1], M. Kim[1], E. S. Kuschner[1] and D. Embick[2], (1)Children's Hospital of Philadelphia, Philadelphia, PA, (2)University of Pennsylvania, Philadelphia, PA*

Background:
Autism Spectrum Disorder (ASD) is a heterogeneous neurodevelopmental disorder often including impairment to language ability. Previous work investigating auditory speech processing with magnetoencephalography (MEG) has found event related desynchronization (ERD) in auditory cortex between 5-20Hz sensitive to a variety of linguistic factors such as semantic congruity, word frequency and word repetition. Recent work suggests that, in higher functioning children with ASD, ERD following linguistic stimuli is correlated with language ability.

Objectives:

In order to better understand the neural responses to language stimuli in the approximately 30% of the ASD population categorized as minimally-verbal/non-verbal (MVNV), we used MEG to measure ERD of the auditory cortex in response to linguistic stimuli (Words, NonWords, ReversedWords) in two cohorts: 1) MVNV children with ASD, 2) lower Intelligence Quotient (IQ) Intellectual Disability/Developmental Disability (ID/DD, non-ASD) clinical controls.

Methods:

Nineteen participants (aged 8-12yrs) were included in the final analysis (MVNV children with ASD, n=12, 9.6±1.1yrs; lower IQ ID/DD (non-ASD) clinical controls, n=7, 10.7±1.4yrs). MEG data were obtained using a 275-channel whole-cortex CTF magnetometer (CTF MEG, Coquitlam, Canada). Subjects listened to three types monosyllabic stimuli with different linguistic properties (100 each type): words (low age of acquisition), pronounceable nonwords, and acoustically reversed words. Bilateral ERD of the auditory cortex was measured between 5-20Hz and 200-1650ms. Cognitive ability

was assessed using the Nonverbal IQ (NVIQ) of the Leiter-3. Language ability was assessed using the Peabody Picture Vocabulary Test 4th edition (PPVT).

Results:

No significant group differences in age or NVIQ were observed (p>0.05), while significantly lower PPVT scores (p<0.01) were observed in MVNV children with ASD (33.0±11.0) compared with the ID/DD group (60.4±10.3). Higher NVIQ was significantly correlated with higher PPVT scores (R^2=0.27; p<0.05). Linear mixed models with subject entered as a random effect found significantly less ERD in MVNV+ASD children compared to ID/DD (p<0.01) and a significant interaction between hemisphere and group. No main effects of age, hemisphere, stimulus type, or other interactions (ps>0.1) were observed. Post-hoc analysis of each hemisphere found significant (p<0.01) bilateral decreases in ERD in MVNV+ASD children with a larger magnitude difference in the Right Hemisphere (Left: ID/DD 8.2±3.3; MVNV+ASD 5.7±1.9 Right: ID/DD 9.5±3.3; MVNV+ASD 5.2±1.6). Hierarchical regression was used in an attempt to disentangle the effects of group and PPVT. When entered first, both variables explained significant amounts of variance (group 42%; PPVT 40.8%; ps<0.01). When entered second neither variable explained significant amounts of variance (group 5.7%, PPVT 4.1%; ps>0.1).

Conclusions:

These findings suggest a correlation between the ERD and the behavioral classification of MVNV in children with ASD. These children exhibited little to no expressive linguistic ability, and their brain responses show little of the ERD previously linked to processing linguistic input. As suggested by hierarchical regression, the observed decreases in ERD in this study could be due to either ASD or poor language ability. Future work will potentially disambiguate these effects. Finally, the fact that no differences were observed between stimuli types in any group suggests that semantic differences between word types are processed outside of early auditory cortex.

334 **246.334** The Atypical GAMMA Range EEG Is NOT Explained By Developmental Delay in Young Children with Autism Spectrum Disorder

T. M. Helminen[1], *S. Pihlajamaa*[1], *S. Yrttiaho*[1], *K. Eriksson*[2], *J. M. Leppanen*[1] *and A. Kylliainen*[1], *(1)Tampere University, Tampere, Finland, (2)Tampere University and Tampere University Hospital, Tampere, Finland*

Background:

It has been suggested that the cortical brain activity of children with autism spectrum disorder (ASD) would show an imbalance between excitation and inhibition, which is reflected in atypically high baseline gamma activity. The previous research have showed abnormalities in gamma band activity in children with ASD when compared with typically developing children. However, there are age-related changes in gamma band activity during the development, and the developmental level of children with ASD has been shown to correlate with abnormalities in gamma band activity. Thus, it is not clear, whether the abnormalities found in previous studies could be better explained by developmental delay than ASD.

Objectives:

This study aimed at investigating whether the baseline gamma band EEG is atypical in children with ASD, when compared with typically developing children, and with children with developmental delay without ASD. In addition, the aim was to investigate whether the level of autistic behaviour correlates with gamma band EEG.

Methods:

Fifteen children with ASD (2.5–5.3 years, developmental age 1.2–4.2 years), 16 typically developing children (TD) matched with chronological age, and 14 children with developmental delay (DD) matched with developmental age, participated in the study. The baseline EEG was recorded when the children were watching a 3 minute video, where a person was calmly building a block tower. Only segments without movements or other distractions were analyzed, based on video analysis. The gamma band activity (24.4-44.0 Hz) was analyzed in central and parietal areas, which are least likely to be contaminated by of myogenic artefacts. The level of autistic behaviour was measured with ADOS-2 and ADI-R.

Results:

The split-plot ANOVA [Brain area (2) x Group (3)] on gamma activity showed a significant main effect of Group [$F(2,42)=3.276$, $p=.048$, $\eta p^2=.135$]. The gamma activity was significantly higher in ASD Group, when compared to TD ($p=.029$) or DD group ($p=.036$). The gamma activity between TD and DD groups did not differ. Activity was higher on parietal than on central areas [$F(1,42)=5.709$, $p=.021$, $\eta p^2=.120$], but there was no interaction between brain area and the Group. The correlation between gamma activity on central brain areas and ADOS-2 comparison scores in ASD group was marginal ($r_s = .487$, $p=.066$). The more autistic symptoms the child exhibited in ADOS-2, the higher was the gamma activity. No significant correlations were found between gamma activity and ADI-R scores.

Conclusions:

The present study supports previous studies by showing that the gamma band activity is higher in children with ASD than in typically developing children. Moreover, this finding seems to be specific to autistic psychopathology and not related to developmental delay per se, as according our results, the children with ASD showed higher gamma activity also when compared to children with developmental delay but without ASD. Some indications were found that the severity of autistic symptoms might be associated with gamma band activity. These findings suggest that the gamma band activity could be considered as one potential diagnostic marker for autism.

Poster Session
247 - Sensory physiology
11:30 AM - 1:30 PM - Room: 710

335 **247.335** Thalamic GABA:Glutamate Ratio Is Related to Severity of Sensory over-Responsivity in ASD

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Background: A better understanding of the underlying neurochemistry of Sensory Over-Responsivity (SOR) is vital for developing potentially groundbreaking and life-altering psychopharmacological interventions for the 50-75% of children with ASD who experience SOR. Parents report that SOR symptoms, ranging from tactile discomfort to distress in loud or complex environments, are among the most disruptive in their children's everyday life (Ben-Sasson *et al.*, 2007), but the biological mechanisms underlying SOR remain poorly understood, leaving a dearth of effective treatments. Genetic studies of GABA receptor function, biochemical analyses of GABA synthesis and degradation and computational models have suggested that core features of ASD are driven by an excitatory-inhibitory imbalance of neuronal activity (Rosenberg *et al.*, 2015). Neuroimaging research from our laboratory shows reduced modulation of thalamocortical connectivity in autism in response to mildly aversive sensory stimulation, further suggesting that an imbalance of excitation and inhibition in thalamic neuronal populations may play a role in SOR.
Objectives: Examine how GABA, Glutamate, and GABA/Glutamate ratios in the thalamus 1) differ between youth with and without ASD; and 2) correlate with behavioral measures of SOR within children with ASD.

Methods: Single-voxel edited ^{1}H-MR spectra and SOR measures were acquired from 19 youth with ASD (17 males; age (mean±SD) 16.0±2.0 years) and 8 typically developing (TD) youth (4 males; age 13.8±2.1 years). MRS GABA levels were measured in the bilateral thalamus with a midline voxel (8750mm^{2}) using a Siemens prototype MEGA-PRESS sequence (TE/TR 68/2000ms; 256 averages). Post-processing in MATLAB (Guo *et al.*, 2018) consisted of spectra phase and frequency correction, difference editing, and frequency-domain peak fitting with a simulated basis-set yielding high accuracy GABA and Glutamate+Glutamine (Glx) concentrations. Child sensory responsivity questionnaires were completed by parents including the Short Sensory Profile (SSP; Dunn, 1999) and the Sensory Over-Responsivity (SenSOR) Inventory (Schoen *et al.*, 2008).

Results: Student's t-tests did not demonstrate significant differences between ASD and TD groups in MRS GABA measurements. Pearson's correlations were used to characterize associations between GABA:Glx ratio and SOR measures where higher scores indicate greater severity of SOR symptoms. In the ASD group, negative correlations were found between GABA:Glx ratio and SOR scores on both the SenSOR and the SSP. (SenSOR Total r=-0.68, p<0.01; SSP Tactile Sensitivity r=-0.71, p<0.01; SSP Auditory/Visual Sensitivity r=-0.79, p<0.001).

Conclusions: These preliminary results relate lower thalamic GABA (inhibitory) to Glutamate (excitatory) ratios to greater severity of SOR symptoms within autism, suggesting that in ASD youth, SOR is associated with a deficit in thalamocortical inhibition. These correlations within the ASD group – despite the lack of significant differences between ASD and TD groups in GABA levels – may reflect the considerable phenotypic and etiologic heterogeneity of ASD. Abnormalities of the thalamic excitatory/inhibitory neurochemical balance could interfere with the role of the thalamus in integrating, relaying, and inhibiting attention to sensory information. Further analyses will correlate these spectroscopic findings with thalamocortical connectivity as measured by resting state fMRI.

336 **247.336** Making Sense of Sensory Sensitivity: New Evidence and a New Framework

ABSTRACT WITHDRAWN

Background: Atypical sensory sensitivity in autism is a puzzle. Its definition and measurement is essentially subjective, and it is unknown how it maps on to behavior: is it linked to perceptual abilities (e.g. local processing) or dysfunction? Similarly, it is unclear how an individual can be both hyper-sensitive and hypo-sensitive. Does it change over time, depend on context, or do hyper- and hypo- refer to different things (e.g. high sensitivity v. low responsivity)? Finally, although increased sensory sensitivity is assumed to reflect increased neurophysiological responses to sensory stimuli we don't know which neural circuits are crucial, including the relative importance of sensory and affective regions.
Objectives: I will present a new framework for exploring these issues which, whilst not directly answering these questions, provides a roadmap for how they can be tackled by future research. Specifically, I will discuss how different facets of sensory sensitivity (subjective, neural, behavioral) can be understood within a signal detection framework and how existing theories fit within this (including ideas from other panel speakers). I shall present unpublished data from psychophysical studies and brain stimulation that explore the idea that individual differences in neural noise contributes to adaptation and hyper-excitability.

Methods: Adaptation (measured in terms of subjective discomfort, or subjective neutrality) to visual stimuli is measured in several paradigms. Variability in TMS phosphene thresholds from visual cortex stimulation is considered (with motor thresholds as a control). These objective measures are regressed again subjective sensory sensitivity and autistic trait measures (with the AQ).

Results: Findings show a relationship between high sensory sensitivity and low adaptation (aversive visual patterns become less aversive through repetition in most people, but this is diminished in people with high sensory sensitivity), and a negative relationship between phosphene thresholds and sensory sensitivity (low phosphine thresholds linked to high sensory sensitivity).

Conclusions: Different accounts of sensory sensitivity are not mutually exclusive and future research needs to bridge the gap between implementational theories (e.g. excitation:inhibition ratio) and those couched in cognitive/computational terms (e.g. predictive coding).

337 **247.337** Acoustic Startle Response in Children with Autism Spectrum Disorder with and without Co-Morbitiy of Attention Deficit Hyperactivity Disorder

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Background: Parents of children with Autism Spectrum Disorder (ASD) and or Attention Deficit Hyperactivity Disorder (ADHD) often report that their children have trouble "tuning out" sensory stimuli. It is estimated that over 96% of children with ASD have difficulties filtering sensory information. Typically, no objective physiological measures of sensory filtering are assessed for those with ASD nor for those with ADHD and clinicians must rely on subjective reports of behaviours and symptoms. Though many symptoms overlap between ASD and ADHD and some estimates of comorbidity are as high as 50%, there is evidence that the underlying causes of these conditions may differ. An objective method for assessing sensory filtering ability is to study the eye-blink component of the startle reflex (SR) in response to unexpected startling sounds. The subject's ability to habituate to these random noises can be quantified and compared to traditional diagnostic tools.
Objectives: This study sought to quantify the differences and similarities in sensory filtering among individuals with ASD, ADHD, both ASD and

ADHD (Dual), and those with neither ASD nor ADHD (Control). A second objective was to compare EMG SR data to current clinical measures of sensory-related behaviours currently.

Methods: Data from 32 participants aged 9-17 years were grouped according to diagnostic status into one of the four groups mentioned above. All individuals were assessed using pencil and paper standardized tests for characteristics of ASD, ADHD as well as the Raven's Progressive Matrices as a measure of non-verbal intelligence. Orbicularis occuli electromyograph (EMG) measurements were recorded during an acoustic startle protocol that included input/output function, and habituation. Baseline EMG SR amplitude, and response latency were compared between groups. Welch's Anova and Games-Howell post-hoc analysis was conducted to determine statistical significance of findings.

Results: Baseline average EMG voltage of participants with ADHD was significantly higher than the baseline voltage for those with ASD or those who were dually diagnosed ($p<0.05$). The ASD group's average amplitude of startle response was significantly higher than Controls and included a period of sensitization. The degree of habituation over the course of the session was not strongly correlated to the subjective reporting measures of ASD nor ADHD symptoms nor did it correlate strongly to age, or IQ. No differences between groups was seen for the latency of the startle response. Latency was not effected by the age of the participant.

Conclusions: The results of this work demonstrate that there are differences between the population of individuals who have ASD with ADHD and those that have ASD without ADHD. The correspondence of the EMG data to subjective measures indicates limitations in relying on third-party subjective assessments for diagnostic purposes. The EMG SR of the groups will inform the validity of animal models of autism currently being used in basic research and further develop the neuroscience models of sensory filtering pathways.

338 **247.338** Changes in Muscle Strength, Static Balance and Dynamic Plantar Pressures in Autism Spectrum Disorder

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Background: Individuals with autism spectrum disorder (ASD) show affected sensorimotor skills that impair postural control and static balance, both necessary components of standing and walking without risk of fall and injury. Muscle strength, body composition and reaction time are known to effect injury risk from falls.

Objectives: To examine the extent of alterations in static balance, gait alterations within individuals with ASD.

Methods: Forty-eight subjects (14.3 ± 4.3 years) participated in this study. Height (62.8 ± 6.1 inches), weight (133.5 ± 50.9 pounds), body mass index (23.0 ± 6.4), fat deposition (25.9 ± 9.8 % body fat), grip strength (11.4 ± 6.4 kg), upper body strength, standing balance and reaction time were measured. Correlations with Childhood Autism Rating Scale (CARS-2) and other incidence reports were also investigated. Plantar forces, pressures and oscillations during walking were also analyzed and compared to a control group of non-ASD subjects.

Results: Compared to normative values, arch index was decreased (pes cavus) in subjects with ASD. Plantar force distribution surface area distribution during walking was significantly different in individuals with ASD. During static balance assessment, center of pressure distances and speed of deviations were significantly greater in subjects with ASD.

Conclusions: Overall, these findings are consistent with clinical observations that abnormalities of movement performance and cognitive performance are an associated feature of ASD in children and young adults. These abnormalities may contribute to the increased rates of injuries that individuals with ASD experience. Implications for intervention to potentially mitigate these deficiencies are discussed.

339 **247.339** Clinical & Genetic Subtypes of Sensory Processing Sensitivities in Autism

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Background:

Sensory processing sensitivities are critical cornerstone for characterising and understanding Autism Spectrum Disorder (ASD). These prevalent symptoms correlate with symptoms severity and cognitive impairments, suggesting shared biological mechanisms. Understanding these mechanisms may shed light not only on sensory processing deficits but also on ASD.

Objectives:

This study characterises extreme cases of high and low sensory sensitivity among subjects and investigate their correlation with mutations in pathways related to ASD.

Methods:

The analysis was done on 420 subjects of the C0733 cohort including 165 with ASD, 210 first-degree relatives & 97 controls. Low- and high-sensitive participants were selected based on the Short Sensory Profile [SSP; Dunn, 1999]. We used GRAVITY (http://gravity.pasteur.fr) for the analysis of all exonic variants.

Results:

Preliminary analysis showed a normal distribution of scores in all groups but with statistically significant differences in variance. The exploration of the GABA and GLUT pathways suggests that likely gene disruptive mutations in GABA have stronger impact on Perceptual Sensibility than GLUT. For Missense mutations, there was no difference between groups.

Conclusions:

These results show how hypo/hyper-sensitivity in ASD may be caused by the higher clinical heterogeneity, with deleterious genetic mutations as one underlying cause.

340 **247.340** Pain Anticipation in High Functioning Autism: Physiological Evidence from a Skin Conductance Study

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Background:
Previous research showed the existence of brain areas dedicated to pain processing in self and others. These areas were demonstrated to respond both to actual pain stimulation and to pain anticipation (i.e. when the painful stimulus approaches participant skin without touching it). A very few studies have investigated pain anticipation patterns in people with High Functioning Autism (HFA), even though hyper/hyporeactivity to sensory input has become one of the key DSM-5 criteria for Autism Spectrum Disorders diagnosis.

Objectives:

The present study was aimed at investigating psychophysiological responses in people with HFA when observing a painful stimulus approaching their or other participants skin.

Methods:

Skin Conductance Responses (SCR) were measured in a group of participants with HFA diagnosis and a control group including participants without any psychiatric or neurological diagnosis. All the HFA participants obtained ADOS - 2 scores above the diagnostic cut-off (Level 1). Moreover, both the HFA and the control group participants filled out the Autism Quotient before taking part in the study, which served as an additional group manipulation check. During the experimental session, participants observed, respectively, a painful (sterilized needle) or a neutral (cotton bad) stimulus that could approach their own hand, the hand of another person or the hand of a robot.

Results:

SCR results showed that – regardless of the experimental condition – in general HFA participants exhibited greater physiological responses than control group participants. Interestingly, we also found that HFA participants showed greater pain anticipation responses when observing the painful stimulus approaching the skin of the human hand. In addition, lower responses in HFA compared to control group participants were observed when the robotic hand was approached by the needle.

Conclusions:

Taken together, our results indicate a substantial physiological hyperactivation in HFA participants when observing a noxious stimulus approaching another human being compared to the control group participants, who exhibited a lower activation pattern. These findings are in line with previous evidence showing that the affective component of empathy would be preserved in HFA and it might at the basis of an overreaction when observing others in pain. These results are expected to shed light on the pain processing patterns in people with HFA and to better clarify how social signals coming from the social world are processed by this population.

341 **247.341** Sleep Problems and Sensory Sensitivities Are Strongly Related in Children with ASD

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Background: Previous research has suggested that sleep problems and sensory processing are associated in both typically developing children and those with Autism Spectrum Disorders (ASD).
Objectives: To examine whether a relationship between sleep and sensory processing is also apparent during early ASD development (below the age of 36 months) and whether longitudinal changes in sleep problems are associated with changes in sensory processing.
Methods: 195 children with ASD (mean age 3.77±1.54 years old, 45 females) were recruited at the Negev Autism Center (www.negevautism.org). All children fulfilled DSM 5 and Autism Diagnostic Observation Schedule (ADOS) criteria for ASD. Parents filled out the Children Sleep Habits Questionnaire (CSHQ), a caregiver questionnaire that quantifies the severity of sleep problems, and the Sensory Profile (SP)**,** a caregiver questionnaire that quantifies sensory processing. In 44 of these cases, both questionnaires were filled out again (after ~1.5 years) by parents during an annual follow-up visit. The relationships between sleep and sensory measures were examined at both time-points.
Results: ASD children exhibited abnormally high rates of sleep disturbances (75% had total sleep disturbance scores >41 on the CSHQ) and sensory processing (52%) in comparison to typical development norms. Total sleep disturbance scores were most strongly associated with sensory sensitivity and avoidance scores in children under 36 months old (avoiding: r=0.56, p<0.001, sensitivity: r=0.59 p<0.001) and in older children with ASD (avoiding: r=0.47 p<0.001, sensitivity: r=0.56 p<0.001). Most importantly, changes in sleep disturbance scores over a period of 1.5 years were positively correlated with changes in sensory sensitivity and avoidance (avoiding r=0.39 p=0.04, sensitivity: r=0.45 p=0.01).
Conclusions: These results demonstrate that ASD children exhibit relatively large sleep and sensory abnormalities, which are strongly associated. This association is apparent not only in cross-sectional assessments, but also when examining longitudinal changes in sleep and sensory measures. We speculate that sleep problems and sensory sensitivities enhance one another in a vicious cycle that is likely to have considerable impact on the family's well-being and on the efficacy of behavioral interventions. Specific targeted interventions for these particular children are currently lacking.

342 **247.342** The Association between Sensory Behaviors and Heart Activity in Preschool Children with Autism Spectrum Disorder and Fragile X Syndrome

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Background:
Fragile X syndrome (FXS), the most common heritable genetic cause of autism spectrum disorder (ASD), is characterized by abnormal social behavior and intellectual disability (ID). Children with FXS or ASD are at risk for physiological dysregulation, atypical sensory processing, and anxiety (Sinclair, et al, 2017). Sensory processing difficulties are linked to anxiety in ASD (Green & Ben-Sasson, 2010; Lane, et al, 2012). Further, children with FXS or ASD often show autonomic dysregulation, resulting in lower respiratory sinus arrhythmia (RSA), which may contribute to increased vulnerability to anxiety (Klusek et al, 2015; Roberts et al, 2012). Dysregulated startle response to an auditory stimulus is one example of

atypical sensory processing (Kohl et al, 2014; Friedman, 2007). Understanding the influence of sensory processing on physiological regulation can provide insight into early risks and features of anxiety in these children.

Objectives: The purposes of this study are to employ a multi-method approach to (1) compare parent-reported sensory behaviors in FXS, ASD, and typically developing (TD) controls, (2) characterize and test group differences in the association between sensory processing difficulties and RSA during an anxiety-provoking task across preschoolers with FXS or ASD, and TD controls.

Methods:

Participants included 29 children with FXS, 26 TD children, and 25 children with non-syndromic ASD between the ages of 3-6 years old. The FXS and ASD groups had ID. The Sensory Experiences Questionnaire total score (SEQ) measured sensory processing. RSA was measured throughout the auditory startle task, which is comprised of the pre-startle (30 seconds), 100 dB, white-noise startle (1 second), and post-startle (30 seconds).

Results: One-way ANOVA results identified significant differences in SEQ scores across ASD, FXS, and TD children ($F(2, 78) = 22.75$, $p < .001$), with ASD highest and FXS next highest. Sensory processing and post-startle RSA were significantly correlated within the entire sample ($r = -.357$, $p = .001$). A moderated regression model showed that sensory processing predicted post-startle RSA, but only in the FXS group ($b = -2.09$, $p < 0.01$). FXS and ASD groups significantly differed on post-startle RSA, holding SEQ scores constant ($b = -4.25$, $p = 0.02$). Results also indicated a significant difference in the effect of SEQ on post-startle RSA between the FXS and ASD groups ($b = 2.09$, $p = 0.01$), in that the predicted effect of sensory difficulties on post-startle RSA is stronger for the FXS group. There was no such difference between FXS and TD groups.

Conclusions:

Consistent with prior work, these findings demonstrate greater sensory processing difficulties in both ASD and FXS groups than the TD group. A significant association between post-startle RSA and sensory behaviors was found only in the FXS group, suggesting that the more atypical sensory behaviors, the lower or more blunted RSA for the FXS group only. Further, the association between RSA and sensory processing differed between the FXS and ASD group, suggesting that these mechanisms are a unique aspect of the FXS phenotype. Future steps include evaluating the relationship between sensory processing, RSA, and anxiety symptoms.

343 **247.343** Thermal Detection Thresholds Are Not Elevated in Children and Adults with Autism Spectrum Disorder

Z. J. Williams[1], *S. L. Davis*[2], *C. D. Okitondo*[3], *L. E. Mash*[4,5], *B. H. Heflin*[6], *A. S. Weitlauf*[7] *and C. J. Cascio*[8], *(1)Medical Scientist Training Program, Vanderbilt University School of Medicine, Nashville, TN, (2)Vanderbilt University Medical Center, Nashville, TN, (3)Psychiatry Department, Vanderbilt University Medical Center, Nashville, TN, (4)Brain Development Imaging Laboratories, Department of Psychology, San Diego State University, San Diego, CA, (5)Joint Doctoral Program in Clinical Psychology, SDSU / UC San Diego, San Diego, CA, (6)Florida International University, Miami, FL, (7)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, Nashville, TN, (8)Vanderbilt University School of Medicine, Nashville, TN*

Background: In recent years, sensory features, including an “apparent indifference to pain/temperature” (American Psychiatric Association, 2013) have been included in the diagnostic criteria for autism spectrum disorder (ASD). However, most evidence of atypical pain/temperature perception in ASD is based on clinical descriptions or parent reports rather than experimental studies (Moore, 2015). The few studies to date examining warm and cold detection thresholds in this population have produced mixed and contradictory results (Cascio et al., 2008; Duerden et al., 2015; Fründt et al., 2017; Yasuda et al., 2016). Nevertheless, all prior studies utilized small sample sizes (≤20 ASD participants), and none explicitly controlled for covariates such as age and IQ when comparing groups.

Objectives: To assess thermal detection thresholds in a large sample of children and adults with ASD, comparing them to typically-developing (TD) controls and adjusting for a number of covariates.

Methods: Participants included 143 individuals with average or above-average intelligence (WASI-II FSIQ > 70): 32 ASD adults (22 males, mean age 28.76 years), 24 TD adults (13 males, mean age 29.0 years), 51 ASD children (41 males, mean age 11.24 years), and 36 TD children (26 males, mean age 10.03 years). In the experimental task, a thermode on the palm increased or decreased in temperature at 1°C per second until the participant indicated a sensation of warmth or cold via mouse click. This procedure was repeated over four alternating blocks of five warm or five cold trials (counterbalanced across participants). Warm and cold detection thresholds were estimated using the Harrell-Davis median (Harrell & Davis, 1982) of threshold temperatures from warm and cold trials, respectively. Participants or caregivers also completed measures of IQ (WASI-II), autistic traits (SRS-2), and sensory reactivity (Sensory Profile). Threshold values were analyzed using proportional odds regression models (Liu et al., 2017), with baseline models including ASD status, age, sex, and counterbalance order as predictors. Additional predictors were added to the model using a best-subset approach based on BIC values.

Results: ASD and TD groups in the full sample and child/adult subsamples were matched on age, sex, and performance IQ ($ps > 0.118$), although verbal IQ was higher in the TD group ($p < 0.001$). Baseline regression models that included ASD status, age, sex, and counterbalance order as predictors failed to find any significant associations with warm or cool detection thresholds in the combined sample or any subgroup ($ps > 0.05$). In the best-subset regression, performance IQ was consistently included in all best-fitting models, with higher performance IQ predicting lower warm thresholds and higher cool thresholds ($ps < 0.025$). Questionnaire measures of autistic traits and sensory reactivity were not found to significantly predict warm or cool thresholds in any model.

Conclusions: Warm and cool detection thresholds did not differ between individuals with ASD and TD controls. Performance IQ was the only consistent predictor of sensory threshold across temperature conditions and age groups. These findings suggest that the “hyposensitivity” to thermal stimuli observed in some individuals with ASD is likely not related to a quantitatively higher sensory threshold.

344 **247.344** Weaker Neural Suppression during Visual Perception in Autism Spectrum Disorder

M. P. Schallmo[1,2], *T. Kolodny*[2], *A. M. Kale*[2], *J. Gerdts*[3], *R. Bernier*[3] *and S. Murray*[2], *(1)Psychiatry and Behavioral Science, University of Minnesota, Minneapolis, MN, (2)Psychology, University of Washington, Seattle, WA, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA*

Background:

It has been proposed that autism spectrum disorder (ASD) is associated with an imbalance of excitation and inhibition. While this is supported by specific animal models of ASD, there is little direct experimental support for this hypothesis from studies in humans.

Objectives:

Using a visual motion paradigm, we tested whether mechanisms that regulate neural activity may be disrupted among individuals with ASD.

Methods:

Within the visual system, a powerful suppressive regulatory effect occurs in neurons when a stimulus is presented that is larger than that neuron's classical receptive field – information from the surround suppresses the neural response to the stimulus in the center. We used a well-known behavioral paradigm that reflects this spatial suppression by measuring the amount of time required to perceive the motion direction of stimuli at various sizes. In addition, we used fMRI to measure neural suppression in the motion sensitive brain area called human MT complex (hMT+). We further tested the mechanism of this suppression by measuring levels of the inhibitory neurotransmitter GABA in the hMT+ region using MR spectroscopy. Participants included 28 young adults with ASD (10 male, 8 female) with diagnoses confirmed through ADOS, ADI and clinical judgment using DSM-5 criteria, as well as 35 age-, gender-, and IQ- matched neurotypical controls (21 male, 14 female).

Results:

In both the behavioral and fMRI measurements, we found strong evidence of reduced suppression among young adults with ASD compared to neurotypical controls (Supplemental Figures 1 & 2). However, MR spectroscopy measurements in the region of hMT+ showed no difference in GABA levels between ASD and control groups.

Conclusions:

Our results suggest that differences in suppressive regulatory mechanisms in ASD reflect changes in neural activity, but are not driven by a specific difference in GABA concentration.

Panel Session
Adult Outcome: Medical, Cognitive, Behavioral, Social, Adaptive, Vocational
249 - Autism, Sexuality and Romance: From a Better Understanding to Attuned Support
1:30 PM - 3:30 PM - Room: 516ABC

Panel Chair: Jeroen Dewinter, *GGzE, Eindhoven, Netherlands, GGzE, Eindhoven, Netherlands*

Discussant: Laura Graham Holmes, *Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA*

Our insight in autism, sexuality and relationships has improved over the last four decades, yet questions remain relating to themes that impact the daily lives of autistic adolescents and adults. The presentations in this panel focus on directions for future research on autism, sexuality and relationship, and highlight recent findings relating to these priorities. In the first presentation, a research agenda on autism, sexuality and romantic relationships developed with researchers, autism advocates, and stakeholders at INSAR 2018 and additional groups of autistic adults is presented and discussed. The second speaker discusses sexuality in autistic women. Data from an online survey on sexuality in autistic women compared to autistic men and women in the general population, revealed a lower desire for sex, notwithstanding higher levels of experience and more negative sexual experiences. The third presentation offers insight in on how autistic individuals experience the role of sensory processing in dating and sexuality. Our last speaker discusses the experiences and needs of professionals in working with autistic adults presenting with gender identity questions. This study revealed the need for knowledge on gender issues in professionals working with autistic people in order to provide them with attuned support.

1:30 **249.001** Autism, Sexuality and Relationships: Defining Themes and Priorities for Future Research Based on a Participatory Approach.

J. Dewinter[1,2], *L. Graham Holmes*[3] *and A. I. van der Miesen*[4], *(1)GGzE, Eindhoven, Netherlands, (2)Tilburg School of Social and Behavioral Sciences - Tranzo, Scientific Centre for Care and Welfare, Tilburg University, Tilburg, Netherlands, (3)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (4)Child- and Adolescent Psychiatry, VU University Medical Center, Amsterdam, Netherlands*

Background:

In 2018, a special interest group (SIG) was initialized at INSAR 2018 to discuss research priorities resulting in the development of a research agenda relating to autism, sexuality and romantic relationships.

Objectives:

To explore research priorities relating to sexuality and romantic relationships in and together with autistic people, in order to develop a research agenda that contributes to the well-being of autistic adolescents and adults.

Methods:

The nominal group technique (NGT), reliable to define healthcare priorities, was applied in eight groups (n=65, 31 self-identified as autistic). Five of these groups were mixed groups consisting of researchers, autism advocates, clinicians and students (n=39, group range n=5-10, all professionals or students, 5 autistic). In order to warrant the input of autistic adolescents and adults, three additional groups were organized; two in collaboration with a Dutch LGBT$^+$-group (Lesbian, gay, bisexual, trans and inclusive to all other groups) for autistic people (n= 20, group range n= 8-12) and one with a self-organization (Persons on the Autism Spectrum; PAS) for autistic adults (n=6). Themes were grouped based on thematic analysis. All participants selected 5 themes they found having the highest priority. Priorities were calculated and compared over all groups and in autistic participants.

Results:

Three general themes emerged, overarching 17 thematic clusters, based on 222 topics collected during the group meetings. The first, '*Getting a better understanding*', included questions relating to sexual development across lifespan, sexuality and intellectual disability, cultural differences, experiences and needs in autistic LGBT+'s, sexual identity development, gender differences, relationship characteristics and experiences, pregnancy and parenthood, healthcare, sensory issues, well-being, and the influence of medication use. Second, '*Improving support and treatment*' included the need for evidence on ways to support and promote sexual well-being and healthy romantic relationships, preventing

offending and victimization, improve healthcare experiences and needs, and involving and supporting families, partners and professionals. Finally, '*Changing societal views and practices by a participatory approach*' referred to the need for a participatory approach in research and ways to influence societal views on autistic people, their sexuality and romantic relationships. Using the priority scores as indicated by all participants, ways to support romantic relationships (1), sexual well-being (2) and getting a better insight in sexual development across lifespan got the highest priority scores (3). The autistic participants ranked insight in lifespan issues higher than education and support.

Conclusions:

This research agenda relating to autism, sexuality and romantic relationships can guide the design of future research in this field. Highest priorities are promoting and supporting sexual well-being and positive relationship experiences and prevent victimization. Therefore, increasing our insight in sexual development across lifespan, with attention to the influence of autistic information processing characteristics in relationship experiences and types, and in sexual identity development and the needs of autistic LBGT+'s is needed. Gaining knowledge should benefit and support autistic people directly, and indirectly by influencing societal views and stereotypic ideas on autism, sexuality and romance. A participatory approach could guarantee that research is valuable to the daily lives of autistic people.

1:55 **249.002** Characterizing the Sexuality and Sexual Experiences of Autistic Women

M. A. Stokes[1], *L. Pecora*[2] *and G. Mesibov*[3], *(1)Deakin University, Burwood, Australia, (2)School of Psychology, Deakin University, Burwood, VIC, Australia, (3)University of North Carolina at Chapel Hill, Chapel Hill, NC*

Background: There is limited understanding of the sexuality and sexual experiences of autistic women. While preliminary insights have been drawn from few anecdotal and qualitative reports, findings have begun to identify a profile marked by increased sexual risks and vulnerabilities. These initial observations require further exploration via quantitative means.

Objectives: This study aimed to expand upon initial understandings of the sexuality of autistic women to examine the prevalence and nature of sexual functioning and experiences for individuals in this group.

Methods: A total of 459 autistic (*N*=232) and typically developing (*N*=227) adults completed the SBS-III online. Self-reported levels of sexual interests, behaviours, and negative experiences of 135 autistic women (*M*=26.2 years, *SD*=8.7) were compared between autistic males (*N*= 96 [*M*=24.2 years, *SD*=7.4]) and TD females (*N*=161 [*M*=22.0 years, *SD*=4.6]).

Results: Despite reporting less interest in sex ($p<.05$), compared to autistic males, proportionally more autistic females reported having had sexual experiences ($p<.05$). Autistic females also reported more instances of negative sexual experiences, including the engagement in sexual behaviours that were later regretted ($p<.001$), unwanted ($p<.001$), or being the victim of unwanted sexual advances by others ($p<.001$) than male counterparts. Age trends were also observed, where reported instances of negative sexual experiences increased with age in the TD group, yet decreased in the autistic sample from 41 years.

Conclusions: Results indicate that due to a mismatch between low levels of sexual interest, yet increased engagement in sexual behaviours, autistic women are at greater risk of being subject to negative sexual experiences including victimisation and abuse. These results highlight the need for further research to identify the factors leading to these increased vulnerabilities. Additionally, these findings affirm the growing need to deploy gender specific programs that educate and support autistic women to reduce these risks and facilitate a healthy sexual life.

2:20 **249.003** Sensory Processing and Autistic Experiences of Sex and Relationships

A. V. Kirby[1], *L. Graham Holmes*[2] *and S. Gray*[3], *(1)University of Utah College of Health, Salt Lake City, UT, (2)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (3)Life Skills Clinic, University of Utah, Salt Lake City, UT*

Background:

Autistic individuals often process sensory information differently than neurotypical people. Dunn's Model of Sensory Processing is commonly used to understand sensory processing and outlines four main types of processing differences including sensory sensitivity, sensory avoiding, low registration, and sensation seeking. Sensory processing plays a critical role in many life roles and activities, including sexuality and dating. However, prior research on sexuality and relationships for autistic people has focused on social communication aspects, with limited research and understanding about the effects of sensory processing. This study addressed this gap by considering both positive and negative effects of sensory processing on sexuality, and how autistic people address these experiences.

Objectives:

To understand autistic sexuality and relationship experiences as related to sensory processing.

Methods:

Two methodological approaches were used to address the research objective. First was qualitative analysis of publicly-available narratives from autistic adults including books by autistic authors, quotes attributed to other autistic adults in those books, movies, and online forums. Second was qualitative analysis of open-ended responses from 59 autistic adults on an online survey about sexuality and relationship experiences. Text segments related to sensory experiences and sexual activity or romantic experiences were retained for analysis. Qualitative thematic analyses included deductive theoretical coding using Dunn's Model of Sensory Processing. Inductive coding was also used to generate additional themes from the text data. Multiple approaches were used to strengthen trustworthiness of the analyses and results including investigator triangulation, data triangulation, an audit trail, and researcher reflexivity.

Results:

Identified narratives written by self-identified autistic adults revealed that some perceive sensory processing as influencing their experiences of sexuality and romantic relationships. Some of the experiences were described as beneficial or positive, while many others were uncomfortable or negative. All four of Dunn's sensory patterns were observed in the narratives, with sensory avoiding being the most frequently identified pattern. Individuals described a variety of ways of addressing negative experiences including avoiding physical contact or dating, increased communication with partners, and various adaptations. Some individuals indicated that intense or overwhelming sensory experiences decreased or altered their desire, ability, or willingness to participate in partnered sexual activity or other relationship-related activities (e.g., going on dates in traditional noisy or crowded settings, cohabitating). On the other hand, some participants discussed positive sensory experiences as a benefit

of being autistic.

Conclusions:

Sexuality and relationships provide opportunities for connection and fulfillment, and are important factors in adult health and well-being. The results of this study suggest that sensory processing plays an important role in these experiences for many autistic adults. Some of these experiences are positive—warranting no intervention. Other sensory experiences may be limiting individuals' desired relationships—warranting support. Understanding autistic experiences of sexuality and relationships can inform self-advocacy, education, resources, and/or services to support autistic people in the pursuit of healthy and fulfilling sexual experiences and romantic relationships.

2:45 **249.004** Clinicians' Perspectives on the Co-Occurrence of Gender Dysphoria and Autism Spectrum Disorder: A Pilot Study

***A. I. van der Miesen**, Child- and Adolescent Psychiatry, VU University Medical Center, Amsterdam, Netherlands*

Background: The co-occurrence of gender dysphoria (GD) and autism spectrum disorder (ASD) is an area of inquiry by researchers with the vast majority of publications reporting an increase in (symptoms of) ASD in individuals diagnosed with (symptoms of) GD and vice versa. All clinicians may therefore encounter individuals with the sometimes challenging co-occurrence of ASD and gender identity questions. But how comfortable are these clinicians in assessing and/or working with individuals with both GD and neurodiversity and what is their approach?
Objectives: This pilot study assesses experiences, perspectives and needs of clinicians working with neurodiverse and gender diverse individuals.

Methods: A questionnaire with both multiple choice as well as open ended questions was used to assess the views of clinicians working with individuals with (symptoms of) GD and ASD on their feelings of competence, their ideas and hypotheses on the co-occurrence, the topics they consider important to discuss during assessment, and their professional needs in improving their approaches. This pilot study included 44 mental health professionals working with different age-groups.

Results: While none of the participants worked in a specialized gender identity service, all had at least some experience with assessment of individuals with (symptoms of) GD and 95.5% had at least some experience with individuals with ASD. A total of 72.7% had experience with assessment of individuals with ASD for (symptoms of) GD. A total of 22.7% of clinicians would discuss similar topics with neurotypical as well as with neurodiverse individuals. But there were also clinicians (22.7%) who had no idea which topics they should discuss with neurodiverse individuals. Others mentioned that they would take specific aspects of autism during the counseling into account such as rigid thinking, problems with abstract thinking, and the difficulties during social transition and treatment. Some clinicians were able to mention hypotheses about why neurodiversity and gender diversity could co-occur, but others had no idea. Of the clinicians, 51.2% considered themselves competent to talk about gender/GD with neurodiverse individuals because of experience and specific education. A total of 23.3% felt incompetent and 25.6% felt as well competent and incompetent.

Conclusions: Being an expert in the separate fields of neurodiversity or gender diversity alone doesn't seem to be enough for clinicians to feel competent in working with neurodiverse and gender diverse individuals, especially with regard to scientific background and clinical approach. Clinicians assessing and treating neurodiverse and gender diverse individuals stated that they want to broaden their knowledge of the current state of literature and the different views that exist on co-occurring GD-ASD. Being well-equipped with these scientific findings would enable the clinicians to adapt their clinical guidance on a case to case basis, thereby improving the assessment and care for neurodiverse and gender diverse individuals. In the present talk, specific implication for clinical practice will be discussed.

Panel Session
Biomarkers (molecular, phenotypic, neurophysiological, etc)
250 - Human and Animal Models: Impact of High-Risk Copy Number Variants on Brain Structure, Functional Connectivity, and Sexual Development.
1:30 PM - 3:30 PM - Room: 517C

Panel Chair: Ana Silva, *Neurosciences & Mental Health Research Institute, Cardiff University, Cardiff, United Kingdom*

An increased burden of rare copy number variants (CNVs), structural variations of the genome, has been associated with neurodevelopmental and psychiatric disorders, including intellectual disability, autism spectrum disorders and schizophrenia. Given their relatively high penetrance, a significant impact on brain structure and function is anticipated but studies within brain structure are still relatively scarce. This panel of senior and early-career researchers brings together exciting multidisciplinary evidence on the impact of some of these rare variants using different imaging modalities (MRI, rs-fMRI, DTI, TEM) and functional measures in both human and animals. Results on the effects of 1q21.1, 15q11.2, and other rare CNVs on brain structure using big data from large collaborative efforts will be presented. Next, we will focus on mirror effects associated with 16p11.2 and 22q11.2 in functional connectivity (FC) and how these deletion-FC-signatures are specifically enriched in a large idiopathic autism sample. Next, mirror effects of 16p11.2 CNVs on sexual development will be explored by looking at 16p11.2 CNV carriers, patient cells, and animal models. Finally, using a novel Cyfip1 haploinsufficiency rat line, we will address how this gene in 15q11.2 BP1-BP2 affects white matter microstructure, which starts to unravel the cellular mechanisms contributing to 15q11.2 associated phenotypes.

1:30 **250.001** Enigma-CNV: Unraveling the Effects on Brain Structure of Rare Copy Number Variants Involved in Autism and Other Neurodevelopmental Diseases

***I. E. Sønderby**[1], D. van der Meer[2], S. Djurovic[3], I. Agartz[4], L. T. Westlye[3], S. Jacquemont[5], P. M. Thompson[6], O. A. Andreassen[7] and .. for the ENIGMA-CNV working group[8], (1)CoE NORMENT, University of Oslo, Oslo, Norway, (2)Oslo University, Oslo, Norway, (3)NORMENT, Oslo, Norway, (4)Dep of Psychiatric Reseach, Diakonhjemmet Hospital, Oslo, Norway, (5)CHU Sainte Justine, University of Montreal, Montreal, QC, Canada, (6)Stevens Neuroimaging & Informatics Institute, University of Southern California, Los Angeles, CA, (7)NORMENT, KG Jebsen Centre for Psychosis Research, Institute of Clinical Medicine,, University og Oslo, Oslo, Norway, (8)UCLA, Oslo, CA*

Background: Many recurrent copy number variants (CNVs) dispose to autism, including the 16p11.2 proximal and distal CNV, 1q21.1, 15q11.2 and 16p13.11 CNV. Although many CNVs are highly penetrant, their low frequency makes them challenging to study. ENIGMA-CNV is an international

effort launched to create the statistical power to identify the effect of CNVs on brain MRI measures. The study currently includes n~17,000 participants with CNVs and structural brain data. The 1q21.1 CNV predisposes to e.g. delayed development, autism and schizophrenia. Deletion carriers display microcephaly and duplications carriers macrocephaly. Frequency of the deletion in UK biobank: 0.027 %.
Objectives: Our aim is to identify the effect of CNVs on brain MRI measures.

Methods: Structural T1-MRI data from ENIGMA-CNV and the UK biobank were analyzed (FreeSurfer) and CNVs called (PennCNV). Subcortical volumes, cortical area and thickness were normalized correcting for age, age squared, gender, scanner and intracranial volume (ICV). Dose response (deletion = 1, non-carrier = 2, duplication = 3) was analyzed in a linear model on the normalized brain values.

Results: We found a positive dose-response effect of copy number on intracranial volume (β=1.52, P=1.4E-26) and total surface area (β=0.81, P = 1.5E-08) with the highest effect on the frontal lobe and a small, significant negative dose response on caudate and hippocampus (β=-0.44, P=0.0026; β -0.5, P=0.00064) (deletion=30, non-carriers=24,575, duplications=19). In addition, in the largest analysis to date on 15q11.2 (119 deletions, 154 duplications, 37,871 non-carriers), we showed a positive dose response for cortical surface area (β=0.19, P=2.9E-3) and a negative dose response for average cortical thickness (β=-0.25, P=1.3E-4).

Conclusions: The mechanism behind the head circumference change in 1q21.1 distal CNV carriers seems to be an increase in cortical surface area which may indicate an effect on early development of the (dorsal) telencephalon. Together with other results both from ENIGMA-CNV and others, this indicates that each recurrent CNV has its own specific brain structural signature independent of its phenotypic outcome. These results underline the value of large-scale collaboration such as ENIGMA-CNV for studies of rare genetic variants implicated in autism and brain pathology.

All contributors to ENIGMA-CNV working group can be found at: http://enigma.ini.usc.edu/ongoing/enigma-cnv/enigma-cnv-co-authors/.

1:55 **250.002** Mirror Effects of 4 Neurodevelopmental CNVs on General Functional Connectivity and Implications for Idiopathic Autism

C. Moreau[1,2], *S. Urchs*[2,3], *C. Shramm*[1,4], *A. Lin*[5], *L. Kushan*[5], *A. C. Evans*[3], *C. Bearden*[5], *P. L. Bellec*[2] *and S. Jacquemont*[1,6], *(1)CHU Sainte Justine, University of Montreal, Montreal, QC, Canada, (2)Centre de Recherche de l'Institut Universitaire de Gériatrie de Montréal, Montreal, QC, Canada, (3)Montreal Neurological Institute, McGill University, Montreal, QC, Canada, (4)Lady Davis Institute for Medical Research, Jewish General Hospital, Montreal, QC, Canada, (5)University of California, Los Angeles, CA, (6)Service of Medical Genetics, CHUV, Lausanne, Switzerland*

Background: Copy number variants (CNVs) at the 16p11.2 and 22q11.2 loci are among the most frequent risk factors for autism and schizophrenia. Almost nothing is known, however, on the alterations of functional connectivity (FC) associated with these genomic variants. fMRI studies of ASD (Autism Spectrum Disorder) have resulted in heterogeneous findings yet there is a paucity of research into homogeneous groups of individuals that share the same genetic ASD risk factors.
Objectives: Our aims are : 1) To characterize the functional impact on brain connectivity of 4 CNVs at the 16p11.2 and 22q11.2 loci. 2) To investigate whether these CNV-associated patterns are observed in a heterogeneous group of idiopathic autism at a level consistent with the risk conferred by each genetic variant. 3) To explore the similarity of spatial patterns of FC alterations associated with each CNV.

Methods: To this mean, we have analyzed rs-fMRI data from n=105 deletion and duplication carriers and 128 controls from the Simons VIP dataset and UCLA. We then correlated the pattern of connectivity of each CNV to patterns observed in n= 276 autism and n=290 control subjects from the ABIDE dataset. fMRI data were preprocessed with NIAK pipeline and FC was estimated as the pairwise correlation between the average time series of 64 brain regions. A linear model was fitted to each connection with genetic status, subject motion, sex and site as explanatory factors. The effect of the 4 genetic groups were then tested by post-hoc contrasts. Each contrast was controlled for false discovery rate (FDR) across all connections at q < 5%. The 16p11.2 and 22q11.2 connectivity patterns were compared to the autism cohort using spatial correlation of the individual connectome with the CNV derived pattern of connectivity alterations.

Results: The 16pDel is associated with an overall increase in connectivity while the 22qDel is associated with an overall decrease in connectivity compared to control. An enrichment of their individual profiles is reported in an idiopathic ASD sample in 4 seed regions (Putamen, Thalamus, perigenual anterior Cingulate, and dorsomedial Prefrontal Cortex). Finally, a functional covariance pattern between 16pDel and 22qDel is observed in the Fronto-parietal, Limbic, and Anterior DMN networks.

Conclusions: Deletions and reciprocal duplications are associated with a mirror effect at the global and individual connection level for both the 16p11.2 and 22q11.2 CNV loci. In addition, FC alterations exhibit opposing relationships for DEL (and DUP) carriers at both loci: 16p11.2 DEL is characterized by overall over-connectivity while the reverse is true for 22q11.2 DEL carriers. Striato-striatal and striato-cortical over-connectivity in the DEL carriers is consistent with previous reports of aberrant functional connectivity in ASD. Despite the opposing pattern of FC alteration exhibited by DEL carriers of each locus, we find an enrichment of both in an idiopathic autism sample. This is likely conferred by the similar relative distribution of FC alterations (convergence of covariance connectivity patterns between 16p11.2 and 22q11.2 deletions).

2:20 **250.003** Using Rare Variants, Animal Models and Mendelian Randomization to Pinpoint Causative Genes

A. Reymond, *Center for Integrative Genomics, University of Lausanne, Lausanne, Switzerland*

Background: Although accumulating evidence suggests that rare CNVs are a common health problem in the population, their phenotype spectrum have largely only been investigated in clinical (often pediatric) patients.
Objectives: Our aim is to pinpoint causative genes within the 16p11.2 region influencing sexual development in general population.

Methods: We combined data from a comprehensive set of clinically ascertained 16p11.2 families (n=660 affected individuals) with unselected adult population cohorts (>470,000 individuals recruited to the UK and EGCUT biobanks) to assess adult phenotypes.

Results: We uncovered that the 16p11.2 BP4-BP5 dosage, one of the most frequent genetic causes of mental disorders, was oppositely associated with age at menarche (AaM) in the UK Biobank ($p=7.8e^{-05}$; ANOVA, corrected for BMI and birth year). Compared to controls AaM was decreased in deletion (Δ=-1.5 years, p=0.01) and increased in duplication carriers (Δ=+1.5; $p=7.8x10^{-5}$). We replicated these associations in EGCUT ($p=2.4e^{-05}$) and in two unrelated cohorts of 16p11.2 clinical patients ($p=7.7e^{-05}$; $p=3e^{-03}$). We observed a directionally consistent trend for pubertal onset in male 16p11.2 CNV carriers. These features were accompanied by various diagnoses related to function of reproductive organs and fertility, with up to half of deletion and two-third of duplication female carriers presenting at least one diagnosis related to hormonal problems or function of genital organs. We validated the human results by detecting changes in timing of first ovulation, estrous cyclicity and uterine size in females and reduced

anogenital distance in males 16p11.2 mice. Corroboratively, genes differentially-expressed in 16p11.2 patients cells and mice model cortices were enriched for urogenital disease genes. We unraveled a negative correlation between the 16p11.2 dosage and hypothalamus volume both in human (p_{FWE}<0.05) and mice ($p<1x10^{-04}$), suggesting that perturbation of the gonadotropin-releasing hormone (GnRH) axis could contribute to the observed phenotypes. Whereas Mendelian Randomization (MR) suggested *INO80E* and *KCTD13* as potential causal genes for AaM, an agnostic modulation of all 16p11.2 genes dosage in *gnrh3:egfp* transgenic zebrafish larvae pinpointed to *ASPHD1* a gene specifically expressed in brain and pituitary gland. Pairwise interaction experiments in zebrafish revealed epistasis between the *ASPHD1* "driver" and the *INO80E* and *KCTD13* “modifiers”.

Conclusions: Our findings highlight how identification of traits associated with rare variants, such as CNVs, in the general population provides valuable unbiased insight into disease etiologies. Our data also demonstrate how rare variants combined with MR can be utilized to pinpoint causal genes within GWAS loci as the common SNPs within the 16p11.2 interval were previously associated with AaM.

2:45 **250.004** Impact of Cyfip1 Haploinsufficiency on White Matter Microstructure in a Rat Model

***A. I. Silva**, J. E. Haddon, Y. A. Syed, D. E. Linden, M. J. Owen, J. Hall and L. S. Wilkinson, Neurosciences & Mental Health Research Institute, Cardiff University, Cardiff, United Kingdom*

Background: The 15q11.2 BP1-BP2 deletion has been associated with learning and motor delays, autism and schizophrenia. This region includes a gene that codes for the cytoplasmic FMRP interacting protein 1 (*CYFIP1*). *CYFIP1* haploinsufficiency is considered to be a likely significant contributor to the 15q11.2 BP1-BP2 deletion psychiatric phenotype due to its known involvement in a number of key brain plasticity-related functions. *CYFIP1* gene plays a crucial role in actin remodeling, where dysregulations could result in changes in white matter microstructure by influencing axonal density, organisation, and myelination.

Objectives: Our aim is to identify possible cellular changes underlying white matter effects at 15q11.2 BP1-BP2 region.

Methods: We used a novel CRISPR/Cas9-engineered hemizygous-null *Cyfip1* (*Cyfip1*$^{+/-}$) rat line. All the rats used in this experiments were males and 6-8 months old. Diffusion tensor imaging (DTI) data were collected in a cohort of 24 rats (wild-type (WT) n=12, *Cyfip1*$^{+/-}$ n=12) and analyzed using Tract-Based Spatial Statistics (TBSS) available in FSL. To investigate the cellular nature of the DTI changes we used transmission electron microscopy (TEM) to measure the number of myelinated and unmyelinated axons, the axon diameter, and the myelin thickness and g-ratio (myelin thickness relative to axon diameter) of each myelinated axon. The experiment used a new cohort of rats (WT n=5, *Cyfip1*$^{+/-}$ n=4). We then quantified the number of oligodendrocytes lineage and mature cells using immunofluorescence technique, where sections were stained for Olig2 and Cc1 proteins. This experiment used rats taken randomly from the same group of rats providing the DTI data (WT n=7 and *Cyfip1*$^{+/-}$ n=7). Linear mixed effects (LME) models were used to analyze the effect of genotype on axon diameter, g-ratio and myelin thickness, considering variation across animals, whereas a two-tailed unpaired t-test was used to compare the number of axons and number of oligodendrocytes between groups.

Results: A main finding of DTI were significant decreases in fractional anisotropy (FA) in the *Cyfip1*$^{+/-}$ rats that were most pronounced in the corpus callosum and external capsule. TEM showed that decreased FA was associated with thinning of the myelin sheath in the corpus callosum (LME: $X^2(1)=14.63$, $p<0.001$), where no differences were found in the number of unmyelinated ($t=0.39$, $df=5.15$, $p=0.71$) and myelinated ($t=-0.63$, $df=5.72$, $p=0.55$) axons, or in the diameter of the axons (LME: $X^2(1)=0.05$, $p=0.83$). Immunofluorescence showed a reduction in the number of mature oligodendrocytes ($t=2.48$, $df=11.99$, $p<0.05$) in the corpus callosum of the *Cyfip1*$^{+/-}$ rats.

Conclusions: Altogether, our study suggest that haploinsufficiency in the *Cyfip1* gene results in changes in white matter microstructure associated with thinning of the myelin sheath. The reduction in oligodendrocyte cells suggests that this might be caused by an insufficient supply of myelinating oligodendrocytes. Insufficient myelination can result in impaired cognitive processing, which can lead to deficits in tasks of higher cognitive demand and contribute to the cognitive deficits seen in 15q11.2 BP1-BP2 deletion carriers.

Panel Session
Diagnostic, Behavioral, Sensory and Intellectual Screening and Assessment
251 - Clinical Presentation of ASD and Access to Care Among Girls
1:30 PM - 3:30 PM - Room: 517B

Panel Chair: Allison Ratto, *Children's National Health System, Washington, DC*

Discussant: Sharon daVanport, *Autistic Women & Nonbinary Network, Lincoln, NE*

There is a rapidly expanding field of research showing that ASD may manifest differently across the sexes, particularly among individuals with intact core language and intellectual abilities. Girls may have important socio-communicative strengths that “camouflage” their challenges and deficits related to ASD, which in turn places them at risk for under-diagnosis, delays in diagnosis, and reduced access to treatment. Although there is a growing sense among both researchers and self-advocates that autism may be camouflaged in girls, there is not yet a clearly established set of diagnostic differences by sex, necessitating further research in this area. The presentations in this panel will focus on differences by sex among autistic youth in performance on standard diagnostic tools used in research in and clinical practice for identifying ASD and co-occurring conditions, as well as associated disparities in access to care. Sex differences in both core domains of ASD and related areas of emotional-behavioral functioning will be explored. Data from the National Survey on Children’s Health will also examine disparities in psychotropic medication prescription rates as possibly related to differences in clinical conceptualization of co-occurring conditions.

1:30 **251.001** Sex Differences in Youth with ASD: Language Phenotype and Relation to Autism Behaviors from the ACE Gendaar Network

***S. J. Webb**[1], A. Kresse[2], V. Y. Kang[3], E. Neuhaus[4], S. Corrigan[2] and R. Bernier[1], (1)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (2)Seattle Children's Research Institute, Seattle, WA, (3)Special Education, University of Illinois at Chicago, Chicago, IL, (4)Seattle Children's Hospital, Seattle, WA*

Background:
The GENDAAR study is a multisite collaboration focused on understanding sex-based differences in youth with ASD using multimodal behavioral measures, neuroimaging, and genetics. This analysis specifically focuses on sex-based language differences in youth with ASD and neurotypical development, and the relation to autism behaviors (as reported by parents or observed by clinicians). In this abstract, we focus on the Word Class Expressive (WC-E) domain of the Clinical Evaluation of Language Fundamentals (CELF), in which the participants explain why words go together; this task involves both word knowledge and social/cultural-understanding of similarities between words.

Objectives:

To understand sex differences in language ability in verbal youth with ASD and how these sex based differences in language ability impact assessment of autism symptoms.

Methods:

8- 18-year-old individuals participated at four sites as part of the ACE GENDAAR Network. This analysis included 157 youth with ASD (71 female) and 158 youth with neurotypical development (NT; 80 female). All individuals with ASD met criteria on the ADOS, ADI, and DSM and had Verbal IQ > 70. Participants with NT had no family history or concerns about ASD and had scores £ 11 on the SCQ and £ 60 on the SRS. Language was assessed using the DAS II (Word Definitions, Verbal Similarities) and the CELF-5 subdomains. Analyses used ANOVA and regression to investigate effects of participant sex and diagnosis on language skills; and the contribution of language ability to observed and reported autism behaviors.

Results:

On all standard language measures, the NT group had higher scores than the ASD group (ps<.05). There were no sex differences within the ASD group on the DAS Word Definitions or Verbal Similarities; but there were sex differences on the CELF, with ASD females demonstrating better language skills than ASD males (Total Score; Recalling Sentences; Formulating Sentences; WC-E; Word Definitions; ps<.05). In the ASD group, WC-E was predicted by the sex (t=1.96) but not age, autism symptoms, executive functioning (EF) or parental education. Within the ASD group, parent report of autism behaviors (via SCQ) was predicted by sex (t=-1.7), with additional variability explained (FD=5.0) by language WC-E scores (t=-2.5), EF (t=2.5), and parental education (t=-3.9). In contrast, observed autism severity (ADOS calibrated severity score) was predicted by sex (t=-2.7) with no additional contribution from language and other variables (FD=.84).

Conclusions:

In this preliminary analysis, female youth with ASD had better verbal skills than males with ASD but only on the CELF, suggesting that even when "similar" language domains are being assessed, subtle differences in the measures may identify different sex related functioning within ASD (and may account for previous inconsistencies in sex-based findings in ASD). Sex and language were related to parent report of autism behaviors but not clinician observation of autism severity. Additional analyses will explore sex differences in other aspects of language and probe why differences were observed on the CELF but not the DAS; discussion will focus on implications for identifying sex-based differences in other autism samples.

1:55 **251.002** Social Strengths of Autistic Girls: Sex Differences in Clinician-Rated and Parent-Reported Autistic Traits

A. B. Ratto[1], *C. E. Pugliese*[1], *L. Kenworthy*[1], *S. J. Webb*[2], *R. Bernier*[2] *and K. A. Pelphrey*[3], *(1)Children's National Health System, Washington, DC, (2)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (3)University of Virginia, Charlottesville, VA*

Background: Females are diagnosed with autism spectrum disorder (ASD) at significantly lower rates than males, with particularly discrepant rates among those without co-occurring intellectual disability (ID; Loomes et al., 2017). A growing body of research indicates that females with ASD without co-occurring ID may have important social strengths that "camouflage" autistic traits, making the condition harder to capture (Lai et al., 2016). We have previously found sex differences in parent-reported autistic traits among school-age children with ASD, but not on gold-standard diagnostic measures (Ratto et al., 2017).
Objectives: The aim of the present study was to further investigate sex differences in autistic traits among school-aged children on a clinician-rated and parent-report to extend prior findings.

Methods: The sample was composed of participants ages 8-18 years enrolled in the Gender Exploration of Neurogenetics and Development to Advance Autism Research (GENDAAR) study. From a total sample of 523 participants, a subsample of 196 children (n=85 female) were identified who had been administered the Module 3 of the Autism Diagnostic Observation Schedule-2 (ADOS-2) and had a clinician-confirmed diagnosis of ASD. There were no significant differences by sex in age [$t(194)= -.22$, $p=.83$] or full-scale IQ [$t(194)= -1.11$, $p=.27$]. Independent samples t-tests and chi-square analyses were used to evaluate sex differences in ADOS-2 performance, as well as parent report on the Social Responsiveness Scale (SRS) and the Vineland Adaptive Behavior Scales-II. Chi-square analyses were used to examine differences on select items on the ADOS-2, which prior literature suggested may be strengths for girls with ASD. Social items included Conversation, Facial Expressions, Empathy, Social Insight, Imaginative Play, and repetitive items included Stereotyped Language, Restricted Interests, and Compulsive Behaviors.

Results: Overall, girls were significantly less likely to meet criteria on the ADOS-2 [$X^2(1, N=196)= 4.80$, $p=.03$], though there were no significant sex differences in total scores on the diagnostic algorithm. Socially, girls showed better conversation skills [$X^2(2, N=196)= 5.85$, $p=.05$], empathy [$X^2(2, N=196)= 18.00$, $p<.0001$], and imaginative play than males [$X^2(3, N=196)= 14.63$, $p=.002$], but no differences in facial expressions or social insight. With respect to repetitive features, girls showed fewer compulsive behaviors [$X^2(2, N=196)= 7.19$, $p=.03$], but no differences in stereotyped language or restricted interests. Parents of girls reported greater communication [$t(179)= -3.01$, $p=.003$] and social [$t(180)= -2.10$, $p=.04$] skills on the Vineland-II, though not on the SRS. All results retained significance after controlling for multiple comparisons using the Benajmini-Hochberg procedure.

Conclusions: Although there is a growing literature indicating that non-intellectually disabled girls with ASD may show more subtle autistic traits, most prior studies have not identified differences in performance on gold-standard diagnostic measures. The sample used in this study was specifically recruited to be sex-balanced and thus better able to assess possible sex differences. Girls in this study showed important social strengths in both clinician and parent ratings, as well as reduced compulsive behavior. Despite comparable average algorithm scores, girls were less likely to meet ADOS criteria, suggesting that an adjusted cut-off score may need to be explored in future studies.

2:20 **251.003** Gender and Psychiatric Symptoms Among Youth with ASD and ADHD

A. Verbalis[1], *A. C. Armour*[1], *G. L. Wallace*[2], *E. Sadikova*[1] *and L. Kenworthy*[1], *(1)Children's National Health System, Washington, DC, (2)The George*

Washington University, Washington, DC

Background: Gender-related differences have been studied in ADHD for many years (e.g., as early as Gaub & Carlson, 1997), but inquiries in autism spectrum disorders (ASD) are relatively new (Bargiele, 2016). An important line of research is investigation into gender differences within and between developmental disabilities. This current study, using a large clinical sample of youth with diagnoses of ASD or ADHD, investigates potential gender-related differences in emotional and behavioral symptoms.
Objectives: To examine potential gender and diagnosis driven differences on the Child Behavior Checklist (CBCL).

Methods: 945 parents of youth with developmental disability diagnoses (440 with ASD and 505 with ASD) reported on their child's emotional and behavioral functioning using the CBCL. Youth age 6-18 with IQ > 50 were included in the analyses. Altogether there were 690 males and 255 females in the study. The diagnostic groups did not differ in age or IQ. A mixed-model ANOVA was used to investigate internalizing and externalizing symptoms (CBCL t-scores) across gender and diagnostic group, with post-hoc analyses following.

Results: The ANOVA revealed a main effect for diagnosis group ($F(1,941)=8.238$, $p=.004$), with ASD children exhibiting overall higher symptoms then ADHD children. Further, an interaction was identified between CBCL domain and diagnosis group ($F(1,941)=5.587$,$p=.020$), as the ASD children exhibit greater internalizing problems then ADHD children (post-hoc T-test: $t(943)=4.455$, $p<.001$), but similar levels of externalizing problems (post-hoc T-test: $t(943)=0.559$, p=ns. Additionally, this interaction was further driven by gender (ANOVA 3-way interaction $F(1,941)=4.066$, $p=.040$), with ASD girls being higher than ASD boys on externalizing problems specifically (post-hoc T-test: $t(438)=-1.984$, $p=.04$), but no differences between ASD boys and girls on internalizing problems, nor differences between ADHD boys and ADHD girls on internalizing or externalizing problems (p-values all = ns).

Conclusions: In a large sample of youth clinically diagnosed with ASD or ADHD, differences were observed with the parents of ASD children reporting higher overall symptoms then parents of ADHD children. This was primarily caused by higher levels of reported internalizing problems, rather then externalizing problems. However, within diagnostic groups, gender differences were noticed in the ASD children, but not the ADHD children, specifically for externalizing problems. It is important to note that these findings are based on standardized scores that have been normed according to both age and gender, suggesting that while ADHD children follow these norms more closely, the ASD children may exhibit discrepancies from these norms. These findings are in line with a growing literature of notable gender-related differences and risks within developmental disabilities, particularly ASD. It is also possible that the findings of this study might be driven by the fact that ASD girls who get referred for evaluations have increased overt symptoms. Studies in both ADHD and ASD have identified under-referral of girls for diagnostic evaluations. Finally, the finding of increased internalizing symptoms in ASD as compared to ADHD, without any effect of gender, is notable for potentially increased anxiety and depression specific to the autistic condition beyond developmental disability status.

2:45 **251.004** Evidence for Undertreatment of ADHD in Girls with ASD in the National Survey of Children's Health

***K. A. Register-Brown**, A. B. Ratto, S. I. Habayeb and L. Kenworthy, Children's National Health System, Washington, DC*

Background: Numerous studies have established that pharmacological treatment of ADHD is more effective than behavioral intervention alone for ADHD symptom improvement, although effect sizes are typically lower in children with autism spectrum disorders. Untreated ADHD has been associated with worse long-term outcomes in a wide range of functional domains. **Objectives:** To elucidate national patterns in ADHD medication use among girls and boys with and without autism in the US. **Methods:** The 2016 National Survey of Children's Health (NSCH), conducted by the US Census Bureau from June 2016 to February 2017, provides state-level and nationally representative data of parent report on the health and wellbeing of noninstitutionalized children aged 0-17 with and without special healthcare needs. The 2016 NSCH surveyed the parents/caregivers of 50,212 children in all 50 states and the District of Columbia. Data were adjusted and weighted by the survey team to create state and nationally representative samples of noninstitutionalized children aged 0-17. The overall weighted response rate was 40.7%. Weights were adjusted to account for nonresponse, and a nonresponse bias analysis is available on the survey website. In the current study, chi-square and logistic regression analyses were performed examining rates of ADHD diagnosis and medication use among children with and without ASD. SPSS Version 25 Complex Samples Module with subpopulation routine was use to estimate variance per the study documentation. **Results:** For boys, unweighted N=917 for current ASD and 430 for current ASD+ADHD; for girls, unweighted N=214 for current ASD and 91 for current ASD+ADHD. ASD children were age 3-17 (mean age 10.04). Race/ethnicity distribution was 53.3% white, 24.1% Hispanic, 14.4% black, and 8.2% "other." There was not a significant difference by gender of ADHD diagnosis among children with ASD (OR 0.575, 95%CI 0.327-1.010, 51.2% of ASD boys and 37.6% of ASD girls); girls who currently had both ASD and ADHD diagnoses had lower odds of currently using medication for ADHD (OR 0.318, 95% CI 0.149-0.677, 69.1% of ASD+ADHD boys and 41.5% of ASD+ADHD girls) compared to boys. Non-ASD girls had lower odds of ADHD diagnosis (OR 0.439, 95% CI .381-0.507) versus boys; there was not a significant difference by gender of medication use among children with ADHD but not ASD (OR 1.156, 95% CI 0.868-1.539). In logistic regression, the odds ratio for ASD girls' ADHD medication use remained at 0.311 (95% CI 0.128-0.757, $p<0.01$) even after controlling for race/ethnicity, household income, service use (current mental health therapy [$p<0.05$] and special education services), and parent rating of ADHD severity and three ADHD behaviors (finishing tasks, doing all homework, and staying in control when challenged [$p<0.05$]). **Conclusions:** This nationally representative dataset indicates that girls with both ASD and ADHD are being undertreated for ADHD. The one-third of ASD girls with ADHD diagnoses therefore might have improved long term outcomes in academic and occupational achievement, antisocial behavior, unsafe driving, drug/alcohol use, obesity, services use, and self-esteem, social functioning if their ADHD were treated in accordance with practice guidelines.

Panel Session
Interventions - Non-pharmacologic - Infant, Toddler, and Preschool
252 - Lessons Learnt from the Field-Testing of the W.H.O. Caregiver Skills Training
1:30 PM - 3:30 PM - Room: 518

Panel Chair: Erica Salomone, *Department of Psychology, University of Turin, Turin, Italy*

A growing body of evidence, mostly from high-income, research-based settings, supports caregiver-mediated interventions for autism; however, these are rarely available to families. To reduce the treatment gap, the World Health Organization with international partners and Autism Speaks, developed the Caregiver Skills Training (CST) programme for families of children with developmental disorders/delays, which aims to meet affordability and feasibility criteria of low-resource settings. In this panel we present emerging evidence on the implementation of CST across the globe. We first present a global update on the field-testing initiative, highlighting adaptation processes, challenges and lessons learnt from 29 sites. The second presentation reports on the pre-piloting of CST in the low-income context of Ethiopia, exploring perspectives of participating caregivers, facilitators and supervisors through thematic analysis. The third presentation describes findings from the pre-pilot implementation in Kenya, a middle-income country, through quantitative and qualitative methods. The final presentation will report from the adaptation of CST in a high-income country, Canada, using a Community of Practice, a social participative approach to assess barriers and change in practice. In the panel discussion we aim to critically reflect on these findings, to inform the adaptation, implementation and evaluation of scalable caregiver-mediated interventions in real-life settings.

1:30 **252.001** International Field-Test of the Who Caregiver Skills Training for Families of Children with Developmental Disorders or Delays

E. Salomone[1,2], *L. Pacione*[2,3], *T. WHO CST Team*[2] *and C. Servili*[2], *(1)Department of Psychology, University of Turin, Turin, Italy, (2)Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland, (3)Department of Psychiatry, Division of Child and Youth Mental Health, University of Toronto, Toronto, ON, Canada*

Background: Despite evidence of significant gains to children and families from parent-mediated early interventions, open-access programs deliverable by non-specialists in low-resource settings are not currently available. To reduce the treatment gap, as part of the mhGAP initiative, WHO, with support from Autism Speaks developed through systematic literature reviews and expert consultation a novel Caregiver Skills Training (CST) program. The CST aims to meet feasibility criteria for implementation in low-resource settings. Its core psycho-education strategies, informed by principles of behavior analysis, developmental science, social-communication interventions, positive parenting and self-care, aim to be cross-culturally valid and acceptable.

Objectives: to compile data on field-testing of WHO CST in a variety of settings and regions

Methods: The CST suite of materials (intervention manuals, adaptation and capacity building tools; Monitoring & Evaluation (M&E) Framework) was made available for field-testing. Sites involved in field-testing (N=29) are located in all world regions: African (n=4), Americas (n=9), Eastern Mediterranean (n=5), European (n=4), South-East Asia (n=2), and Western Pacific Region (n=5). Participating sites progress through four Phases outlined in the M&E framework: 1) Planning and Adaptation (21% of sites); 2) Training of Trainers (ToT) and Post-ToT practice (38%); 3) Pre-pilot field-testing (17%); 4) Pilot testing (24%). Sites representatives completed an online survey including multiple choice and open-ended questions regarding: a) adaptation processes; b) project implementation characteristics; c) challenges and lessons learnt from field-testing.

Results: Program materials have been translated into 18 languages. The majority of sites (n=26) reported adapting the program to the local context, mostly with minor measures: of these, 76% were adaptations of content (e.g. language use, idioms), 17% adaptations to improve feasibility (e.g. childcare) and 7% adaptations of processes (e.g. frequency of group sessions). Major adaptations include: adaptation of the delivery method (technology application; 1 site) and of program contents for participants with low literacy (e.g., simplification of participant booklets, adding additional psychoeducation; 2 sites). Reported frequency of sessions (planned or actual) was generally weekly (72%). Sites reported planned or actual implementation in a variety of settings, often in combination: public health settings (76%), community centers (41%), public or NGO education settings/schools (48%), university/faith-based setting/private (14%). Target diagnostic groups were in most cases autism (83%), developmental delay/intellectual disability (75%) and other neurodevelopmental disorders or concerns. Reported challenges from Phases 1-2 include: difficulties in securing funding and collaboration with stakeholders; need to devise sustainable intervention fidelity support strategies; challenges in selecting site-specific useful and validated outcome measures. Most endorsed challenges from Phases 3-4 include: selection criteria for master trainers and facilitators (clinical experience, motivation); good acceptability but feasibility issues for home visits and videorecording (safety, travel, lack of time); lack of childcare as a barrier to attendance.

Conclusions: Survey data from participating sites indicate good progress on global field-testing of WHO CST. Lessons learnt from the M&E phases are progressively compiled and inform support strategies to field-testing sites. Feasibility, acceptability and effectiveness data are being collected and will inform revision and preparation of the WHO CST programme materials and tools for wider release and dissemination.

1:55 **252.002** Pre-Testing the Who Caregiver Skills Training Programme for Implementation in Urban and Rural Ethiopia

R. A. Hoekstra[1], *B. T. Gebru*[1], *F. G. Bayouh*[2], *M. Kinfe*[2], *R. Abdulrahman*[3], *T. Zerihun Kebede*[4], *M. Tesfaye*[4], *T. WHO CST Team*[5], *E. Salomone*[6], *L. Pacione*[7], *C. Servili*[5] *and C. Hanlon*[8], *(1)Department of Psychology, King's College London, London, United Kingdom, (2)Department of Psychiatry, School of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia, (3)Department of Psychiatry, Yekatit 12 Hospital Medical College, Addis Ababa, Ethiopia, (4)Department of Psychiatry, St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, (5)Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland, (6)Department of Psychology, University of Turin, Turin, Italy, (7)Department of Psychiatry, Division of Child and Youth Mental Health, University of Toronto, Toronto, ON, Canada, (8)Addis Ababa University and King's College London, Addis Ababa, Ethiopia*

Background: The World Health Organization (WHO)'s Caregiver Skills Training Programme (CST) aims to teach caregivers of children with developmental disorders (DD) strategies to help them support their child's development and learning. The programme, delivered over nine group sessions and three home visits, is developed to suit low-resource settings. We recently adapted the programme for implementation in Ethiopia (Tekola et al., 2018), characterised by limited autism awareness, high levels of stigma and a severe lack of service provision (Tekola et al., 2016; Tilahun et al., 2016).

Objectives: Pre-test the adapted CST programme in an urban clinical setting and a rural community setting, and explore the perspectives of participating caregivers, CST facilitators and supervisors.

Methods: The programme was pre-tested in: i) one group (n=10) in Addis Ababa, delivered by a specialist CST facilitator; ii) two groups (n=20) in rural Butajira, delivered by non-specialist facilitators under supervision of two specialists. Feasibility and acceptability data were collected, including enrolment and attendance rates and programme fidelity ratings. In-depth interviews were conducted with participating caregivers (n=9 in both settings), CST facilitators (n=3 in Addis Ababa, n=2 in Butajira), and CST observers (n=2 in Addis Ababa); a focus group discussion was held with six trainee facilitators in Butajira. Qualitative data were analysed using thematic analysis.

Results: Both pre-pilots had excellent participation (100% in both locations) and retention rates (90% in Addis Ababa, 100% in Butajira). Participating families completed at least 7/9 group sessions and all home visits. All essential CST training elements were fully or mostly completed. The competencies of the specialist facilitator as rated using the ENACT scale (Kohrt et al., 2015) were higher than those of non-specialist facilitators. Four themes were developed from the qualitative data: 1) Programme acceptability and relevance: Caregivers indicated the programme was highly relevant to their needs. CST facilitators and observers commented on the eagerness of caregivers to attend the training, reflected in high attendance rates and in caregivers arriving at sessions on time. 2) Perceived programme benefits: Caregivers described how the programme helped promote their child's communication and self-help skills and in managing their child's challenging behaviours. Caregivers also indicated the programme improved their own wellbeing and helped them to manage their stress. 3) Challenges and barriers: Caregivers raised that travel and finding childcare were barriers to attending sessions. Facilitators highlighted the long preparation time needed to deliver the group sessions well, especially the role play demonstration activities. Another challenge was the variation in caregivers' level of understanding and education and making sure the caregivers with little education understood all strategies and tips presented in the CST. 4) Suggested revisions: Some suggestions were offered to simplify the materials, including simpler Amharic translations for some key terms and simplifying the role play activities.

Conclusions: The CST programme is highly acceptable to Ethiopian caregivers. It is feasible to deliver the programme in both urban and rural settings. Before the programme can be fully implemented in low-resource settings, further research needs to determine what constitutes 'good enough' fidelity for non-specialist CST facilitators.

2:20 **252.003** The Acceptability, Feasibility and Preliminary Evaluation of the Who Caregiver Skill Training Programme in Rural and Urban Kenya

A. Abubakar[1], *E. Mwangome*[1], *M. Mwangi*[1], *S. Onyango*[1], *P. Kitsao-Wekulo*[2], *T. WHO CST Team*[3], *C. Servili*[3] *and C. Newton*[4], *(1)Neurosciences Department, Kemri -Wellcome Trust Research Programme, Kilify, Kenya, (2)African Population Health Research Centre, Nairobi, Kenya, (3)Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland, (4)Kenya Medical Research Institute, Kilifi, KENYA*

Background: The global burden of mental and neurological conditions is increasing and affects more than 10% of the children in the world. In Africa, improved childhood survival has led to increasing numbers of children with neurodisability due to exposure to multiple risk factors including neonatal insult. Despite the significant burden of neurodisability in Africa there are few specialized therapists or services to support children with disabilities and their families.

Objectives: To investigate the feasibility and acceptability of the WHO's caregiver skill training programme to improve behaviour, communication and quality of life of children with disabilities and their families.

Methods: A sequential mixed methods study where qualitative work advised quantitative work was carried out in two sites, Kilifi and Nairobi. In the first stage focus group discussion and in-depth interviews were carried out with key informants and parents of children with disability. In the second stage, 105 children living with a disability and their families were involved in a pilot randomized control trial (RCT) to evaluate the World Health Organization (WHO) Carent Skill Training (CST). While the third phase, some of the parents taking part in the CST programme provided feedback on their experience.

Results: In the first phase of the study both key informants and parents reported that the CST addresses an important need for the parents of children with disability, although there were concerns about its applicability for parents who were illiterate, given the heavy dependency on written materials. A pre-pilot study indicated that even parents with low literacy levels could adequately follow CST. In the pilot RCT, a significant proportion of the parents attended most of the sessions, rates and the preliminary analysis indicated a decrease in behavioural problem scores and depressive symptoms scores for children and families that participated in CST. In the post CST, parents articulated their satisfaction with the programme, however, the salient challenges mentioned by the caregivers mentioned with the program were focused around attendance; for example, problems finding an alternative caregiver to look after their child while they attended training sessions or lack of family support or conflicts with employers. The key challenge with CST, was the requirement for higher skilled staff than originally anticipated.

Conclusions: Our pilot study, indicates that it is feasible and acceptable to implement the CST in both rural and urban settings in Kenya. A full scale RCT is needed to establish efficacy.

2:45 **252.004** Facilitators and Barriers to Implementation of Manualized Interventions in Community Based Settings

M. Elsabbagh[1], *A. Ibrahim*[2], *A. Yusuf*[3] *and T. WHO CST Team*[4], *(1)McGill University, Montreal, PQ, Canada, (2)McGill University, Montreal, QC, Canada, (3)Psychiatry, McGill University, Montreal, QC, Canada, (4)Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland*

Background: The Caregiver Skills Training (CST) Program aims to provide evidence-based skills training for caregivers of children with autism in community settings. The program was developed by the World Health Organization using a systematic approach engaging stakeholders globally in the design and now field testing and scaling up the program, including community organizations, government, advocates, and researchers in over 30 countries.

Objectives: In the Canadian adaptation of the CST Program, we focused on measuring facilitators and barriers of implementation within community settings. We formed a Community of Practice (CoP), a dynamic social participative approach to learning and discovery previously used in health research. The CoP brought together professionals involved in early intervention.

Methods: Professionals in public sector and community health and educational services involving children with autism (n=15) participated in Community of Practice over a one year period. At baseline, the participants received 35 hours of training on the intervention model and self-rated their confidence in implementation of the intervention in their own setting: (a) continue to train towards fidelity, (b) use the intervention and/or specific strategies in routine practice, or (c) coach others in the same setting. Three follow up sessions were completed with the CoP to assess change in practice and to discuss facilitators and barriers to implementation.

Results: By the end of the follow up period, only one professional had continued to train to fidelity and none of the professionals had implemented the intervention. Qualitative analysis of CoP sessions was conducted to ascertain barriers to implementation. Reported barriers

include limited time to attain fidelity, limited time available with each family to deliver the full intervention, inconsistency in some of the intervention characteristics relative to the target setting, and limited support from management in adopting the new intervention. However, participants reported indirect influence of intervention strategies including improved understanding and capture of "shared engagement" and "play" and increased consolidation of routine strategies reinforced in the intervention.

Conclusions: Despite intention to do so, professionals who trained on a manualized intervention did not exhibit a direct change in practice as a result of the training. In contrast, indirect influence on practice was reported, yielding more general and positive improvements in practice as reported by professionals.

Panel Session
Rare Genetic Disorders
253 - Multi-Site, Direct Comparison of Three Autism Synaptopathies
1:30 PM - 3:30 PM - Room: 524

Panel Chair: Joseph Buxbaum, *Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY*

Discussant: Mustafa Sahin, *Boston Children's Hospital/Harvard Medical School, Boston, MA*

Many of the genes implicated in autism spectrum disorder (ASD) converge on common molecular pathways, particularly those relevant to protein synthesis that contributes to synaptic function. The mTOR pathway is one such example. In this panel, we examine three genetic disorders of the mTOR pathway, all of which have high penetrance of ASD: Tuberous Sclerosis Complex (TSC1 and TSC2 genes), PTEN Hamartoma Tumor Syndrome (PTEN gene), and Phelan-McDermid Syndrome (SHANK3 gene). We will provide a bench-to-bedside perspective on these disorders, with talks describing the molecular and cellular analyses of these disorders using patient-derived stem cells, structural findings on MRI, electrophysiological findings on EEG, and phenotypical characterization. Overall, data from this combination of genetic syndromes provides an opportunity to understand the relationship between genetics, pathological molecular mechanisms, structural and functional findings that provide opportunities for biomarker development, and behavioral symptomatology across these three biologically related but distinct disorders.

1:30 **253.001** Molecular and Cellular Analyses across Three Autism-Associated Genetic Disorders

J. Buxbaum[1], *C. Eng*[2], *A. Kolevzon*[3] *and M. Sahin*[4], *(1)Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (2)Genomic Medicine, Cleveland Clinic, Cleveland, OH, (3)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (4)Boston Children's Hospital/Harvard Medical School, Boston, MA*

Background: The Developmental Synaptopathies Consortium (DSC) is studying three rare genetic disorders associated with high risk for autism, specifically Phelan-McDermid Syndrome (PMS), Tuberous sclerosis complex (TSC), and PTEN-hamartoma tumor syndrome (PHTS). Each of these disorders are being studied extensively using biomarkers and clinical assessments, while, in parallel, molecular analyses are being carried out on patient derived samples, in the context of ongoing preclinical research.
Objectives: The purpose of this study was to map out genotype–phenotype correlations, to collect and characterize patient-derived stem cells, to look for genetic modifier loci, and to analyze gene expression data from blood samples and correlate this with phenotypes.

Methods: The study samples comprised 98 participants in the PMS group, 98 with TSC, and 67 with PHTS. Mean age was 8.74 years (SD = 4.74) with no group differences observed. Blood and skin samples were collected where feasible, and induced pluripotent stem cells were derived. Whole exome sequencing and RNAseq in blood samples were carried out in a subset of cases and family controls. Protein lysates from peripheral leucocytes collected from PHTS patients were subjected to Western blotting with antibodies against the signaling proteins of the PTEN-mTOR pathway.

Results: Induced stem cells were derived from over 30 participants. Gene expression analyses in PMS-derived neurons indicate that specific pathways are dysregulated in these human neurons in vitro. Some of these findings suggest potential therapeutic approaches to PMS. Similar studies in TSC and PHTS are ongoing. The greatest genetic variation across the 3 disorders is found in PMS, were point mutations and deletions can contribute to the phenotype. We demonstrate that there is a strong overlap of phenotypes observed with point mutations as compared to deletions; however, the severity of the phenotype is typically greater in the presence of a deletion. For example, language abnormalities are more profound in the presence of a deletion, compared to a point mutation. RNAseq in over 70 blood samples identifies significantly dysregulated genes in cases versus controls. Interestingly, the dysregulation correlates with the severity of the phenotype, as measured by the Aberrant Behavioral Checklist, and particularly the lethargy/social withdrawal subscale. No genetic modifiers were identified to date, although we have identified individuals with more than one deleterious likely pathogenic change. Western blotting was performed for 54 PHTS subjects, which demonstrate altered expression of PTEN-mTOR signaling molecules.

Conclusions: In the first iteration of the DSC, we have made significant advances in relating preclinical research to clinical findings. We have an extensive repository of patient-derived stem cells for ongoing and future studies, and we continue to expand our sample that undergo RNAseq and Western blotting. While still quite preliminary, we will present how some of these first findings suggest pathways that might be therapeutic drug targets in these rare genetic disorders.

1:55 **253.002** Evaluating the EEG Power Spectrum across Three Neurogenetic Disorders of the mTOR Pathway

A. R. Levin[1], *E. Berry-Kravis*[2], *C. Eng*[3], *L. E. Ethridge*[4], *J. Foss-Feig*[5], *A. Y. Hardan*[6], *D. S. Karhson*[6], *A. Kolevzon*[5], *M. E. Modi*[1], *M. W. Mosconi*[7], *C. A. Nelson*[8], *C. M. Powell*[9], *V. Punia*[10], *P. M. Siper*[5], *A. Thaliath*[11] *and M. Sahin*[12], *(1)Neurology, Boston Children's Hospital, Boston, MA, (2)Pediatrics, Neurological Sciences, & Biochemistry, Rush University Medical Center, Chicago, IL, (3)Genomic Medicine, Cleveland Clinic, Cleveland, OH, (4)Pediatrics, University of Oklahoma Health Science Center, Norman, OK, (5)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (6)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, (7)Clinical Child Psychology Program, Schiefelbusch Institute for Life Span Studies, University of Kansas, Lawrence, KS, (8)Boston Children's Hospital, Boston, MA, (9)Neurobiology, UAB School of Medicine, Birmingham, AL, (10)Cleveland Clinic, Cleveland, OH, (11)Rush University Medical Center, Chicago, IL,*

(12)Boston Children's Hospital/Harvard Medical School, Boston, MA

Background: Neural networks act as a bridge between genotype and phenotype, thus offering clues about how basic biology translates to behaviorally-defined disorders such as autism spectrum disorder (ASD). Electroencephalography (EEG) serves as an index of the synchronous activity of large populations of neurons, and is therefore an ideal tool for measuring the activity of neural networks. Several genetic disorders of the mammalian target of rapamycin (mTOR) pathway confer significantly increased risk of ASD, despite differences in their exact function on the mTOR pathway: Examples include tuberous sclerosis complex (TSC), Phelan-McDermid Syndrome (PMS), and PTEN Hamartoma Tumor Syndrome (PHTS).

Objectives: We evaluate the EEG power spectrum among children with each of these genetic disorders, compared to typically developing controls.

Methods: As part of the ongoing multisite Developmental Synaptopathies Consortium, EEG data are being acquired at baseline (i.e., without a time-locked task) across 6 sites on children and adolescents with TSC (n=11), PMS (n=32), PHTS (n=8), and age-matched typically developing controls (n=23). We used the Batch EEG Automated Processing Platform (BEAPP) to standardized EEG processing across sites. Within BEAPP, preprocessing occurred via the Harvard Automated Preprocessing Pipeline (HAPPE), which was developed specifically for preprocessing of EEG in children with neurodevelopmental disorders. To standardize data length for each participant, 180 seconds of useable data (after processing) were randomly selected for further analysis. Because limited data were previously available on the EEG power spectrum in these disorders, we began by calculating mean power across all electrodes in the 10-20 electrode system. Normalized spectral power was calculated in each frequency band, and we used a Mann-Whitney U test (threshold $p<.05$), corrected for multiple comparisons, to compare power in each group to typically developing controls.

Results: Children with TSC show reduced gamma power, children with PMS show reduced alpha power, and children with PHTS show no significant differences in power compared to typically developing controls (Figure 1). There were no significant differences in EEG power across sites in any frequency band.

Conclusions: Although all of these mTOR pathway disorders increase the risk for ASD, each disorder shows a different pattern of EEG spectral power as compared to controls. This may help to explain the heterogeneity of EEG power findings among children with ASD who are not stratified by genotype. Further studies probing the mechanisms underlying these spectral power differences may offer helpful insights into the biology underlying ASD.

2:20 **253.003** Computational MRI Analysis of Cerebellar Circuitry across Three Different Genetic Forms of Autism and Intellectual Disability

S. Srivastava[1], *A. Prohl*[2], *B. Scherrer*[2], *S. K. Warfield*[2], *A. Kolevzon*[3], *C. Eng*[4], *D. A. Krueger*[5] *and M. Sahin*[6], *(1)Boston Children's Hospital, Boston, MA, (2)Computational Radiology Laboratory, Department of Radiology, Boston Children's Hospital, Boston, MA, (3)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (4)Genomic Medicine, Cleveland Clinic, Cleveland, OH, (5)Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (6)Boston Children's Hospital/Harvard Medical School, Boston, MA*

Background:

The genetic landscape of autism spectrum disorder (ASD) and intellectual disabiity (ID) is expanding to include a wide number of single-gene disorders, leading to increased efforts to study ASD and ID through the lens of specific genetic causes. The basis for this approach is that seemingly unrelated genetic disorders associated with ASD and ID may converge on final common pathways. Therefore, better understanding of mechanistic commonalities among distinct causes may shed light on the pathogenesis of ASD and ID, opening the door to potential targeted treatments.

Phelan-McDermid syndrome (PMS), PTEN hamartoma tumor syndrome (PHTS), and Tuberous sclerosis complex (TSC) are three examples of genetic disorders associated with a high prevalence of ASD and ID, with evidence for cerebellar dysfunction in all three. In PMS, cerebellar vermal hypoplasia is commonly reported as a finding on MRI. In PHTS, Purkinje cell-specific knockout of *Pten*leads to autistic-like traits in mice. In TSC, there is overactivity of the mechanistic target of rapamycin (mTOR) pathway leading to Purkinje cell degeneration in the cerebellum.

Objectives:

In order to investigate whether defects in cerebellar circuits may be one of the final common pathways disrupted in ASD and ID, we performed computational volumetric analysis on brain MRIs of individuals with PMS, PHTS, and TSC, focusing on cerebellar regions of interest.

Methods:

Participants were part of the Developmental Synaptopathies Consortium, a multi-site, natural history study of PMS, PHTS, and TSC, collecting neurocognitive data as well as MRI brain data. We used an automated approach based on the PSTAPLE algorithm to carry out automatic MRI segmentation and generate relative volumes (structure volume divided by intracranial contents volume) of the following cerebellar structures: right/left cerebellar white matter, right/left cerebellar cortex, vermal lobules I-V, vermal lobules VI-VII, vermal lobules VIII-X. For each of the three syndromes, we compared relative volumes to different cognitive/adaptive measures depending on age/functioning of the participants using linear regression.

Results:

In this preliminary interim analysis, there were n=11 individuals with PMS (6 females, 5 males, mean age 9.24 [+/-5.29] years); n=15 individuals with PHTS (6 females, 9 males, mean age 9.42 [+/-5.77] years); and n=6 individuals with TSC (3 females, 3 males, mean age 9.49 [+/-1.93] years) who were part of the analysis.

For the PMS group, there was a trend for increasing Vineland Adaptive Behavior Scales (VABS) composite score with increasing relative volume of cerebellar vermal lobules I-V ($p=0.074$) and cerebellar vermal lobules VI-VII ($p=0.068$). For the PHTS group, there was a trend for increasing Stanford Binet-5 full scale IQ with increasing relative volume of left cerebellum white matter ($p=0.095$). For the TSC group, with increasing VABS composite score there was increasing relative volume of the cerebellar vermal lobules VI-VII ($p=0.029$).

Conclusions:

Based on volumetric analysis, the cerebellum may be affected in three different genetic causes of ASD and ID, warranting further investigation into cerebellar circuitry defects in the pathogenesis of ASD/ID.

2:45 **253.004** Initial Phenotypic Characterization across Three Developmental Synaptopathies

L. Soorya[1], *C. Farmer*[2], *E. V. Ocampo*[1], *A. Wainer*[1], *A. Snow*[3], *D. A. Pearson*[4], *P. M. Siper*[5], *A. Kolevzon*[5], *J. Buxbaum*[6], *C. Eng*[7], *E. Berry-Kravis*[8], *C. M. Powell*[9], *J. A. Bernstein*[10], *D. A. Krueger*[11], *M. Sahin*[3] *and A. Thurm*[2], *(1)Department of Psychiatry, Rush University Medical Center, Chicago, IL, (2)National Institute of Mental Health, Bethesda, MD, (3)Boston Children's Hospital/Harvard Medical School, Boston, MA, (4)McGovern Medical School, Univ. TX Health Sci Cntr-Houston, Houston, TX, (5)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (6)Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (7)Genomic Medicine, Cleveland Clinic, Cleveland, OH, (8)Pediatrics, Neurological Sciences, & Biochemistry, Rush University Medical Center, Chicago, IL, (9)Neurobiology, UAB School of Medicine, Birmingham, AL, (10)Pediatrics, Stanford University, Stanford, CA, (11)Cincinnati Children's Hospital Medical Center, Cincinnati, OH*

Background: Pathways involved in synaptic function play a critical role in conditions associated with intellectual disability and autism spectrum disorder (ASD) such as Tuberous Sclerosis Complex (TSC), PTEN hamartoma tumor syndrome (PHTS), and Phelan-McDermid Syndrome (PMS). Defining observable phenotypes within and across related developmental synaptopathies is a fundamental level of analysis to understanding the relationship between underlying genetic causes and behavioral/cognitive expressions in these syndromic conditions.
Objectives: We analyzed baseline data from DSC to characterize and compare patterns of intellectual disability (ID), autism, and behavioral/psychiatric symptoms in TSC, PHTS, and PMS.

Methods: A comprehensive battery was collected at baseline for children ages 3-18 with TSC (n=98), PHTS (n=67), and PMS (n=98). This battery included measures of IQ, adaptive behavior, problem behaviors, mood and psychiatric symptoms, and ASD symptoms. Adaptations to this assessment battery were necessary to facilitate the evaluation of ID, ASD, and behavioral symptoms in these samples and will be detailed in the presentation. Initial results are presented from one-way ANOVAs with Bonferroni's corrections were conducted to analyze group differences on IQ, Vineland Adaptive Behavior Scale-II (VABS-II) Adaptive Behavior Composite (ABC) and domain standard scores standard scores , the ADOS2 Calibrated Severity Score (CSS), Repetitive Behavior Scale-Revised (RBS-R) Total Score, and Child Behavior Checklist 6-18 (CBCL/6-18) Internalizing and Externalizing T-scores.

Results**:** Mean chronological age of 8.74 years (SD=4.74) did not differ across the samples. Intellectual disability (ID) appeared as a characteristic phenotype in all three developmental synaptopathies. In the context of wide within-group variability, significant group differences were found on FSIQ ($F_{(2, 237)}$=93.9, p<.0001) and VABS-II ABC ($F_{(2, 207)}$=14.4, p<.001), such that PHTS>TSC>PMS, corresponding to the following levels of ID: PHTS (Borderline), TSC (Mild to Moderate), and PMS (Severe to Profound). Initial analyses suggesting group differences on ADOS2 CSS require correction for IQ and cohort effects. RBS-R total scores did not differ across groups ($F_{(2, 211)}$=1.9, p=.156). Across groups, mean CBCL scores were in the non-clinical range or cusp of the borderline clinical range. Post-hoc analyses pointed to significantly lower CBCL/6-18 internalizing symptoms in PMS vs. TSC (p=.013) (omnibus $F_{(2, 112)}$=4.8, p=.010) though no differences were found on VABS-II internalizing scale. Higher externalizing problem behavior levels were reported in TSC vs. PHTS on both the CBCL/6-18 (p=.001) (omnibus $F_{(2, 211)}$=6.9, p=.001) and VABS-II (p=.031) (omnibus $F_{(2, 199)}$=4.4, p=.014).

Conclusions: Initial results suggest diverse ID, ASD, and behavioral phenotypes across PTEN, PMS, & TSC, as well as considerable within syndrome variability. Interpretation of findings requires further study given that many of measures were not validated on individuals with moderate to severe ID (e.g., CBCL/6-18). Additional analyses related to within-disorder variability and genotype-phenotype correlations will be presented. In addition, the effect of IQ/ID on autism and behavior profiles and potential age-cohort effects are of interest given evidence that individuals now diagnosed with genetic conditions associated with ASD and ID may not be as severe as those previously identified.

Panel Session
Technological Approaches
254 - Improving Access and Expanding the Reach of Clinical Care and Research in Autism Spectrum Disorder (ASD) through Innovations in Remote Delivery Methods
1:30 PM - 3:30 PM - Room: 517A

Panel Chair: Elizabeth Berry-Kravis, *Pediatrics, Neurological Sciences, & Biochemistry, Rush University Medical Center, Chicago, IL*

Discussant: Shafali Jeste, *University of California, Los Angeles, Los Angeles, CA*

Research and clinical care for non-syndromic and syndromic ASD have been hampered by limitations in access of families to research and medical centers. Intervention programs require creativity and flexibility in design and implementation to maximize scalability. In this symposium, we present four innovative models of remote clinical care and/or intervention delivery for children with autism and related neurodevelopmental disorders (NDDs). We begin with a presentation by Drs. Connie Kasari and Stephanie Shire which describes the effectiveness of three community partnered effectiveness-implementation hybrid trials of JASPER (Joint Attention, Symbolic Play, Engagement, and Regulation). Next, Dr. Alexander Kolevzon introduces the new ECHO model of clinical care delivery for Phelan McDermid Syndrome (PMS), through the PMS Neuropsychiatric Consultation Group (PMS-NCG). Dr. Hedda Meadan then discusses the Internet-Based Parent-implemented Communication Strategies (i-PiCS) program, which uses telepractice to coach parents in strategies to promote social-communication skills in their children. Finally, Elizabeth Berry-Kravis presents her NeuroNext NN107 trial which will evaluate effects of a pharmacological intervention on language learning from a remotely delivered parent-implemented language intervention in children with Fragile X syndrome. Lessons learned and strategies developed from these innovative studies can greatly inform the development of more scalable models of intervention delivery across NDDs.

1:30 **254.001** Use of Remote Delivery of Language Intervention in a Pharmacological Trial Targeting Learning in Fragile X Syndrome

E. Berry-Kravis[1], *L. Abbeduto*[2] *and A. McDuffie*[3], *(1)Pediatrics, Neurological Sciences, & Biochemistry, Rush University Medical Center, Chicago, IL, (2)M.I.N.D. Institute, UC Davis, Sacramento, CA, (3)UC Davis, Sacramento, CA*

Introduction: Basic research in fragile X syndrome (FXS) has identified neuronal targets for treatment of the underlying disorder. The best-studied pre-clinical target has been has been reduction of excessive mGluR5 pathway signaling, with over 60 papers showing pharmacological and genetic reversal of synaptic, cellular, cognitive, and behavioral phenotypes in 3 species with 4 mGluR5 negative allosteric modulators (NAMs). Human

trials of mGluR5 NAMs failed to meet primary behavioral outcomes in adolescents and adults with FXS. These trials may have failed due to lack of measurement of core FXS phenotypes of cognition and learning in a sufficiently young population over a long enough period of time.
Objective: To use an innovative exploratory trial design to determine whether mGluR5 NAM AFQ056 can improve language learning in 100 very young (age 3-6 years) children with FXS during participation in an intensive parent-implemented language intervention (PILI).

Methods: The trial uses a double blind placebo-controlled parallel flexible-dose forced-titration design with a 12 month blinded treatment period including randomization to AFQ056 or placebo and titration to maximum tolerated dose (MTD) and 6 months treatment with AFQ056/placebo combined with PILI, followed by an 8 month open-label extension with treatment for all participants with PILI and AFQ056. PILI is delivered remotely by Skype in order to allow sufficient training time without the cost and scheduling constraints of in-person visits, and has been show to promote language learning in patients with FXS without concomitant pharmacological intervention. The study assesses effects of AFQ056 versus placebo on language, developmental functioning and CNS biomarkers (eye tracking and ERP) after language intervention. The primary outcome is the weighted communication scale (WCS), an observational measure of communication synched to the communication/language targeted by PILI. The parent delivering the PILI attends education sessions, is trained by an SLP wearing Bluetooth headphones in training sessions, while working directly with the child, and does videotaped homework sessions which are reviewed in feedback sessions with the SLP, all via communication using Skype. Drug dilution for the placebo/AFQ056 liquid is monitored via Skype or facetime, as another way to avoid frequent study visits.

Results: To date 13 sites have been trained and opened, including 20 SLPs brought to fidelity on delivery of PILI. Thus far, 65 FXS participants have enrolled, and 3 screen failed, with mean age 5.6, 88% male, and 88% white, 7% Hispanic. Adverse events have been mild, with sleep and hyperactivity being most frequent. PILI has been in general quite well received by families. There have been some technology issues which have not yet been limiting. Methodology will be presented as well as many lessons learned regarding implementation of PILI across sites.

Conclusions: Processes developed in this trial for cross-site standardization of PILI, as well as use of Skype and Bluetooth methodology for delivering PILI and monitoring drug dilution, will be available for other trials. If the design is successful, this novel multi-center trial can serve as a model for future trials of mechanistically-targeted treatments operating on neural plasticity in other NDDs.

1:55 **254.002** Reaching Community Early Intervention Providers in Diverse Communities: Application of Remote Training Supports

C. Kasari[1] *and S. Y. Shire*[2]*, (1)University of California, Los Angeles, Los Angeles, CA, (2)University of Oregon, Eugene, OR*

Background. Rare disorders and distance from a University medical center can limit access to evidence based early interventions. In order to increase access, remote access with support from experts may be necessary. However, it is not currently known the extent to which remote training mirrors what can be obtained in person.
Methods. We examine data from three community partnered effectiveness-implementation hybrid trials. Studies 1 and 2 were conducted in a center based US early intervention program (Shire et al., 2018; Shire et al., 2019) and Study 3 was a provincial intervention deployment study delivering publicly funded health services in a Canadian Maritime province (Shire, et al in progress).

Intervention & Training**.** Across studies, children received approximately 3 months of a developmental social communication intervention- Joint Attention, Symbolic Play, Engagement, and Regulation (JASPER: Kasari et al., 2006) from their local providers who were training to achieve implementation fidelity. All trainees received a 5 day intensive introduction to JASPER including discussion, live coached practice, and feedback delivered either by the research team (Study 1&2) or by local senior JASPER trainers who were trained by the same research team (Study 3). Then, due to the geographic distance of the research team and/or local supervisors from the trainees, this was followed by a combination of remote supports including video feedback, clinical supervision calls, and/or real time video conferenced supervision for the remainder of the study.

Participants. Studies 1 and 2 included a diverse sample of toddlers (n= 55/study) and teaching assistants (TAs; n=24/ study) randomized to immediate JASPER intervention. Study 3 included children age 2.0-6.0 years (n=33) paired with 20 community health providers (e.g., speech language pathologists, occupational therapists, psychologists). All children were eligible for community early intervention services based on diagnoses of autism and other rare sensory and genetic disorders (e.g., visual impairment, Down Syndrome).

Measures. Ten-minute interventionist-child interactions at treatment exit were coded for trainee's JASPER implementation, a total score across 32 items each rated 0-5.

Results. After 3 months of support, all three trainee groups made significant gains over their entry implementation scores demonstrated an average of 80.9%, 72.0%, and 82.51% fidelity respectively. Study 3 allowed for the unique comparison of interventionists who received in person supervision and those who received remote supervision. On average, trainees receiving remote supervision scored 89.17% at exit while those receiving in person support on average achieved 80.29% at exit.

Conclusions. Together, these studies demonstrate that community interventionists of a variety of disciplines can learn to deliver JASPER with high quality through training and supervision methods using primarily remote support strategies. This substantial adaptation to the resource intensive in person supervision previously tested in JASPER clinical trials provides promising evidence for the broader deployment of the intervention model within public early intervention settings including those engaging rural and geographically remote communities.

2:20 **254.003** Echo Model for Remote Delivery of Care for Phelan-Mcdermid Syndrome (PMS): The PMS Neuropsychiatric Consultation Group

A. Kolevzon[1]*, T. Kohlenberg*[2] *and M. P. Trelles*[1]*, (1)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (2)University of Massachusetts, Boston, MA*

Background: Patients with Phelan-McDermid syndrome (PMS) may develop complex neuropsychiatric symptoms, including features of bipolar disorder, psychosis and catatonia, regression in language and motor skills, and early dementia. Given the rarity of the diagnosis, and the range of presenting neuropsychiatric symptoms, patients may be cared for by a wide array of physician specialties, most of whom are unlikely to have any previous experience in the special needs of individuals with PMS.
Objectives: The PMS Neuropsychiatric Consultation Group (PMS-NCG) aims to provide multidisciplinary consultation to geographically-dispersed physicians, to support them in providing the best possible care to patients with PMS.

Methods: This initiative will utilize the established model for knowledge dissemination and capacity building called ECHO. The ECHO model

consists of video-conferencing case consultation with teams of experts and local providers meeting regularly to discuss case management. The existing ECHO national infrastructure provides the necessary technology, training, and ongoing technical assistance for implementation of replication projects – all free of charge. The patient management support provided and CME credits are offered for attendance to incentivize participating providers for their time.

Results: The PMS-NCG was convened in January, 2018 and has met monthly to establish treatment algorithms for a wide array of neuropsychiatric symptoms in PMS. The PMS-NCG went live in September, 2018, and meets monthly. The PMS-NCG has since been soliciting consultation requests from the community of providers across the world through web-based advertising, conference announcements, webinars, and word of mouth. One formal consultation has occurred to date. Long terms goals include measurement of clinical outcomes.

2:45 **254.004** Internet-Based Parent-Implemented Communication Strategies: Remote Delivery of Social Communication Interventions

***H. Meadan**, University of Illinois, Champaign, IL 61820, IL*

Background: High-quality early intervention programs are characterized by services that are developmentally appropriate, evidence-based, and delivered by parents and therapists in the child's natural environment. However, there are significant challenges to providing services with needed dosage or intensity to families with young children with autism and other developmental disabilities (DD). Barriers include the time and cost demands of traveling from one home to the next; limited financial resources to support this work; and situational barriers (e.g., serving families in rural areas; serving families living in neighborhoods providers perceive as unsafe; serving transient families). Innovative solutions are needed to positively impact the early development of young children with autism and other DD by providing greater access to research-based interventions.

Objectives: The i-PiCS (Internet-Based Parent-implemented Communication Strategies) program aims to teach and coach parents, via telepractice, to use evidence-based strategies with their young children to promote their social-communication skills.

Methods: The i-PiCS program includes online self-paced modules that are: (a) interactive, rather than delivered as a simple training video or webinar; (b) asynchronous, allowing parents to complete each module at a time, location, and pace that works best for them; and (c) aligned with adult-learning theory. These asynchronous modules are followed by synchronous embedded coaching provided in real time via videoconference, telepractice, to ensure that participants both master the target skills and feel confident in their application in naturally occurring contexts.

Results: Evaluation of the i-PiCS program has included multiple-baseline single-case experimental studies, and the findings are very promising. The parents have acquired the evidence-based strategies, have implemented them with high fidelity, are satisfied with the telepractice service delivery model, and their children's social-communication skills have improved. In addition, the telepractice program was used to teach and coach early intervention service providers to use the i-PiCS program with families on their caseload. Long terms goals include valuating the i-PiCS program with a larger number of families to assess its effectiveness at a larger scale.